VALUE CHAIN ANALYSIS OF MILK: THE CASE OF *DESSIE ZURIA* DISTRICT, SOUTH WOLLO ZONE, NORTHERN ETHIOPIA

MSc. Thesis

ALI TEGEGNE

June, 2017

JIMMA UNIVERSITY

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APPROVAL SHEET

JIMMA UNIVERSITY

COLLEGE OF AGRICULTURE AND VETERINARY MEDICINE

MSc THESIS APPROVAL SHEET

We, the undersigned, member of the Board of Examiners of the final open defense by **Ali Tegegne** have read and evaluated his/her thesis entitled **"Value Chain Analysis of Milk: The Case of Dessie Zuria District, South Wollo zone of Northern Ethiopia"** and examined the candidate. This is therefore to certify that the thesis has been accepted in partial fulfillment of the requirements for the degree Master of Science in **Agribusiness and Value Chain Management.**

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DEDICATION

This thesis manuscript is dedicated to my brother, Jemal Tegegne for his advice throughout my life.

STATEMENT OF THE AUTHOR

I declare that this thesis is my real work and all sources of materials used in this thesis have been properly acknowledged. This thesis has been submitted to Jimma University, College of Agriculture and Veterinary Medicine in partial fulfillment of the requirements for M.Sc. degree in Agribusiness and Value Chain Management and is deposited at the Library of the University to make accessible for borrowers under rules of the Library.

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BIBLIOGRAPHICAL SKETCH

The author was born on 24 February, 1971 in *Dessie Zuria* District of *South* Wollo Zone, *Amhara* region. He attended his elementary and junior secondary education at *Gerado* elementary and junior secondary school. He also attended his grade 9^{th} and $10\text{-}12^{th}$ education in Dessie town at *Hotie* secondary school and *W/siheen* comprehensive secondary school, respectively.

After passing Ethiopian school leaving certificate exam (ESLCE), he joined Addis Ababa University, at Debre-Zeit Faculty of Veterinary Medicine in September, 1987 and graduated in Diploma in Animal Health on 15^{th} July, 1989. After his graduation, he served in *Dire Dawa* Administrative town office of Agriculture for four years and in different districts of South Wollo Zone Office of Agriculture for fourteen years. He has attended senior meat inspection training at *Alagie* Agricultural Technical Vocational and Educational Training (ATVET) College for six months and got certificate on July, 2007.

He joined Haramaya University in October, 2004 to pursue his B.Sc. degree in Animal Science and graduated in September, 2008 and up on his return, he served in South Wollo Zone Department of Agriculture for five years. In October, 2014, he joined Jimma University for pursuing his M.Sc. degree in Agribusiness and Value Chain Management.

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ABBREVIATIONS AND ACRONYMS

AGP	Agricultural Growth Program
CC	Contingency Coefficient
CSA	Central Statistical Agency of Ethiopia
EAAP	East Africa Agricultural Productivity Program
FAO	Food and Agricultural Organization
GDP	Gross Domestic Product
GIZ	German Society for International Cooperation
GM	Gross Margin
GMM	Gross Marketing Margin
ILRI	International Livestock Research Institute
LIVES	Livestock and Irrigation Value Chains for Ethiopian Smallholders
MVAP	Milk Value Addition Participation Decision
NMM	Net Marketing Margin
OCSP	Office of Cooperatives Society Promotion
OLS	Ordinary Least Squares
TGMM	Total Gross Marketing Margin
VIF	Variance Inflation Factor
VVAM	Volume of Value Added Milk

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VALUE CHAIN ANALYSIS OF MILK: THE CASE OF *DESSIE ZURIA* DISTRICT, SOUTH WOLLO ZONE, NORTHERN ETHIOPIA

ABSTRACT

This study was dealt with value chain analysis of milk performed in Dessie Zuria District of South Wollo Zone, Northern Ethiopia. Using random sampling technique, 100 smallholder milk producer households were selected and 69 milk traders from different marketing actors were involved in the sample. The required data were collected from both secondary and primary sources of data and analyzed using descriptive and econometric method of data analysis. The value chain analysis found chain actors along with their roles and the core actors identified in the district were input suppliers, producers, local collectors, wholesales, processors, retailers and consumers. Marketing margin among the actors was analyzed across the main milk marketing channels. The benefit share of producers ranges from 28% (in channel 3) to 100% (in channel 1). Cafes /Hotels were the highest benefited market actors for the share of GMM in channel 3(63.3%) followed by retailers in channel 2 (33.3%). Factors determining status and intensity of participation of smallholder milk producers in milk market supply was analyzed using Tobit model and the results showed that land holding size, amount of income from sale of livestock and livestock products, local and cross breed milking cows owned, access to market information and service contact frequency of extension affected significantly the participation decision and level of participation of households in milk market supply. Similarly, Heckman two stage model was used to analyze determinants of milk value addition and the results of Heckman first stage regression model showed that volume of milk allocated for home consumption, distance from market/urban centers, volume of milk yield per day and number of children under 6 years old affected significantly the participation decision while the results of second stage regression model showed that education level of the household, local breed milking cows owned, land holding size, membership to milk producers cooperative and family size affected significantly level of participation of milk producer households in milk value addition. Thus, it is suggested to strengthen participation of smallholder milk producers in milk market supply and value addition via capacity improvement and enhanced access of proper technical support service provisions.

Key words: Tobit model, Heckman model, Milk, Market supply, Value addition, Value share

1. INTRODUCTION

1.1 Background of the Study

The growth of economy in developing countries largely depends on the growth of agricultural sector. Agricultural growth is important for reduction of poverty as 75% of the world's extremely poor people live in rural areas and depend on it for their income source. About three-fourth of these extremely poor people are engaged in livestock keeping for their livelihood and thus, contribution of livestock for escaping poverty and to improve economic growth is important (FAO, 2011).

Dairy is a common agricultural production and people milk their dairy animals in almost every country across the world, and up to 14% of the world population live on dairy farms. It is a vital part of the global food system and it plays a key role in the sustainability of rural areas in particular. Out of total agricultural production, milk production value represents between 8.5 and 10.5%. In terms of trade value, FAO estimates the trade of milk and milk products (aggregate containing milk, cream, butter, cheese, whey, buttermilk, milk powder, yoghurt, casein, lactose and infant formula) to be at 6.4% of all of the agricultural products trade (IDF, 2013). Hence, improving this sector to increase livestock outputs is highly linked and a strategically crucial means to escape poverty (Pica-Ciamarra *et al.*, 2011).

Livestock production is an integral part of Ethiopia's agricultural sector and plays a vital role in the national economy. Livestock sector in the country serves as source of income, draft power and means of employment with an economic contribution share of about 40% of agricultural GDP excluding the values of draught power, manure and transport of people and products (Duguma *et al.*, 2013), 60- 70% livelihoods of the population (USDA, 2016) and 11% of formal exports earnings of the country (Trade Bulletin, 2011). Besides as a crucial means of income, employment, and poverty alleviation, milk subsector also used as food source with better nutritive value such as protein and minerals for Ethiopian smallholder milk producers. Given considerable potential for increasing smallholder income and employment generation from milk and milk products in Ethiopia, development of the milk subsector can

remarkably contribute to poverty reduction and improved nutritional status in the country (CSA, 2015).

Ethiopia is the first top ranked country for its largest livestock population in Africa having about 56706389 cattle, 29332382 sheep, 29112963 goats, 2033115 horse, 400 329 mule, 7428037 donkey, 1164106 camel, 56866719 poultry and 5885263 beehives (CSA, 2015). Cattle, goats and camel are the main sources of dairy products in Ethiopia (Gelan *et al.*,2012). According to CSA (2015), Ethiopia earned about 3071977015 liters of cow milk from 11381972 milking cows by the year 2014/2015. About 82% of total milk in Ethiopia is obtained from cow and of which 97 % is from local breeds with an average milk yield of 1.35 liter per cow per day for about 6 months of lactation period (CSA, 2015). This production and productivity is very low compared with other countries and world average (FAO, 2011). However, Ethiopians consume less milk (19kg) (World Bank, 2016) when compared with average consumption of Africa (40kg) and world (105kg) (FAO, 2011). Such milk supply shortage in Ethiopia is due to absence of sustainable approach of the dairy development to improve milk production and marketing and due to the challenges of active engagement in milk value chain and market by smallholder milk producers (Eyasu *et al.*, 2014).

Supporting of intensified dairying is one of the strategies of the Ethiopian government to improve the low productivity problem of local cattle and then to allow mixed crop-livestock smallholder farmers raise their incomes. To boost the productivity of livestock and milk products, government has attempted to support the livestock sector and solve livestock development associated problems. Development agents of livestock production and management, veterinary and artificial insemination technicians were trained and assigned at *kebele* level. The livestock and fishery resource development has been established autonomously at ministry level to improve the sector contribution and increase the income level of households at large and thereby ensure food security of the community.

On the other hand, by the intervention activities of Dessis Zuria District Office of Agriculture and different projects like Livestock and Irrigation Value Chains for Ethiopian Smallholders (LIVES) and East Africa Agricultural productivity improvement program (EAAPP) in providing estrus synchronization hormone and other artificial insemination inputs, it is

observed that rural households of Dessie Zuria are rearing improved crossbreed cattle which thereby improved their productivity (Dessie Zuria District Office of Agriculture).

However, the nature of milk value chain information in the study area is lacking which requires an assessment to indicate the leverage point of interventions strategies of milk production, marketing and value addition by milk value chain actors and service providers.

1.2. Statement of Problem

Enhancing market participation of households to benefit them from growing demand of dairy products is a better option that should be considered by policy makers since participation of producer in market supply is an essential strategy for poverty alleviation and ensuring food security in developing countries (Shapiro *et al.*, 2015)

In Ethiopia, about 98% of milk is held and managed by smallholder dairy farmers. However, only 5% of the milk produced in the country is sold in commercial markets while the rest of 95% is consumed and processed at home (CSA, 2012). Whereas in the year 2011, out of the total production of milk, butter and cheese in rural Ethiopia, about 6.55%, 36.58% and 14.35% was sold in the market, respectively (CSA, 2011). This indicates that the demand for milk and milk products is higher and supply is lower in towns than in rural areas due to high pressure of population growth (Zelalem *et al.*, 2011). Dessie is one of the towns with large number of population to be 245129 (CSA, 2013) and high demand for milk and milk products with low supply from peri-urban areas that do not meet the observed demand in the area (South Wollo Zone department of agriculture annual report, 2015) which is an opportunity for smallholder milk producers of Dessie *Zuria* District to exploit the milk market access or high demand. Given such opportunity, milk producers could not get better income from their products sale mainly due to either their inability to increase their market supply or failure to minimize loss from perishable nature of fresh milk.

The perishable nature of milk incurs extra transactions costs to households as it causes possibility of product spoilage and losses during processing or transporting (Holloway *et al.*, 2000). Farmers process milk traditionally to convert into butter, ghee, butter milk and cheese to increase shelf life when the immediate sale of fresh milk is not attainable (Tadele *et*

al., 2014). Tadesse *et al*. (2015) studied about characterizing milk supply and marketing chains and losses in Wolmera and Ejere districts of Ethiopia and found that out of the total milk produced, there is about 9% loss per day across the milk supply chain. Milk handling practice at collection points, lack of immediate buyer and long waiting time at collection sites, milk carrying tools used, means of transport used, and lack or ineffective communication with other partner in the chain were identified in order of severity as important problems causing of milk losses.

So, improving milk market supply and value addition can help to satisfy the demand in the area and create market access for milk producers and thereby increase their income.

Interventions were made by Government to enhance producers' income via market oriented strategies by giving technical support and introducing improved technologies to increase the capacity of smallholder milk producers and improve their livelihood. Although remarkable successes have been attained, the benefits gained from productivity and production of milk is not encouraging. In addition, some households in the study area participate in milk market supply and value addition while others not participate.

Assessment of determinants of milk market supply and value addition is important to design new intervention strategies by governmental and non-governmental organizations (NGOs). With regard to this, many studies were conducted on determinants of milk market (Woldemichael, 2008; Meryem, 2013; Berhanu, 2014; Bedilu *et al*., 2014) and milk value addition (Berhanu, 2012; Tadele, 2014; Kumar, 2015). However, none of these studies has been done so far in the study area to gather milk value chain information.

Conversely, the nature of milk value chain information in the study area is lacking which requires an assessment to indicate the interventions strategies of milk production and marketing by milk producers and service providers and thereby to enhance and safeguard the involvement of producers into milk subsector development. To enhance opportunities for value chain actors, we need to understand the main value chain actors affecting the entire value chain (Berhanu, 2012). The intention of this study was therefore, to enrich availability of relevant information about benefit share of the milk value chain actors, determinants of

milk market supply and value addition by producers and to answer the following research questions:

1.3. Research Questions

- Who are the milk value chain actors, their functions and what does marketing margins along the chain looks like?
- What are the factors affecting participation decision and level of participation of smallholder milk producer households in milk market supply?
- What are the factors determining participation decision and level of participation of smallholder milk producer households in milk value addition in the study area?

1.4. Objectives

1.4.1. General objective

The general objective of the study is to analyze the value chain of milk at smallholder milk producers' level in the study area.

1.4.2. Specific objectives

The specific objectives of the study are:

- ✓ to identify milk value chain actors, their functions and marketing margins along the chain;
- ✓ to analyze factors affecting participation decision and level of participation of smallholder milk producer households in milk market supply;
- ✓ to analyze factors determining participation decision and level of participation of smallholder milk producer households in milk value addition in the study area

1.5. Significance of the Study

The study is valuable as it provides the necessary information about benefit share of milk market actors, determinants of milk market supply and milk value addition. Then, it can be used as reference for scaling up and implementation of improved milk production interventions systems by value chain actors, government organizations, NGOs as well as

bilateral organizations engaged in milk development in the area. It can also give background information for further and detailed studies on milk value chain at the zonal and regional level.

1.6. Scope and Limitations of the Study

The study was conducted and restricted only in Dessie *Zuria* district and the data was collected only from the study area. Though, findings might be used in similar situation of the district, the study might have the geographic limitation to represent wider area. Some smallholder milk producers also were not well committed to be interviewed seeking pediem and showing boring behavior.

1.7. Organization of the Thesis

The thesis is organized into five main sections. Section one holds introduction which includes the background of the study, problem statement, research questions, objectives, significance of the study, scope and limitations of the study and organization of the thesis. Section two contains review of literature; both theoretical and empirical evidences for the study. Section three presents research methods and materials which includes overview of the study area, types of data and their sources, data collection method, sample size and sampling techniques and method of data analysis. Section four presents results and discussions. Section five generalizes findings of the research along its conclusion and recommendations.

2. LITERATURE REVIEW

This section contains basic concepts and relevant theories of milk marketing margin, market supply and value addition. Moreover, it presents the findings of related empirical reviews that have been studied.

2.1. Definitions of Basic Terms and Concepts

2.1.1. Market and marketing

Market can be referred to as when the products and/or services and their substituent's undergo exchanging process by one or more sellers through competition of a group of buyers for their patronage. A market can be also stated as a point where an operation of price making force and actual movement of ownership of goods takes place. Market can be viewed as a process by which the transformation of ownership of goods from sellers to buyers of a final consumers or intermediaries (Kotler and Armstong, 2003).

"**Marketing** is the activity, set of institutions, and processes for creating, communicating, delivering, and exchanging of offerings that have value for customers, clients, partners, and society at large" (American Marketing Association).

Marketing Channel: is a business structure of interdependent organizations that facilitate the transfer of ownership as products move from producer to business user or consumer (Kotler, P and Armstrong, 2003). The channel is composed of different institutions that facilitate the transaction and the physical exchange and it may be short or long depending on kind and quality of the product marketed, available marketing services, and prevailing social and physical environment (Islam *et al.*, 2001).

2.1.2. Value chain and supply chain

Value chain: a value chain describes the full range of activities required to bring a product or service through the different phases of production, including physical transformation, the input of various producer services, and response to consumer demand which include the vertically linked interdependent processes that generate value for the consumer (Kaplinsky, and Morris 2000).

Value chain refers to a chain of activities that are associated with adding value to a product through the production and distribution processes of each activity (Schmitz, 2005). An organization's competitive advantage is based on their product's value chain. The goal of the company is to deliver maximum value to the end user for the least possible total cost to the company, thereby maximizing profit (Porter, 1985).

Bammann (2007) has identified three important levels of value chain:

i) Value chain actors: The chain of actors who directly deal with the products, i.e. produce, process, trade and own them.

ii) Value chain supporters: The services provided by various actors who never directly deal with the product, but whose services add value to the product.

iii) Value chain influencers*:* this includes the regulatory framework, policies, infrastructures, etc.

S**upply chain:** the supply chain is the arrangement of facilities (factories, warehouses, terminals, ports, stores, and homes), vehicles (planes, trains, trucks, and ocean vessels), and logistics information systems (LIS) connected by an enterprise's supplier's suppliers and its customer's customers (Edward Frazelle, 2002). It is taken to mean that the physical flow of goods that are required for raw materials to be transformed into finished products. Supply chain management is about making the chain as efficient as possible through better flow scheduling and resource use, improving quality control throughout the chain, reducing the risk associated with food safety and contamination, and decreasing the agricultural industry's response to changes in consumer demand for food attributes (Dunne, 2001).

Milk Supply Chain: In nowadays dynamic, complex and highly interconnected milk production, the need for actors to work together becoming increasingly (Anandajayasekeram and Berhanu, 2009). There is a growing recognition that supply chain management (SCM) offers significant opportunities for organizations to create strategic advantages. The recognition of supply chain management is growing from time to time since it offers significant opportunities for organizations to create strategic advantages and interventions (Wen and Gu, 2014). *Milk Supply Chain* is the flow of goods and services from point of origin to point of consumption as well as the storage of raw materials, work-in-process inventory,

and finished goods.

The link of a value chain can be analyzed through mapping value chain which describes the full range of activities required to bring a product or service from conception, through the different phases of production (involving a combination of physical transformation and the input of various producer services), and delivery to final consumers (Kaplinsky and Morris, 2001). In these days, firms are forced by increasing of competitive pressures and market globalization to develop supply chains and thereby to quickly respond to customer needs. The firms must reduce operating costs to remain competitive and improve customer service. Communication among chain actors is important for the effective operation of all stages in the milk supply chain and the degree of implication is directly proportional to the time needed to take countermeasures to change the production process in early stages of required level (Rodríguez-Enríquez *et al.,* 2015). According to these authors, milk supply chain is categorized into eight stages namely:

a) Production of cows feed: The dairy supply chain begins with growing of feed sources such as corn, alfalfa hay, grass, and soybeans, etc. to feed dairy cows.
b) Milk production: Dairy cows are housed, fed, and milked on dairy farms
c) Milk transportation: Milk is transported from point of production or farm to the processing unit or distribution site in different means of transportations.
d) Processing: is turning of milk into cheese, yogurt, ice cream, powdered milk, and etc.
e) Packaging: is typically done by the dairy processor using appropriate containers such as plastic containers that are designed to keep dairy products fresh, clean and wholesome.
f) Distribution: Distribution agents deliver dairy products from the processor to retailers, consumers, and other outlets.
g) Retail: Milk and dairy products are available at certain number of retail outlets
h) Consumer: Milk and milk products delivered and consumed by consumers to get essential nutrients.

2.2. Methods of Evaluating Marketing Marginality

2.2.1. Marketing performance

The evaluation of market performance can be done via analysis of costs and margins of marketing agents in different channels. The system of marketing performance usually measured in marketing margin or price spread.

Marketing margin: It is referred to as a common way of evaluating the performance of marketing system (Abbot and Makeham, 1981). Margin can be a useful descriptive statistics when it is used to show how consumer's prices of products distributed among market participants at different levels of marketing system (Mendoza, 1995). The total marketing margin is the difference between what the consumer pays and what the producer receives for his product. It can also be defined as the difference between retail price and farm gate price (Cramers and Jensen, 1982; William and Robinson, 1990; Holt, 1993). The total marketing margin includes two components: the costs of marketing services and the profit margins or net returns. It can be concluded that a wide margin means usually high prices to consumers and low prices to producers. The total marketing margin is expected to be higher in an imperfect market than in a competitive market for the aim of seeking an abnormal profit level. It is also expected to be high, even in competitive market because of high real marketing cost (Wolday, 1994).

Marketing costs: refers to those costs, which are incurred to accomplish different activities of marketing in the transportation of goods from point of production to the end consumers. Marketing costs includes storage costs, handling costs (packing and unpacking, costs of searching for exchange, screening potential trading partners to ascertain their trustworthiness, bargaining with potential trading partners and officials to reach an agreement, transferring the product, monitoring the agreement to see that its conditions are fulfilled, and enforcing the exchange agreement etc. (Holloway and Ehui, 2002).

Marketing efficiency

Efficiency in marketing is the most used measure of market performance. Improved marketing efficiency is a common goal of farmers, marketing organizations, consumers and

society. It is a commonplace notation that higher efficiency means better performance whereas declining efficiency denotes poor performance. Most of the changes proposed in marketing are justified on the grounds of improved efficiency. If markets are, in fact, efficient, the market price provides the best estimate of value, and the process of valuation becomes one of justifying the market price. If markets are not efficient, the market price may deviate from the true value, and the process of valuation is directed towards obtaining a reasonable estimate of this value. Efficient market is one where the market price is an unbiased estimate of the true value of the investment. (Kohls and Uhl, 1985).

2.2.2. Gross margin of milk marketing

The major way to assure milk traders get sufficient earnings is the level of profit from their invested capital (Karuga, 2009). The normal profit is the minimum payment a trader or the enterprise owner would be willing to perform the entrepreneurial functions. Thus, receiving normal profit is important in order to keep the trader from withdrawing the capital and managerial effort and putting it into another alternative business (Kotler and Armstrong, 2006).

There are different ways of enterprises profitability measurements that includes Gross Margin (GM), Benefit-Cost Ratio (BCR), Return on Investment (ROI), Internal rate of Return (IRR), and Marketing Margin (MM) (Turuka, 2000). The GM is an important measure of resource efficiency in Small and Medium Enterprises. It is useful to identify returns (profit) of traders at each stage along the value chain of milk marketing. The GM calculation for different enterprises in various segments along the value chain of milk marketing involves analysis of the accounts of enterprises, noting precisely the cost incurred and the value added at each stage along the value chain (Debertin, 1993). The size of GM in a competitive market is the effect of supply and demand for marketing functions, and it should therefore be equal to the minimum cost of product/service provided and normal profit (Scarborough and Kydd, 1992). The GM is a gross return minus the total variable expenses, which can be expressed in normal value, ratios or as a percentage of return (Debertin, 1993). In order to compare the profitability of enterprises at different stages along the milk market,

GM can be employed and expressed as a ratio or percentages (Mendoza, 1995). When the GM expressed as ratio is given by;

$$Ratio\ of\ GM = \frac{Total\ Revenue\ (TR) - Total\ Variable\ Cost\ (TVC)}{Total\ Revenue\ (TR)}$$

However, the above expression cannot be used to indicate the normal value of enterprise earnings and profitability measure of non production enterprises; rather it is useful for comparing profit across different enterprises and segments along the value chain (Mendoza, 1995). Debertin (1993) indicated that there are some problems of using GM for the measure of profitability, such as failure to deduct the opportunity costs for the money invested in the enterprises. Ponte (2002) showed that the use of GM has several disadvantages which include failure to consider the variation of fixed costs, and it also fails to incorporate the allowances of costs for depreciation and obsolescence of fixed assets. On the other hand, Phiri (1991) explained that GM is still the best acceptable measure of resource efficiency in Small and Medium Enterprises. Despite the weaknesses of GM as a measurement of profitability, it remains the most satisfactory measure of resource efficiency. GM gives a good indication of the managerial effectiveness and the efficient utilization of the financial resource of an enterprise and deep insight into traders' management efficiency of the enterprises (Hammod, 2001).

2.3. Market Supply

The study of market supply is important to fill the gaps of understanding the success of commercialization and to identify determinants of market supply. Market supply refers to the amount of goods that is actually taken to the markets irrespective of the need for home consumption and other purposes (Wolday, 1994).

Marketable surplus is the amount of produce that is left over after meeting the producer's consumption and requirements of utilization for kind payments and other obligations such as gifts, charity, etc. The marketable surplus can be described as the quantity available for sale in the market. The marketed surplus is the amount which is actually sold after deducting the losses and retention by the farmers, if any and adding the left out of previous stock for sale (Thakur *et al.*, 1997). The supply of surplus product stands for what amount the producer

takes to the market, but does not necessarily imply an excess of the producer subsistence requirement. It includes portion of the product required for consumption by household and supplied to the market when the farmer is forced to sell to pay rents and debts, buy inputs and non-farm staples foods, to meet socio-cultural obligations, and to cover other immediate expenses. Hence, marketed surplus stands for the amount of actual surplus and the quantity sold in the form of enforced selling (ARS-BOARD, 2003). The success of agricultural commercialization involves two options namely: through increased production of marketable surplus of staple food over what is required for own consumption and production of cash crops along with staples or exclusively (Neway, 2006). At the level of household farm, commercialization is simply measured by the value of proportion of sales to the total value of output. However, there would always be some amount of output that a subsistence farmer would sale in the market to buy basic essential goods and services. Due to this reason, the ratio of marketed output up to a certain minimum level cannot be considered as a measure of commercialization. Marketed surplus may be equal to marketable surplus, it may be less if the whole marketable surplus is not sold out and the farmers retain some stock and if losses are occurred at the farm or during transport (Thakur *et al*., 1997). In the case of crops that are wholly marketed, the output and marketed surplus are the same (Reddy *et al*., 1995).

Empirical studies of market supply of farm products indicate that changes in prices cause small proportion of variation in output. The weather and pest influence short run changes in output, while improvement in technology influence long run changes and thereby results change in market supply. The most important causes of shifts in market supply are the changes of input prices and returns from commodities that compete for the same resources. The improvements of technology can influence yields and costs of production as well as the level of price and risk of yield faced by producer (Tomek and Robinson, 1990).

The responses of marketed surplus to changes in prices and non price factors such as irrigation, landholding size and productivity are crucial. The main factors which increase significantly the marketed surplus are the increment of production followed by level of consumption and payments in kind (Thakur *et al*., 1997).

The decision of supplying agricultural products to the market depends on several attributes like household characteristics, availability of farm resource, land, labor supply, access to market, extension service and experience. On the other hand, a farm gate transaction usually takes place when products are scarce in their supply and very demanded by traders or when the produce is bulk amount and difficult for farmers to handle and transport to the markets without losing product quality (Moti, 2007).

2.4. Value Addition

Value addition: is the act of adding value to a product, whether the value chain actor has produced the initial product or not and it involves taking any product from one level to the next level (Fleming 2005). According to Coltrain *et al*. (2000), it can be referred as the process of adding values to products into their original state by changing their current place, time, and form characteristics that improve their value to be preferred by the intended consumers in the market. According to these authors, the act of value addition can be attained in two ways: through innovation and coordination. The approach of value addition through innovation emphasizing on improving the existing condition of activities, processes, procedures, products, and services or creating new ones, while the way of value addition through coordination involves enhancing the link and arranging partnership among the value chain actors who produce and market their farm products.

Value addition results from diverse activities which include bulking, cleaning, grading, sorting and packaging, transporting, storing and processing along the value chain. For farmers, value addition has a particular importance in that it offers a strategy for transforming an unprofitable enterprise into a profitable one. The farmer is not only involved in production of a raw commodity but also takes part in value addition and distribution. This allows the farmer to create new markets or differentiate a product from others and thus gain advantage over competitors (Donovan, 2005). According to Bryceson and Kandampully (2004), the goal of a value chain is to optimize performance in that industry using the combined abilities of expertise and members of the chain. Successful chains depend on integration, organization, cooperation and communication between partners with the traditional measure of success being the return on investment.

A value chain is differentiated from a supply chain in that participants in the value chain have strategic vision of long-term, predisposed to work together with trust, demand oriented, shared commitment to control product quality and have a high confidence level, one with the another that allows greater security in business and facilitates the development of common goals and objectives (Hobbs *et al*., 2000).

2.5. Guiding Concepts in Agricultural Value Chain Analysis

According to Anandajayasekeram and Berhanu (2009) and Kaplinsky and Morris (2000), key concepts guiding agricultural value chain analysis includes the following four basic concepts:

Effective demand: Value chain analysis of Agriculture considers demand as an effective force that pulls goods and services through the vertical system and it incorporate the understanding of the dynamics of demand at both domestic and international markets, and the implications for value chain organization and performance. It also deals with the examination of barriers of information transmission and the changing nature of demand and incentives back to producers at various levels of the value chain (MSPA, 2010).

Production: can be referred to as any operating stage capable of producing a saleable product serving as an input to the next stage in the chain or for final consumption. A stage of production in a value chain performs a function that makes significant contribution to the effective operation of the value chain and in the process adds value (Anandajayasekeram and Berhanu, 2009). Producing the required amount effectively is a necessary condition for responsible and sustainable relationships among chain actors. Hence, one of the aims of agricultural value chain analysis is to increase the quantity of agricultural production. Understanding the mechanisms of the agricultural production greatly help to design appropriate policy that bring more gain to farmers and the whole society at large (Kaplinsky and Morris, 2000).

Value chain governance: refers to the changing nature of value chain characterizing the relationships and linkage between different actors and stakeholders within the chains (Gereffi, 1999). Governance is the act of coordination and controlling role within the chain in identifying efficient profitable opportunities and distributing roles to key chain actors

(Kaplinsky and Morries, 2000). Governance is about power and the ability to exert control along the chain at any point in the chain, some firm (or organization or institution) which sets and enforces parameters under which others in the chain perform.

Value chain upgrading: This can be described as the technological capabilities and market linkage acquirements for the enabling of the competitiveness of the firms to move into higher level activities (Kaplinksy and Morris, 2001). Giuliani *et al*. (2005) represents a clear description of four types of upgrading as follow: (i) Process upgrading - increasing the efficiency of internal processes introducing superior technology such that these processes are significantly better than the previous one. (ii) Product upgrading - introducing new products or improving old products into more sophisticated product lines in terms of increased unit values which involve changing new product development processes. (iii) Functional upgrading - increasing value added functions by changing the mix of activities conducted within the firm or moving the locus of activities to different higher value adding links in the value chain. (iv)Intersectoral upgrading is applying of the competence acquired in a particular function to move into a new sector.

2.6. Milk Production Systems in Ethiopia

According to Land O'Lakes (2010), Ethiopia's milk production systems can be broken down into four main systems as described in detail below.

2.6.1. Commercial production system

This production system mainly keeps pure or cross bred cattle with a better usage of artificial insemination of improved semen and record keeping. In this system, a majority of the pure or cross bred animals are owned by commercial farms. The output per cow can range from 1120 – 2500 liters of milk per lactation. These producers would be willing to pay for the more expensive imported breeds (SNV, 2008).

2.6.2. Peri-urban and urban production system

In this system, producers would have a better understanding of dairy management and have improved breeds with greater interest of using artificial insemination services. The milk

producers have relatively better awareness and accomplish their activities targeting to sell their dairy products for the nearby town and city consumer. They also sell their milk to processors. The preferred cross-bred cow has about 50 – 62.5% or above improved genetic makeup. Because of the scarcity of land, cattle are maintained under confined systems where feed source is mostly agro-industrial by-products such as oil seed cakes, wheat bran, etc) and purchased roughage and feed by cut and carry system.

2.6.3. Rural smallholder production system

The Ethiopian highland smallholder farmers owned about 75% of the country livestock population using their cattle as a main source of milk production, traction power and manure as a fertilizer on crop land or for household fuel. In the rural highland areas of Ethiopia, producers keep mostly zebu cattle which have lower milk production performance but better suited to resist disease and poor management conditions. The sources of feed are communal grazing pastures and crop residues. The possibility of in-breeding is more expected since producers do not practice breeding record keepings. The rural small-holder production system produces the largest share of total milk produced in the country, contributing about 98% of the milk production (CSA, 2015). Small-holder producers' sell their milk and milk products to urban areas when they get market access and affordable transportation. Producers process their milk to butter or yogurt (fermented milk) and consume in their home or sell to their neighbors or in the market.

2.6.4. Pastoral and agro-pastoral

This type of production system is mainly depends on natural pasture located on non-arable rain-fed lands for their livestock keeping and milk production. The seasonal movements by the majority of animal stock in seek of water and feed resource is their main character. When animals are close to home, crop residues (sorghum and maize thinning and Stover) are important feed resources for livestock especially for those of agro pastoral (Land O'Lakes, 2010).

2.7. The Role of Milk in Ethiopian Economy

The Ministry of Finance and Economic Development (MOFED) estimated the gross value of ruminant livestock production in 2008/09 at Birr 32.64 billion; of this, Birr 19.471 billion (59.65%) obtained from milk and milk products (Behnke and Fitaweke, 2011). After one year, the recalculation of values by these authors showed the livestock contributions to the economy is at Birr 48.07 billion, (an increase of 47% from MOFED estimates) during the same year. This figure does not include the value of animal traction. Of this (48.07 billion), milk and milk products contributes 63.49% (30.52 billion Ethiopian Birr) to gross value of ruminant livestock production. This indicates that the government of Ethiopia has been underestimating the contribution of livestock especially the share of milk to the agricultural gross domestic product of the country.

2.8. Review of Empirical Studies

2.8.1. Status of Milk production and Consumption in Ethiopia

Although Ethiopia has the largest cattle population in Africa, at 52 million, and of these 10.5 million dairy cattle, the yearly milk production is very low with low per capita annual milk consumption (19 liters) which is by far below the African average (40 liters) as well as the world average (105 liters) (FAO, 2011).

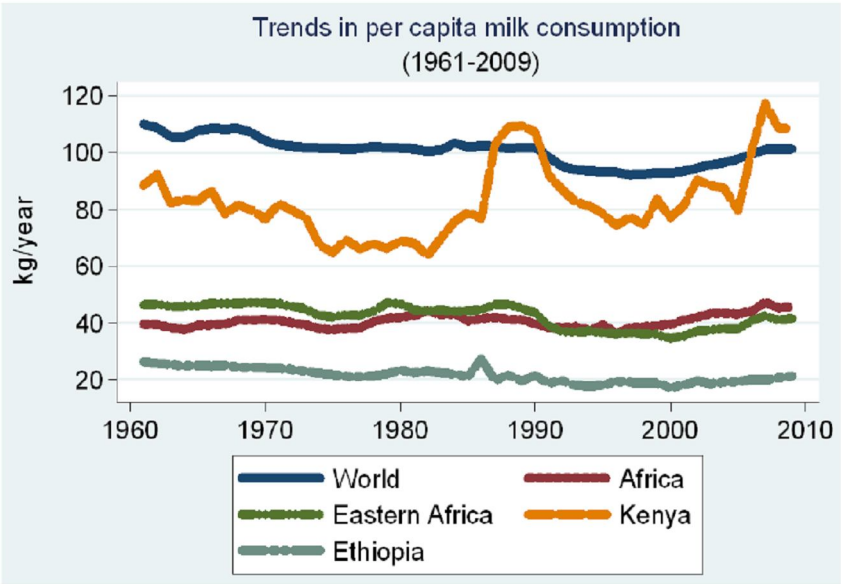


Figure 1: International milk consumption trend

Source: FAO (2011)

Referring data from CSA, AGP (2013) described that Ethiopian milk production has increased significantly since 2000 indicating that national milk production was 1.2 billion liters in 2000, 3.2 billion liters in 2007, and 3.3 billion liters in 2012.

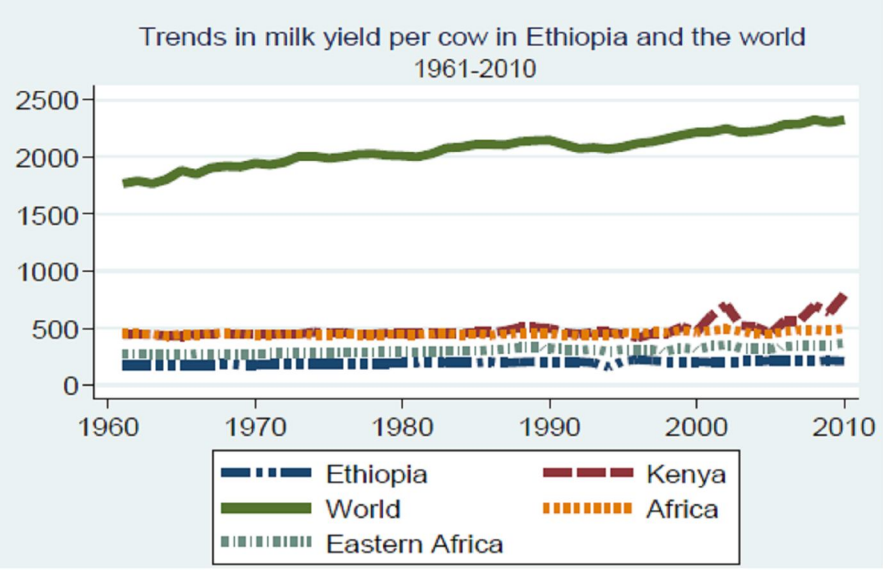


Figure 2: Trends in milk yield per cow

Source: FAO (2011)

The production and market system of milk in Ethiopia face severe constraints along with complex milk value chain both in formal and informal market channels. Only 5% of the milk produced in Ethiopia is sold in commercial markets while the rest of 95% is consumed and processed at home (CSA, 2012). Dairy producers and the downstream actors in the milk value chains face many challenges in getting milk to market. For the most part, milk collection, chilling and transport are not well organized and there are few economies of scale. Transaction costs are high and up to 20-35% of milk is spoiled or otherwise lost. Poor genetic makeup, insufficient access to proper animal feed and poor management practices all contribute to the low productivity levels (Felleke *et al.*, 2010).

Table 1: Milk Productivity per cow

Country	Republic of South Korea	Israel	United States of America	Sweden	Denmark	Algeria	Morocco	Egypt	Angola	Sudan	Ethiopia	Nigeria	Bangladesh	Tanzania
Yield(Kg) Per cow	9616	9583	9118	8152	8131	1320	1102	997	482	378	270	240	206	174

Source: FAOSTAT (2011)

On the other hand, the survey result conducted on consumers and Cafes/Hotels by AGP (2013) stated that very high price of milk and milk products as a major challenge; hence, it becomes increasingly difficult for many middle and low-income consumers to purchase. According to the same source, the major marketable milk products include: fresh milk, is the main product available in the market, sour milk ("ergo" in Amharic, which is useful either for further processing or storing milk during fasting days), cheese, ghee, butter, pasteurized milk and skimmed milk.

2.8.2. Marketing margin

Different studies have been carried out by different scholars on marketing of different agricultural commodities using market concentration ratios, marketing costs and margins and profit analysis. The result indicates that profit and margin received by marketing actors and level of market efficiency varies with respect to location and size of marketing channel. The study of Gizachew (2005) found that the total gross marketing margin to be 44.6% and 10% for milk processer and milk market cooperatives, respectively. The survey result of Woldemichael (2008) revealed that average producer's share of milk marketing margin estimated to be 56.53% while the average total gross marketing margin (TGMM) and retailers net marketing margin of milk in Hawassa, Shashemane and Yergalem found to be 37.2%, 40.9%, 52.3% and 6%, 7.35% , 6.98%, respectively. According to the study of Ayelech (2011) on analysis of marketing margin for fruits marketing chains in Goma woreda of Oromia Region, Ethiopia, the marketing margin of processors (juice house) was highest (88.73%) whereas producers marketing margin was lowest (11.27%) in mango and avocado marketing. Solomon (2004) analyzed performance of cattle marketing system in Borena using marketing cost and margin and found that butchers in Addis Ababa received relatively a larger share of total gross marketing margin (69.5%, 63.4% and 61.6%) for cattle supplied from Yabelo, Negelle and Dubluk markets, respectively whereas producers' share of cattle market in Dubluk, Negelle and Yabelo was 21.9%, 20.6% and 18.6%, respectively. The study of Meryem (2013) on analysis of cow milk market chain revealed that processors obtained the highest gross marketing margin in channel IV which was 43.5% of consumers' price, followed by retailers in channel I that accounted for 42.5% of consumers' price. Her study also showed that retailers and processors obtained the highest NMM of consumers' price which accounted for 32.3% and 31%, respectively and she generalized that semi-whole sellers and dairy cooperative union obtained the least NMM.

2.8.3. Determinants of milk market supply participation and level of participation

Many empirical studies have been discussed regarding on factors that affect the marketable surplus of agricultural commodities and these empirical evidences indicate that assessment of determinants of marketable supply approach has become an important strategy to analyze

economic views in agricultural sector. A study conducted by Berhanu (2012) using probit model indicate that the household size, presence of at least a child in a house, landholding size and distance to the nearest urban market showed an inverse relationship whereas milk yield per day in liter showed a direct relationship with the probability of milk sales decision by milk producers. Another study conducted by Berehanu (2014) using Heckman first stage model also indicated that milking cow owned positively influenced the probability of milk sales decision of milk producers whereas age of the household and dairying experience affected negatively the probability of milk sales decision. Woldemichael (2008) studied the determinants of milk market supply using Heckman model and his survey results showed that family size, education level and number of cross breed milking cows owned affected positively both milk sale volume and milk market participation decision of milk producers. The study of Gizachew (2005) using logit model indicated that the effect of education level of the household head and extension visits showed direct relationship with milk market entry decision of milk producers. However, the study ignored the contribution of access to milk market information and availability of credit to market participation of milk producers. The findings of Asfaw (2009) found that membership of smallholder dairy producers in milk producers' cooperative is a key factor in determining their decision to participate in milk and butter markets and levels of market participation. Quantities of milk and butter that were produced, marketed and consumed by the members of cooperatives are significantly larger than those of non-members.

The study of Meryem (2013) on analysis of milk market supply decision using Heckman first stage model revealed that sex of the household head, access to market information and access to credit affected positively and significantly milk producers' decision to sell milk. The study by the same author also revealed that number of local and cross breed milking cows owned affected positively milk market participation decision and level of participation of milk producers whereas the number of children less than five years of age affected negatively and significantly producers' decision to sell milk and volume of milk sale. The study conducted by Bedilu *et al.* (2014) on determinants of camel and cow milk marketed surplus using Heckman model indicated that number of milking cow and access to milk market information

affected positively both milk sale volume and milk market participation decision of milk producers. According to these authors, access to extension service, number of milking cow, access to milk market information and market price of cow milk affected positively the volume of milk supplied to the market by milk producer households.

2.8.4. Determinants of milk value addition participation and level of participation

The study of Kumar (2015) on determinants of milk value addition using probit model indicated that, age of household head, milk yield per day, market distance for sale, educational level of producers and sex (females) are associated positively with the probability of milk producers decision to add values to milk while number of children under six years age, family size, year of dairying experience of farmer and sex (male) are correlated negatively with the probability of milk producers decision to add values to milk, but milk yield in litre per day, market distance to the nearest urban centre, age of farmer and sex (male) were related positively with the level of participation whereas the number of children less than six year age in a household, family size and sex (female) are associated negatively with the level of participation of household in milk value addition.

The study of Berhanu (2012) on determinants of farm level milk value addition using Heckman two-stage selection model revealed that distance to the nearest urban center, number of children under age six, consideration of value added milk products for social factors, availability of labor for value addition are associated positively with participation decision and level of participation of milk producer households in-farm level milk value addition whereas milk yield per day is related negatively with participation decision and level of participation to add values to milk.

A logit model is used by Kumar (2010) to search out factors encouraging milk traders' participation in milk value addition and the result showed that age, education level and household size have been found to influence the traders' decision to participate in milk value addition. The level of education showed a positive relationship with decision of participation in milk value addition whereas age and household size showed negative relationship with decision of participation by milk traders in milk value addition activities. However, the effect

of size of land holding, access to credit and membership to the milk producer's cooperative were ignored by the above authors.

The study of Taddelle *et al. (*2014) showed that sex of household head, market distance, number of local milking cows owned, volume of annual milk production affected positively and significantly both the likelihood of participation and level of participation of milk producers in milk value addition, but the number of children under six years age and number of crossbred milking cows affected negatively the level of participation in milk value addition while age and education level of the household influenced positively and significantly the likelihood of participation in milk value addition.

2.9. Conceptual Framework of the Study

The value chain concept deals with more critical assessment of performance and competitive advantage in a dynamic context of the existing situation and hence, analyzing the value chain helps to know the nature and source of value created within a supply chain and thereby to take measure for intervention and reducing loss (Simmons *et al.*, 2003). Value chains can be viewed as a network of different functions or stages from production to consumption, including all support services (Kaplinsky and Morris, 2001). Identifying the milk value chain actors, value addition activities and their value share along the chain and what factors affect the farmers' decision to participate in milk market supply and value addition is important.

Therefore; to undertake the analysis, benefit share of milk value chain actors, determinants of milk market supply and value addition were identified and theoretical and empirical reviews have been made and thereafter, based on the theoretical framework and empirical reviews seen, the effects of independent variables (determinants) on probability and level of participation of stallholder milk producers in milk market supply and value addition have also been hypothesized. Thus, participation decision and level of participation in milk marketing and value addition have been considered as dependent variable and factors that affect these dependent variables are summarized herewith by schematic representation of conceptual framework as follow:

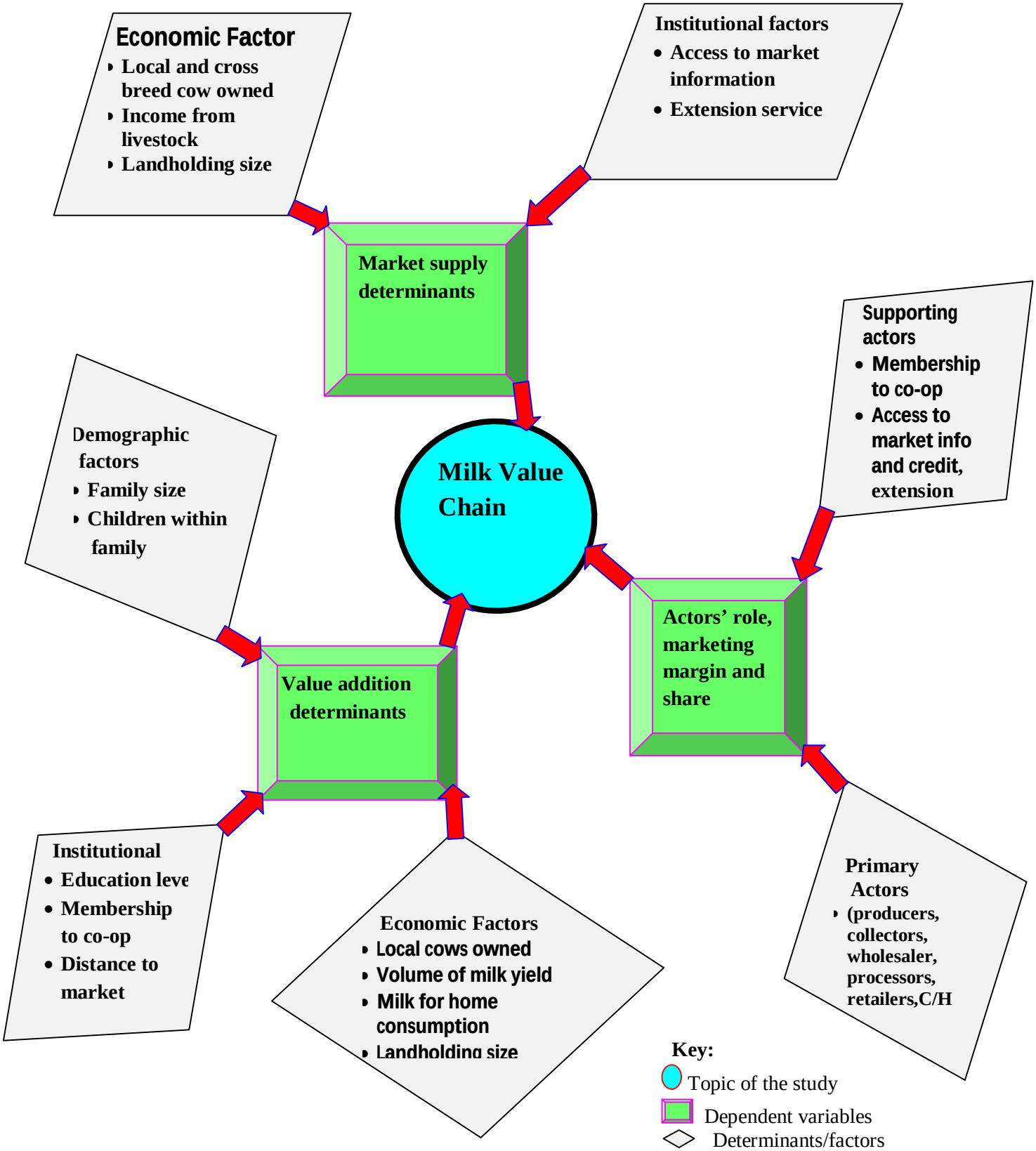


Figure 3: Conceptual frame work of milk value chain analysis

Source: own sketch from survey data (2016)

3. RESEARCH METHODOLOGY

This section justifies all methods, materials and procedures used in the study which includes the general description of the study area, the types and sources of data, sampling procedures and method of data analysis.

3.1.Description of the Study Area

The study was carried out in *Dessie Zuria* District which is one of the 21 districts of South *Wollo Zone* of *Amhara* Regional State and located at 400 and 480 kms to north of *Addis Ababa* and to East of *Bahir Dar* (town of *Amhara Regional* State), respectively (figure 3). The latitudinal and longitudinal location of *Dessie Zuria* District at its main town (*Dessie*) coordinates at 11°10′00″N and 39°19′59″E, respectively (http://dateandtime.info/city.php?id=8643760).

The topographical feature of *Dessie Zuria* District is plain to rugged land with valleys, gorges and mountainous land having three dominantly classified agro ecological zones namely; sub-afro alpine (*wurch*), highlands (*dega*) and mid highlands (*woina-dega*) constituting 25 %, 32% and 45% of the district total area covered, respectively with an overall average altitudinal range of 1800 to 3700 meters above sea level. The average annual rain-fall is about 1072 mm with erratic distribution. Based on colour base classification, black, red, brown and grey soils are the main soil types distinguished in the district. The major crops grown in the study area are barely (very dominant), wheat, pulse, maize and vegetables (potato, cabbage, and carrot) with a dominant crop-livestock mixed farming system.

The total number of human population of the district is 182162 (CSA, 2013) whereas the livestock population in the district of study area is also estimated to be 99128 cattle, 177324 sheep, 38055 goats, 31240 equines, 116712 poultry and 6445 bee colony (*Dessie Zuria* District Agricultural Development Office, annual crop assessment report, 2015).

Crop-livestock mixed production system is the most important components of subsistence farming system in the study area and are assumed to be more valuable to assure food security of the community. However, the erratic rainfall, severe deforestation, deterioration and descending of the coverage of the grazing land proportion as well as worst cultivation

including the high steep areas with traditional system of farming and livestock keeping practices are the main hindrance of developmental progress in the district (*Dessie* Zuria District office of Agriculture, 2016).

Dessie Zuria District (along with *Dessie* town) has high annual milk yield which is estimated to be 11524000 liters by the year 2016. The reason for its high potential of milk production is due to accessibility of the liquid nitrogen production and storage centre of improved cattle breed semen which is located in the town of the study area, *Dessie.* Liquid nitrogen is a basic input to preserve semen of improved cattle breed and undergo artificial insemination of cows. It is impossible to inseminate cows artificially without using liquid nitrogen for preservation of semen of bull. With regard to this, the study area (*Dessie Zuria* District) is fortuned being near to this liquid nitrogen production and semen storage centre that can easily access the liquid nitrogen along with semen of improved cattle breed. The other reason for the high milk production capacity of the study area is that there was huge milk processing enterprise since 2002 with high capacity of milk processing by collecting raw milk from the surrounding *kebeles*. However; the enterprise was working under its capacity of the processing due to low supply of milk from the surrounding *kebeles*. Though the processing unit is not working now, farmers were encouraged by the premium milk price of the enterprise that initiates them to rear high proportion of cross breed cows.

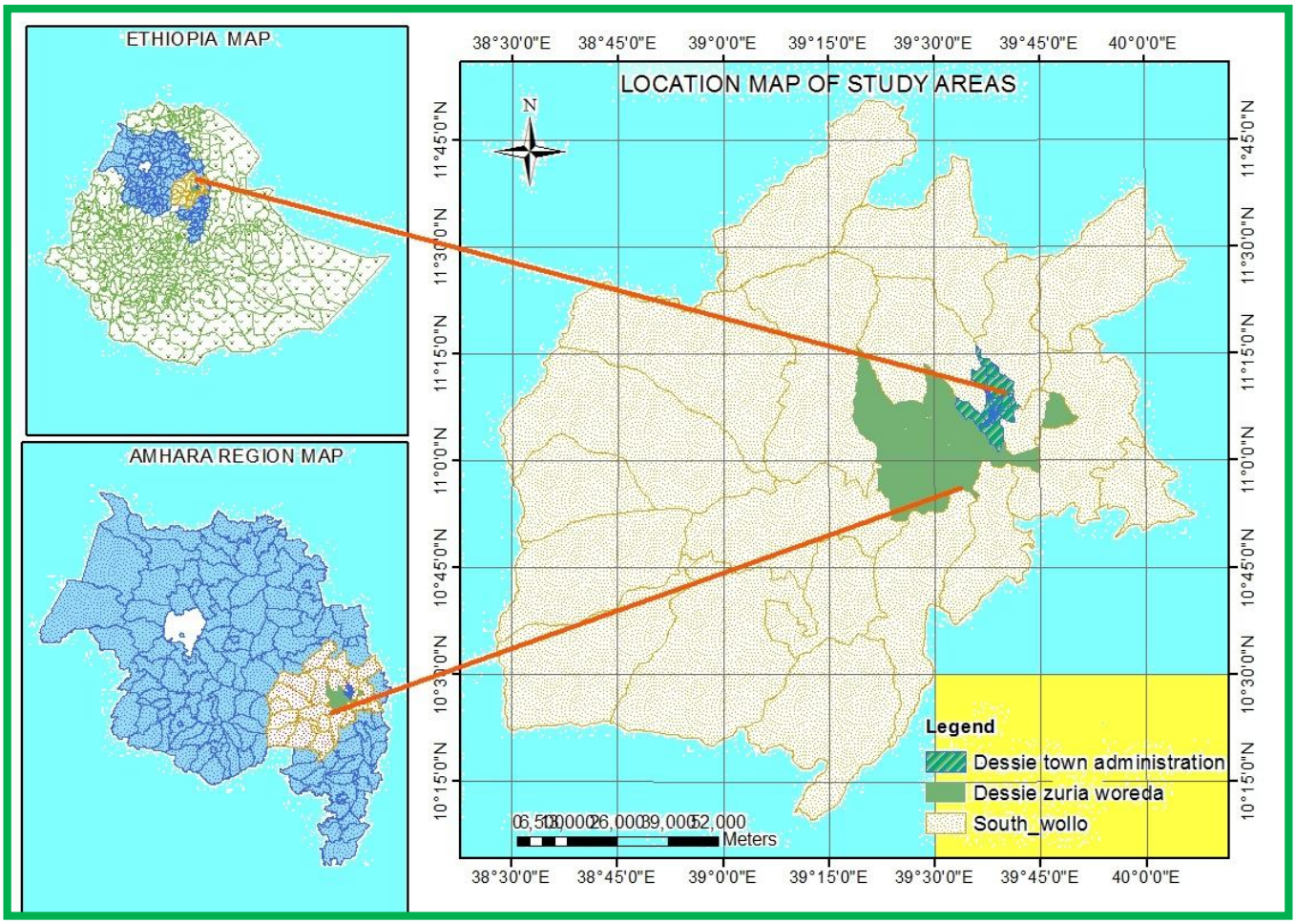


Figure 4: Map of the study area

3.2. Research Design

A cross-sectional study design was employed to study the function and roles of milk value chain actors, factors of milk marketing and value addition activities and benefit share of milk market actors at stallholder milk producers' level in *Dessie Zuria* District. First, thirty seven administrative *kebeles* of the study area were categorized into two: namely low (twenty five) and high (twelve) milk producer *kebeles* based on their current milk production level and market accessibility using the list provided by District Offices of Agriculture and then, six sample administrative *kebeles* of the district were selected randomly out of twelve high milk

producer *kebeles*. Secondly, to select representative sample households from these six *kebeles*, simple random sampling procedure was employed for the smallholder milk producers, from the list provided by *Kebele* Administrative Offices of Agriculture and distributed per sample *kebeles* using probability proportional to size computing.

On the other hand, all milk traders present in the study district were included in the sample. As the number of milk traders in the study area is small, their total population was used as a sample size except for Cafes/Hotels owners.

3.3. Types, Sources and Methods of Data Collection

Both quantitative and qualitative types of data were collected by well trained enumerators from both secondary and primary sources of data as: the secondary data from the District and Zonal Agricultural Office, internet, CSA, and other supporting sectors whereas the primary data from randomly selected milk producers and traders employing surveying method through conducting of interviews using pre-tested structured and semi-structured questionnaires.

3.4. Sampling Procedure and Sample Size

A two stage sampling procedure has been applied to select sample milk producer households in the study area. In the first stage, thirty seven administrative *kebeles* of the study area were categorized into two: namely low (twenty five) and high (twelve) milk producer *kebeles* based on their current milk production level and market access using the list provided by the study District Offices of Agriculture and then, six sample administrative *kebeles* of the district were selected randomly out of twelve high milk producer *kebeles*. In the second stage, a total of 100 sample smallholder milk producer households were selected randomly from these 6 randomly selected *kebeles*. The total population size where samples were drawn was 6207. The sample size of milk producers selected for this study was calculated using the formula of Yamane (1967) given as: $n = \frac{N}{1 + N(e^2)}$ …… (1)

with ±9.9% level of precision where, n = sample size, N = population size and e = level of precision or error margin.

Then, the sample size was calculated and the probability proportional to size (PPS) method of calculation was used to distribute the total sample size for each *kebele* as indicated in table 2 which depicts the selected *kebeles* and sample size of milk producer household heads per *kebele*.

Table 2: Sample summary of milk producer households for *kebeles* and study area

S.No.	Name of the *Kebele*	Total milk producer households	Proportion of households	Sample size of households	Percentage share of sample size (%)
1	*Kelina*	405	0.07	7	7
2	*Abaso kotu*	1186	0.19	19	19
3	*Harawabello*	1055	0.17	17	17
4	*Kurkur*	1746	0.28	28	28
5	*Kelem Dereba*	640	0.10	10	10
6	*Boru Silassie*	1175	0.19	19	19
	Total	6207	100	100	100

On the other hand, 69 milk traders (51 Cafes/Hotels, 5 milk retailing kiosk, 5 collectors, 4 wholesalers and 4 processors) were selected to get milk value chain related information. There were 5 milk retailing kiosk, 5 milk collectors, 4 wholesalers and 4 processors in the study area and all of them were selected since their number is small. However, out of 103 Cafes/Hotels, 51households were selected randomly using the same formula as used in milk producers' selection: Yamane (1967). The records of milk traders in the study area were taken from the records kept by the Chamber of Trade and Sectoral Society Office of *Dessie Zuria* District and then, all of the legal milk traders were included in the probability of sample selection process to have an equal chance of being selected.

Table 3: Sample summary of milk traders

S.No.	Name of milk market intermediary	Total number of population	Sample size
1	Collectors	5	5
2	Cafes/Hotels	103	51
3	Milk retailing kiosks	5	5
4	Wholesalers	4	4
5	Processors	4	4
	Total	121	69

3.5. Method of Data Analysis

The smallholder level milk value chain and marketing channel was displayed through assessment and mapping of the existing chain in the study area. The collected data from milk producers and other respective milk trader respondents were analyzed by descriptive method and appropriate econometric models using version 12, STATA software.

3.5.1. Descriptive analysis

The collected data were analyzed using descriptive statistics and summarized by their means, ratios, percentages, standard deviations and presented using tables accordingly.

Value chain map

Mapping of value chain enables to visualize the flow of the product from input suppliers to end consumer through various actors. It helps to identify the different actors involved in the milk value chain and to know their functions and linkages (McCormick and Schmitz, 2002). Thus, the map of milk value chain was carried out through presenting the various actors of the chain, their linkages and all operations of the chain from supply of inputs to consumption.

Marketing margins:

For the determination of channel, one asks the questions “From whom did you buy?” and “To whom did you sell?” Scott (1995) pointed out to obtain information concerning the margins and agents have to answer the question “what price did you pay?” and “what was the selling price?” To get marketing cost and margin, the cost and price information were gathered during conducting of the survey work. The computation of the total gross marketing margin (TGMM) is always related to the final price paid by the end buyer and is expressed as percentage (Mendoza, 1995):

$$\mathbf{TGMM} = \frac{\mathbf{Consumer\ Price} - \mathbf{Producer\ Price}}{\mathbf{Consumer\ Price}} * \mathbf{100} \qquad \text{……..…… (2)}$$

Where, TGMM = Total gross marketing margin.

Producers' gross margin is the portion of the price paid by the end user or end buyer that goes to the producer.

$$GMMp = \frac{\text{Consumer price} - \text{Marketing gross margin}}{\text{Consumer price}} * 100 \quad \text{..... (3)}$$

Where, GMM_p = the producers' share of consumer price.

The producer's share is the commonly employed ratio calculated mathematically as, the ratio of producer's price to consumer's price. mathematically expressed as:

$$P_s = \frac{P_x}{P_r} = 1 - \frac{MM}{P_r} \quad \text{..... (4)}$$

Where: P_s = Producers share, P_x = Producer's price of milk, P_r = Retail price of milk, and MM = Marketing margin.

$$NMM = \frac{\text{Gross margin} - \text{Marketing cost}}{\text{Consumer price}} \times 100 \quad \text{..... (5)}$$

Where NMM = Net Marketing Margin

3.5.2. Econometric analysis

Depending on the objectives set to be achieved and the hypotheses to be verified, Tobit and Heckman two stage regression models were selected to analyze hypothesized variables of this study. The Tobit and Heckman two stage model were used to analyze factors affecting the probability and level of participation of smallholder milk producer households in milk market supply and milk value addition, respectively.

Tobit regression model: is an econometric model which was used in this study to analyze determinants of probability of participation and level of participation of smallholder milk producers in milk market supply. Many smallholder milk producers in the study area participated in milk market supply; however, the level of participation within the participants differs. On the other hand, some of the producers participate in milk value addition and some are not participate. In Tobit model, the participation decision and level of participation of milk producers in milk market supply can be determined concurrently by the same variables as the variable which affect the probability of participation also affect the intensity of participation or total marketed volume. For those non-participants, Tobit model considers all the zero observations as corner solutions where the respondent is assumed to be a milk supplier with zero marketed volume of milk supply by them.

The Ordinary Least Square (OLS) model can be selected if and only if all observed households participate in the market, but in this case; most households participate in milk market supply while some others do not due to they may prefer not participate in milk market supply in search of other alternatives while other milk producer households may be totally expelled from participation due to asset limitations or marketing conditions. On the other hand, participants are not also supplying in the same intensity or level. If the OLS regression is applied excluding the non-participants from the analysis, a sample selectivity bias is introduced into the model and then the output produced will be biased.

Therefore; to overcome this problem in this situation, either Tobit or Heckan selection model can be applicable for analyzing milk market supply determinants. Many recent scholars adopt Tobit and Heckman's two stage models to analyze factors determining producers' participation in agricultural product marketing (either to participate or not participate to sell their products) and at the same time to analyze factors determining the volume of marketed products.

Heckman selection model was tested for the analysis of the data. However, the inverse mill's ratio produced was insignificant indicating that there was no selectivity bias and which accept the null hypothesis that state: there is no unobserved selection process which governs the participation equation is rejected and this also implies that there was no difference between participants and non participants of milk market supply. In addition, the two groups of milk market participants and non participants are not comparable since the participants by much greater than the non-participants group. For this case double hurdle model was not also considered since the two decisions are not independent as well as the two groups are not equivalent in size.

However, in a situation when the two groups of participants and non-participants differ with large gap in their size and interdependence between the two decisions is assumed, Tobit model is a preferred model. The dependent variable in Tobit model is censored; this means that Tobit models set parameters around it. Tobit models also address problems of data due to measurement or dataset and that are not capturing all the information (i.e. ceiling effects or censored data)

The variable $\mathbf{y_i^*}$ is assumed to be as a variable that captures the outcome variable of interest for all observations in the sample, even for those where one wasn't observed in reality (eg. milk producers who did not sell milk). Tobit model is also applicable to jointly determine factors affecting probability and intensity of participation (Sindi, 2008) and also, Tobit model deals with the identification of variations among the participants intensity of supplying.

Therefore, Tobit regression model was selected for the data analysis of determinants of smallholder milk producers' probability and intensity of participation in milk market supply for its advantage that the latent outcome variable $\mathbf{y_i^*}$ which is related to the observed and censored outcomes in the following way and the model assumes normal distribution with constant variance (Greene, 2003) and specified as:

$$\mathbf{y_i = x_i \beta + \varepsilon_i, \quad \varepsilon_i \sim N(0, \delta^2)} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

$$y_i = \begin{cases} y_i^*, \text{if } y_i^* > 0 \\ 0, \text{if } y_i^* \leq 0 \end{cases}$$

Where: y_i = is the volume of marketed milk supply taking continuous value between 0 and 1

y_i^* = latent outcome variable that captures the outcome variable of interest for all observations in the sample

x_i = vectors of explanatory variables

β = parameters specifying relationship between x and y

ε_i = error term (with assumption of being normally distributed)

To predict the possible effects of changes in explanatory variables x_i, on y_i, the derivatives of the estimated Tobit model result should be computed since interpreting the coefficients of a Tobit result as in OLS method of interpretation in linear model is not an appropriate way (Johnston and Dinardo, 1997). In Tobit model, explanatory variables xi, affect the conditional mean of yi*, when yi* > 0 in the distribution and the marginal effect of an explanatory variable on expected value of the dependent variable can be specified as:

$$\frac{\partial E(y_i)}{\partial x_i} = F(Z)\beta_i, \text{ where } \frac{\beta_i x_i}{\sigma} \text{ is denoted by Z as Maddala (1997)} \ldots\ldots\ldots\ldots\ldots (7)$$

And the explanatory variables xi, also affect the probability that the observed value to fall within yi* > 0 category of distribution per change in x_i (independent variables) and specified

as: $\frac{\partial E(Z)}{\partial X_i} = f(z)\frac{\beta_i}{\sigma}$ ……..…… (8)

The change in level of participation in market supply among participants with respect to a change in an explanatory variables x_i, y can be denoted as:

$$\frac{\partial E(Y_i/Y_i>0)}{\partial X_i} = \beta_i\left[1 - Z\frac{f(z)}{F(z)} - \left(\frac{f(z)}{F(z)}\right)^2\right] \quad \text{……..…… (9)}$$

Where:

β = a vector of maximum likelihood estimates

Z = the z-score for the area under normal curve

f (z) = the value of the derivative of the normal curve at a given point (that is, unit normal density)

F (z) = the cumulative normal distribution of Z

∂ = the standard error of the error term

Heckman's two-stage estimation model: is an econometric model which was used in this study to analyze determinants of decision of participation and level of participation of smallholder milk producers in milk value addition. For this study, Heckman two stage model was preferred for its exceptional efficiency of using the same or different explanatory variables in both the first stage (decision of participation) and the second stage (level of participation) of analysis. This implies that Heckman selection model captures the milk producer's participation decision whether to participate or not in milk value addition and if they participated, also to select their level of participation. Therefore, a Heckman (1979) two stage estimation model was employed for its advantage of selectivity bias correction using the inverse Mill's ratio which is generated in the first stage/probit/ regression of the participation decision and used in the second stage of regression as one of the explanatory variable with other variables to analyze determinants of level of participation (volume of milk value added). If the 'selectivity' value (Inverse Mill's ratio) is significant, the null hypothesis that state: there is no unobserved selection process which governs the participation equation is rejected or in other words, the alternative hypothesis that state: the presence of unobserved selection process which governs the participation equation is accepted/confirmed. The ordinary least squares (OLS) can be used to analyze determinants of level of participation in milk value addition. But, some milk producer households may prefer not participating in milk value

additions in search of other alternatives while other milk producer households may be totally expelled from participation due to asset limitations. Then, if OLS regression is employed excluding the non-participants from analysis, a sample selectivity bias will be formed in the model. So, to overcome this problem, Heckman (1979) two stage selection model was employed to analyze determinants of the likelihood of smallholder milk producers' participation decision and level of participation in milk value addition.

The selection equation for decision of smallholder milk producers either to participate or not to participate in milk value addition could be formulated as binary response model which could be analyzed employing the specification of the probit regression equation as expressed by Wooldridge (2002):

$Y^* = MVAP_i^* = X_{1i}\beta_{1i} + \varepsilon_{1i,}\ \varepsilon_{1i} \approx N(0, \delta 2)$ ……..…….. (10)

$Y = MVAP_i = 1$, If $Y^* > 0$

$Y = MVAP_i = 0$, If $Y^* \leq 0$

Where:

Y^* = is a latent (unobservable) variable representing household discrete decision whether to participate or not in milk market supply

X_{1i} = vector of explanatory variables assumed to determine the likelihood of milk producer households participation in milk value addition

β_{1i} = is a vector of unknown parameter in participation equation

Y = is a dependent (response) variable that takes the value one if a milk producer participates in milk value addition and zero otherwise.

ε_{1i} = Random disturbance term that captures all unmeasured variables and that are independently and normally distrusted with zero mean and constant variance

MVAP = milk value addition participation decision.

The functional form of Probit model requires the error term to be homoscedastic as the probability form depends only on the difference between the error terms of one choice with the other error terms (Amemyia, 1985). This means that the computation comprise the partial derivatives that measure the change in the participation probability per unit change in the explanatory variable. The marginal effect of continuous explanatory variables can be

computed multiplying the estimate of coefficient by standard probability density function holding other explanatory variables at their mean values whereas the marginal effect of dummy explanatory variables can be analyzed by relating the probability result of dummy variables taking the two values; 1 if add value to milk and 0 otherwise holding all other explanatory variables constant at their mean values of the sample (Wooldridge, 2002).

The maximized log likelihood value to obtain estimates of parameters and subsequent marginal effects is denoted as:

$$\mathbf{Ln\ L}\left(\frac{\alpha}{Y}, Z\right) = \sum_{y=1} \ln\left(\Phi(Z'\alpha)\right) + \sum_{y=0} \ln\left(1 - \Phi(Z'\alpha)\right) \quad \text{.. (11)}$$

The value added milk/volume equation of level of participation for smallholder milk producers' in milk market supply could be formulated as Heckman second stage model which could be analyzed employing the specification of regression equation denoted as Heckman (1979):

$$Y_{2i} = VVAM = \beta_0 + \beta_{1i}X_{1i} + \beta_{2i}X_{2i} + \cdots + \beta_n X_n + \eta_n \lambda_m (X_i\beta)j + \varepsilon_j \quad ; E_{j} \approx N(0, \delta^2) \text{ .... (12)}$$

Where:

Y_{2i} = VVAM = volume of value added milk

Xj = exogenous variable in the second stage

β_j = vectors of unknown parameters (to be estimated and measures the effects of independent variables on household's decision) in participation equation

$\lambda_j (X_i\beta)_j$ = the inverse Mills ratio derived in the first stage/probit/ regression

η_n = shows the influence of participation on the volume of value added milk

ε_j = stochastic term in the second stage that are independently and normally distributed with zero mean and constant variance

$$\text{Mills ratio } (\lambda) = \frac{F(X1\ \beta1)}{1-F(X1\ \beta1)} \quad \text{.. (13)}$$

Where:

$X\beta$ = a density function

1-F ($X_1\beta_1$) = distribution function

To detect problem of multicollinearity among variables, Variance inflation factor (VIF) and contingency coefficient (CC) were used. According to Gujarati (2003), multicollinearity refers to a condition where it becomes difficult to identify separate effect of explanatory variables on dependent variable due to the existence of strong correlation among them. VIF used to test multicollinearity among continuous variables whereas contingency coefficient (CC) used to test multicollinearity between dummy independent variables. As a rule of thumb, if the value of VIF is greater than 10 (this will happen if R^2 is greater than 0.91) and if the value of CC greater than 0.75, then the variables are said to be collinear (Gujarati, 2003) and VIF for continuous variables computed as follow:

$$VIF(X_i) = (1-R_j^2)^{-1} \quad \text{.......... (14)}$$

Where, R_j^2 is the squared multiple correlation coefficients between independent variables, the larger the value of R_j^2, the higher the value of VIF (X_i) causing severe collinearity problem in X_i. The value of CC ranges between 0 and 1 and 0 indicates no association between the variables and the value close to 1 indicates a high degree of association between variables.

$$CC = \sqrt{\frac{\chi^2}{N+\chi^2}} \quad \text{.......... (15)}$$

Where, CC is contingency coefficient, χ^2 is chi-square test and N is total sample size.

3.6. Definition of Variables and Hypothesis

Determinants of the participation decision and level of participation of smallholder milk producers in milk market supply and milk value addition including their response effects were hypothesized as follow:

3.6.1. Dependent variables

The dependent variables that are assumed to be influenced by explanatory variables were:

Probability and level of participation in milk market supply (VMforMSupply): is continuous dependent variable measured in liters indicating the actual volume of milk supplied to the market per household per day and regressed using Tobit model and that

represented the probability of milk market participation (either to participate or not to participate) and intensity of participation of milk producers in milk market supply. This variable is a relevant substitute for intensity of market participation by representing the observed and actually marketed amount of milk y_i* in the market.

Decision of participation in milk value addition (PDMProceessing): is a dummy dependent variable that represented the probability of milk producers' participation in milk value addition and was regressed using Heckman first stage model. In this study, milk value addition is to mean the act of processing or adding value(s) changing its form into milk products. Value addition increases the customer value offered by a product or service. The products obtained from smallholder traditional level milk value addition are butter (which is further processed into ghee) and butter milk (which is further processed into cheese and whey). So, if we say milk value addition; in this context, it is to mean that the process of converting milk into different milk products and supplying these value added products to market. However, in this study; butter is the key milk product supplied to market after practice of milk value addition by smaller holder milk producers while other milk products are consumed at home. The variable represented the value of one if milk producer participated in milk value addition and zero otherwise. In this study, those milk producers who process or add value only for their home consumption were not considered as milk value addition participant since they were not involved in market supply after value addition.

Level of participation in milk value addition (VMforVA): is continuous dependent variable measured in liters indicating the actual volume of value added milk for market supply. Volume of value added milk is a proxy variable to represent milk product (butter) for market supply by milk producer households in the study area and was regressed using Heckman second stage model.

3.6.2. Independent variables

The explanatory variables that were hypothesized to influence the smallholder milk producer probability and intensity of milk market supply and milk value addition were the following.

Sex of the household head (sex): is a dummy variable representing one if a household is male and zero otherwise and assumed to influence the households probability of decision to participate in milk market supply and intensity of supply. Male households were expected to be more favored to get dairy input than females. Therefore, in this study, being male household head was expected to affect positively the smallholder milk producer households' probability of participation and level of participation in milk market supply and milk value addition. The study of Meryem(2013) showed that being male household head affected positively the likelihood and level of participation in milk market while Tadele *et al.* (2014) indicated that being male head of a household was found to affect positively both the likelihood of participation in milk value addition and volume of milk value added.

Age of the household (age): is a continuous variable measured in year and hypothesized to have a positive relationship with milk value addition participation decision. As the age of milk producer household increases, their likelihood to be wise in milk business also increases. Tadele *et al.* (2014) stated that age of the household head explained positively the smallholder milk producer households' decision of participation and level of participation in milk value addition practices. .Therefore, in this study, age of the household was hypothesized to influence positively the participation decision of milk producer households in milk value addition.

Family size of the household (thousehsz): is a continuous variable measured in number and assumed to influence positively the level of participation of smallholder milk producer households in milk value addition. This is assumed due to the fact that when the number of family size increases, the probability of work force availability per household increases and thereby increase level of participation in milk value addition since there may not be lack of work force. Finding of Kumar (2015) indicated that family size is associated negatively with the level of milk value addition participation.

Number of children under 6 years old (nchilsix): is a continuous variable measured in number and hypothesized to influence negatively the smallholder milk producer households' probability of participation and level of participation in milk market supply and value addition. According to the study of Kumar (2015), the number of children less than 6 years

age was correlated negatively with farmer's likelihood of participation and intensity of participation in milk market supply as well as decision of participation in milk value addition. This is due to the assumption that milk is as a favorite food for children whereas the study conducted by Berhanu (2012) revealed that the positive relationship of the number of children less than 6 years age and milk producer households' participation in milk value addition while study of Meryem (2013) found that the number of children less than 6 years age and milk producer households' participation in milk market supply showed negative relationship.

Educational level of the household (edulevel): It is a continuous variable measured in number of years of formal schooling and hypothesized to have a positive relationship with probability and intensity of milk market supply and value addition. Education can enhance the knowledge and skills of farmers and enables them to perform the farming activities in an appropriate way accordingly. Moreover, formal education enhances the information sharing and technology implementation abilities of the farmer, thereby improving the quality of decision making (Fakoya *et al*., 2007). Woldemichael (2008) found that education level of a household head affected positively the probability and intensity of participation of smallholder milk producer households in milk market supply while Tadele *et al.* (2014) revealed that education level of the household head showed positive relationship with the smallholder milk producer households' decision of participation and level of participation in milk value addition practices.

Land holding size of the household (landhs): is continuous variable measured in hectare and proposed to influence negatively the decision of participation and volume of milk market supply and value added milk by milk producers. When the land holdings of a household increases, farmers are expected to divert their tendency towards crop cultivation activities than milk business activities. According to Berhanu (2012), landholding size showed an inverse relationship with the probability of milk sales decision and value addition by milk producers.

Number of local breed milking cows owned (tlocalcow): is a continuous variable measured in number and hypothesized to have negative and positive influence on probability and intensity of smallholder milk producers' participation in milk market supply and milk value

addition, respectively. Meryem (2013) found that number of local breed milking cows owned affected positively the probability and intensity of milk producer households' participation in milk market supply while Tadel *et al.* (2014) found the positive correlation of number of local breed milking cows owned with probability and intensity of milk producer households' participation in milk value addition.

Number of cross breed milking cows (tcrosscow): is a continuous variable measured in number and hypothesized to have positive and negative influence on probability and intensity of smallholder milk producers' participation in milk market supply and milk value addition, respectively. When number of cross breed milking cows per household increases, the tendency of household to participate in milk market rather than value addition increases as cross breed cows produce less content of fat during milk processing than local breed one. The result of the study conducted by Meryem (2013) and Tadele *et al*. (2014) showed that number of cross breed milking cows affected positively and negatively the probability of participation and level of participation of smallholder milk producers in milk market supply and milk value addition, respectively.

Amount of income from sale of livestock and livestock products (inclsoff): is a continuous variable measured in number and hypothesized to affect positively the smallholder milk producers' probability and intensity of participation in milk market supply. When the smallholder milk producer households' income level from livestock off take rate and livestock products increases, their attention to sufficiently engaged in dairy development sector and thereby milk market supply also increase and hence this variable was hypothesized to affect positively the likelihood and level of participation in milk market supply.

Experience in milk production (dairyexpe): is a continuous variable measured in years and assumed to influence positively the probability and level of participation of milk producer households in milk market supply. This assumption is based on the fact that when the experience of a farmer in dairy production increases, the skill to perform milk business in a better way also increases. The study of Kumar (2010) indicated that experience of dairy farm has been found to influence positively the producers' participation and intensity of participation in milk market supply.

Volume of milk yield per day in litre (myieldpcow): is a continuous variable measured in liter and hypothesized to have a positive relationship with probability of smallholder milk producers' participation in milk value addition. When the amount of milk produced per day increases, some left out milk from family consumption will be available and there is a chance to allocate considerable amount of milk for value addition. A study conducted by Tadele *et al*. (2014) and Kumar (2015) indicated that milk yield per day in liter showed a direct relationship with the probability of milk value addition participation and level of participation of milk producers whereas the study conducted by Berehanu (2012) found the inverse relationship of milk yield per day in liter and milk producer households participation probability and level of participation.

Volume of milk allocated for home consumption (VMforHC): is a continuous variable measured in litre and expected to affect negatively the milk producer households' probability and intensity of participation in milk value addition. When the household members in a family tend to consume more milk especially for socio-cultural purpose, the probability to add value to milk and supply to the market is decreased. This is mainly related with the culture that a person who involved in milk selling is considered as poor by rural community in the study area.

Access to market information (marketinfo): is a dummy variable taking the value of one if a household had access to market information and zero otherwise. Having good communication with milk traders can provide access to market information. Berhanu (2012), Meryem (2013) and Bedilu *et al.* (2014) found that access to market information showed positive relationship with milk producers' probability of participation as well as the volume of milk market supply. According to the study of Goetz (1992) on food marketing, better market information significantly enhances probability of market participation of households. Therefore, this variable was hypothesized to influence positively the smallholder milk producer households' probability and intensity of participation in milk market supply.

Membership to milk producers' cooperative (membercoop): is dummy variable taking the value of one if a household is member to milk producers cooperative and zero otherwise and hypothesized to have a positive relationship with milk market supply participation. Members

have better opportunity to bargain and get fair price for their milk products which encourages them to participate in milk market supply. According to the study of Asfaw (2009), milk marketing cooperative members produced, consumed and sold more milk than non-members milk producers.

Distance from market/urban centers (distancehome): is a continuous variable measured in km from the home of milk producer households to the market centre and hypothesized to affect negatively households' probability of participation and level of participation in milk market supply, but hypothesized to influence positively households' decision of participation and level of participation in milk value addition. As the distance between market centre and households residence increases, milk producer households prefer and tend to process their fluid milk into other milk products. The study of Luoga *et al*. (2008) found that distance to milk selling point was related negatively and significantly with market participation of producer households. This means, when market centre is nearby to the producer home, farmers are likely to supply more milk to the market and vice versa. Kumar (2015) and Berhanu (2012) found that distance from market centre showed inverse relationship with participation of milk producer households in milk value addition.

Service contact frequency of extension per month (extenservice): is continuous variable hypothesized to have a positive relationship with milk market supply and value addition. It is expected that extension service widens the actor's knowledge and has positive impact on milk market and value addition participation decision and level of participation. Holloway and Ehui (2002) identified that extension visit is directly related to capacity of households skill in dairy production, marketing and value addition. Meryem (2013) also found the direct relationship between extension visit and milk market participation. However, Bedilu *et al*. (2014) found inverse relation of access to extension service with probability and intensity of milk market supply.

Preference of cattle breed type (breedprefer): is dummy variable taking the value of one if a household preferred improved/cross breed cow and zero if a household preferred local breed cow and hypothesized to have a positive relationship with probability and intensity of milk market supply participation. Cross breed cows inherited with high milk productivity, but low

in content of fat in the milk. Hence, milk producers prefer to sell milk rather than to add value and increase their probability and level of participation in milk market supply.

Table 4: Summary of hypothesis and variables relationship

List of independent variables and their type		Dependent Variables, their types and relationship with independent variables		
		Milk Market Supply	Milk value addition	
List	Variable type	PP & LP (continuous)	PD (dummy)	LP (continuous)
• Sex of the household	Dummy	+(M)	+(M)	+(M)
• Age of the household	Continuous		+	
• Family size of the household	Continuous			+
•No. of children ≤6 years old	Continuous	-	-	
• Educational level of the household	Continuous	+	+	+
• Land holding size	Continuous	-	+	+
• Number of local breed cows	Continuous	-	+	+
• Number of cross breed cows	Continuous	+		
• Income from livestock and livestock products sale	Continuous	+		
• Experience in milk production	Continuous	+		
• Volume of milk yield/day	Continuous		+	+
• Volume of milk allocated for home consumption	Continuous		-	
• Access to market information	Dummy	+		
• Membership to cooperative	Dummy	+		
•Distance from market center	Continuous	-	+	+
• Service contact frequency of extension	Dummy	+	+	+
• Preference of breed type	Dummy		-(local breed)	

PP= probability of participation, PD= Participation decision and LP = level of participation measured in liter, M= male

4. RESULTS AND DISCUSSION

This section contains results of descriptive and econometric data analysis of the study. Descriptive analysis was used to describe demographic characteristics of respondent households with regard to their performance analysis, milk market supply and milk value addition participation and level of participation. The econometric analysis was dealt to assess determinants of participation decision and level of participation in milk market supply and value addition.

4.1. The Results of Descriptive Analysis

4.1.1. Demographic and socioeconomic characteristics of the sample households

The total number of sampled smallholder milk producer households and traders used for the survey was 100 and 69, respectively. Out of 100 and 69 sampled smallholder milk producer and traders, 75% and 25% and 67% and 33% were male and female household respondents, respectively. Based on the survey results, about 86% and 45% sample households were found to be milk market supply and milk value addition participants, respectively. This implies that most milk producer households do not participate in value added milk market.

According to the survey findings, of the 86% (milk market supply) and 45% (milk value addition) participants, about 62 (72.09%) and 24 (27.91%) were milk market supply and 33 (73.33%) and 12 (26.67%) were milk value addition participants of male and female households, respectively. The chi-square test showed that there was statistically significant difference at less than 10% probability level between female and male participants and non-participants of milk market supply which implies that sex affected significantly the participation of households in milk market whereas there was no significant difference among milk value addition participants and non-participants.

The marital status of sample households were 5% single, 77% married, 12% divorced and 6% widower. In regard to marital status, there was no statically significant difference between the two groups of participants and non participants of both milk market supply and value addition. Regarding the major annual income source, about 76%, 19% and 5% respondents

said that their major income was from crops, sales of livestock and livestock products and off farm activities, respectively. According to the survey result, there was statically significant difference at less than 5% and 10% probability level between the major income source of the two groups of participants and non participants of milk market supply and value addition, respectively (Table 5).

Table 5: Demographic and economic characteristic of the sample households by categorical variables

variables	Participation in milk market supply							Participation in milk value addition				
	Total (N=100)		Participants (N=86)		Non-participants (N=14)		χ^2	Participants (N=45)		Non-participants (N=55)		χ^2
	number	%	number	%	Number	%		number	%	Number	%	
Sex												
Female	25	25	24	27.91	1	7.14	2.77*	12	26.67	13	23.64	0.1212
Male	75	75	62	72.09	13	92.86		33	73.33	42	76.36	
Total	100	100	86	100	14	100		45	100	55	100	
Marital status												
Single	5	5	4	4.65	1	7.14	3.611	2	4.44	3	5.45	2.419
married	77	77	64	74.42	13	92.86		32	71.11	45	81.82	
divorced	12	12	12	13.95	0	0		7	15.56.	5	9.09	
Widower	6	6	6	6.98	0	0		4	8.89	2	3.64	
Total	100	100	86	100	14	100		45	100	55	100	
Income source from:												
Crops	76	76	64	74.42	12	85.71	6.10 **	38	84.44	38	69.09	5.6247*
Sales of Livestock and livestock Products	19	19	19	22.09	0	0		4	8.89	15	27.27	
Off arm activities	5	5	3	3.49	2	14.29		3	6.67	2	3.64	
Total	100	100	86	100	14	100		45	100	55	100	

The value ** &*represents statistical significance level at 5% and 10%, respectively.
Source: own computation from survey data (2016)

The average age and family size of sample household heads was 47.98 years and 5.68, respectively and there was no statistically significant difference of age and family size between the two groups' participants and non-participants of both milk market supply and value addition. This implies that age and family size did not affect both milk market supply and value addition participation.

The mean educational level of sample household was 4.01 years and there was no statistically significant difference between the two groups of participants and non-participants of milk market supply, but there was significant difference at less than 10% probability level between participants and non-participant groups of milk value addition implying that education level affected milk producers' participation in milk value addition. The average number of children less than six years age per household was 0.445; however, there was no statistically significant difference between participants and non-participant groups of both milk market supply and value addition.

The mean distance from the home of sample milk market and value addition participant and non participant households to milk market center was 7.65, 11.07 and 10.71, 6.02 km, respectively and had statistically significant difference at less than 1% probability level between participant and non participant groups of both milk market supply and value addition indicating that distance affected significantly both milk market supply and value addition participation of households.

The average value of dairying experience of sample households was about 12.54 years with no statistically significant difference between the participants (12.81years) and non-participants (10.86years) of milk market supply while had significant difference at 5% significance level between the participants (14.8years) and non-participants (10.69years) of milk value addition showing that dairying experience affected significantly milk producers participation in milk value addition whereas the service contact frequency of extension per month provided for sample households by development agent (extension worker) was 3.68 times. However, the statistical difference between the participants and non participants group of both milk market supply and value addition was insignificant (Table 6).

Table 6: Socio-demographic depiction of sample households by continuous variables

Variables	Total (N=100)		Participation in milk market supply					Participation in milk value addition				
			Participants (N=86)		Non-participants (N=14)		t-value	Participants (N=45)		Non-participants (N=55)		t-value
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.		Mean	Std. Dev.	Mean	Std. Dev.	
Age (yr)	47.98	12.35	48.03	12.59	46.00	11.03	-0.644	47.11	13.05	48.69	11.87	0.634
Familysize (No.)	5.68	1.69	5.65	1.59	5.86	2.28	0.420	5.38	1.48	5.93	1.82	1.628
Edu. Level(yr)	4.01	4.37	4.21	4.36	2.79	4.37	-1.1318	3.2	3.99	4.67	4.58	1.692*
Children < 6 years old(No.)	0.445	0.65	0.45	0.68	0.393	0.49	-0.3198	0.555	0.69	0.354	0.614	-1.5377
Distance to market centre (km)	8.13	4.53	7.65	4.52	11.07	3.38	2.703***	10.71	3.55	6.018	4.15	-5.996***
Experience in dairying (yr)	12.54	9.92	12.81	10.27	10.85	7.45	-0.6829	14.8	9.39	10.69	10.03	-2.097**
Frequency of extension contact/month	3.67	3.54	3.88	3.61	2.357	2.84	1.505	4.04	3.95	3.364	3.17	-0.956

The value ***, ** and *represents statistical probability level at 1%, 5% and 10%., respectively and yr. stands for year; No. stands for number.

Source: own computation from survey data (2016)

4.1.2. The mean values of production and income source per sample households

The mean annual crop production per sample household was 6.29 quintals and there was no significant difference between the two groups of participants (6.38 quintals) and non-participants (5.75 quintals) of milk market supply whereas there was statistically significant difference at 1% probability level between participants (4.87 quintals) and non-participants group (7.46 quintals) of milk value addition. The average annual income of sample households from agro forestry, trade and livestock sale in the study area were 3566, 300 and 3717 birr, respectively. There was no statistically significant difference between the amount of income from sale of livestock and livestock products of the two groups of milk market participants (3826 birr) and non-participants (3050 birr), but there was significant difference

amongst the participants (2233 birr) and non-participants (4930 birr) of milk value addition at 1% probability level implying that amount of income from sale of livestock and livestock products affected significantly the milk producers participation in milk value addition.

Regarding the annual income source of agro forestry and trade, there was no significant difference amongst the participants and non-participants groups of both milk market supply and milk value addition (Table 7).

Table 7: The mean values of annual crop production and income per sample households

Variables	Total (N=100)		Participation in milk market supply					Participation in milk value addition				
			Participants (N=86)		Non-participants (N=14)		t-value	Participants (N=45)		Non-participants (N=55)		t-value
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.		Mean	Std. Dev.	Mean	Std. Dev.	
Crop production/ year/hh (quintal)	6.29	4.24	6.38	4.11	5.75	5.09	-0.517	4.87	3.69	7.463	4.32	3.188***
Annual income per hh from:												
Agro forestry	3566	5495.66	3553	5211	3642	7238	0.0561	2166	4191	4710	6171	2.355
Trade	300	2129.64	348	2294	0	0	-0.566	155	1043	418	2719	0.6116
Livestock sales (offtake)	3717	4404.57	3825	4405	3050	4504	-0.6091	2233	2890	4930	5042	3.19***

The value *** represents statistical significance level at 1%.

N.B. hh stands for household

Source: own computation from survey data (2016)

4.1.3. Resources owned, cow productivity, lactation length and milk allocation

The average value of landholding size per household in the study area was 0.93 hectare (Table 8). However, the mean value had no statistical significant difference between participants and non participants groups of sample households of both milk market supply and milk value addition. The average total milking cows per household and milk yield per cow per day were 1.48 and 4.55 liters, respectively. Based on the results indicated in table 8, the mean value of total milking cows per household had no statistically significant difference between the two groups of participant and non participant sample households of milk market supply whereas

there was significant difference between the two groups of participant (1.11) and non participant (1.78) sample households of milk value addition at 1% probability level. The mean value of milk yield per cow per day had statistically significant difference between the two groups of participant and non participant households of both milk market supply and value addition at 5% and 1% significance level, respectively. This implies that milk yield per cow per day affected significantly the milk producer households in milk market supply and milk value addition.

The average holdings of local and cross breed milking cows per household were 0.39 and 1.09, respectively. The mean value of local breed milking cows per household had significant difference at 1% and 5% probability level between participants and non participant groups of both milk market supply and value addition, respectively. This implies that local breed milking cows owned had affected milk producer households in milk market supply and milk value addition. On the other hand, the mean value of cross breed milking cows per household had significant difference at 10% and 1% probability level between participants and non participants groups of both milk market supply and value addition, respectively revealing that number of cross breed milking cows affected participation of milk producer households in milk market supply and milk value addition.

The average daily milk yields per local and cross breed milking cows were 2.22 and 5.89 liters, respectively. The mean value of daily milk yield per local cows had no significant difference between participant and non participant household groups of both milk market supply and value addition. Regarding the mean value of daily milk yield per cross breed milking cows, there was no significant difference between the two groups of participant and non participant sample households of milk market supply while there was significant difference between the two groups of participant (4.64 liters) and non participant (6.51 liters) sample households of milk value addition at1% significance level.

The average lactation lengths of local and cross breed milking cows per calving were 6.13 and 8.21 months, respectively. The lactation period of local and cross breed milking cows had statistically significant difference at 5% and 10% probability level, respectively between the two groups of milk market supply participants and non participants, but had no statistical

significant difference between the two groups of milk value addition participants and non participants.

Of the total per household weekly produced milk (46.67 liters), the average volume of milk allocated for home consumption was 11.88 liter (25.5%) which had statistically significant difference at 1% significance level between the two groups of participant and non participant sample households of both milk market supply and value addition. The implication of this difference is that the volume of milk allocated for home consumption showed significant effect on milk producer households in milk market supply and value addition.

The average value of milk allocated for market supply by sample households from weekly production was 27.84 liter (59.6%) which had statistically significant difference at less than 10% significance level between the two groups of milk value addition participant and non participant sample households whereas the average volume of milk allocated for value addition was 6.95 liter (14.9%) that had statistically significant difference at less than 1% probability level between the two groups of milk market supply participant and non participant sample households (Table 8).

Table 8: Resource owned, Cow productivity, lactation period and milk use for different purpose

variables	Total (N=100)		Participation in milk market supply				t-value	Participation in milk value addition				t-value
			Participants (N=86)		Non-participants (N=14)			Participants (N=45)		Non-participants (N=55)		
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.		Mean	Std. Dev.	Mean	Std. Dev.	
Landholding size/hh	0.93	0.53	0.930	0.52	0.91	0.91	-0.126	0.84	0.45	0.99	0.59	1.4125
Total TLU/hh	4.38	3.89	4.54	4.09	3.39	2.06	-1.0180	3.64	2.12	4.98	4.82	1.725*
Milking cows/hh	1.48	1.16	1.52	1.22	1.214	0.58	-0.9244	1.11	0.318	1.78	1.47	2.993 ***
• Local cows	0.39	.0.51	0. 34	0. 499	0.71	0.47	2.639***	0. 53	0. 55	0. 27	0. 45	-2.614 **
• Cross cows	1.09	1.34	1.19	1. 40	0.50	0.65	-1.7941*	0.58	0.66	1.51	1.597	3.664 ***
Milk yield/cow/day	4.55	2.62	4.80	2.63	3.00	2.03	-2.446**	3.26	1.88	5.61	2.68	4.98 ***
• Local cows	2.21	1.15	2.30	1.19	1.95	1.07	-0.8278	2.04	0.86	2.46	1.49	1.1079
• Cross cows	5.89	2.38	5.98	2.38	5.00	2.37	-0.9649	4.64	1.84	6.51	2.39	3.236 ***
Lactation length per calving in months:												
• Local cows	6.13	1.97	8	2.35	5.85	1.78	-2.41**	6.2	1.98	5.33	2.08	-0.72
• Cross cows	8.21	2.22	8.59	2.15	7.68	2.25	-1.68*	8.17	2.31	8.38	1.93	0.341
Milk allocation per week /household for:												
• Consumption	11.88	9.8	10.4	8.06	21	14.27	4.029***	6.81	4.99	16.04	10.81	5.2774***
• Market supply	27.84	59.3	32.37	62.83	0	0	-1.9192*	15.43	10.72	37.98	78.24	1.9169*
• Value addition	6.95	10.52	8.08	10.93	0	0	-2.7507***	15.43	10.72	0	0	-10.68 ***

The value ***, ** and * represents statistical probability level at 1%, 5% and 10%, respectively
Source: own computation from survey data (2016)

4.1.4. Access to different support services/enabling factors

According to the survey results indicated in table 9, 22% of sample households have got access to market information while 78% have not got. Out of 22% of sample households who accessed market information, all of them were milk market supply participants and none of non- participants were accessed market information. The chi-square test indicated that access

to market information affected positively and significantly the small holder milk producers' participation in milk market supply at 5% significance level. The survey result also showed that about 17.78% and 25.45% of milk value addition participants and non-participants have got access to market information, respectively; but the chi-square test indicated that the difference was statistically insignificant between the two groups of milk value addition participants and non participants.

Table 9: Access to different support services/enabling factors

Variables	Total access level (%) (N=100)		Participation in milk market supply					Participation in milk value addition				
			Participants (%) (N=86)		Non-participants (%) (N=14)		χ^2 test	Participants (%) (N=45)		Non-participants (%) (N=55)		χ^2 test
	Yes	No	Yes	No	Yes	No		Yes	No	Yes	No	
Market information (Yes or No)	22	78	25.58	74.42	0.00	100	4.59**	17.78	82.22	25.45	74.55	0.85
Access to credit (Yes or No)	19	81	17.44	82.56	28.57	71.43	0.9690	20.00	80.00	18.18	81.82	0.0532
Access to training (Yes or No)	20	80	23.26	76.74	0.00	100	4.069**	13.33	86.67	25.45	74.55	2.273
Membership to milk producers cooperative (Yes or No)	3	97	3.49	96.51	0.00	100	0.5035	2.22	97.78	3.64	96.4	0.170

The value ** represents statistical probability level at 5%.
Source: own computation from survey data (2016)

The findings indicated that 17.44% of milk market supply participants and 28.57% of non-participants have got access to credit while in milk value addition, the participants and non participants was 20.00% and 18.18%, respectively with no statistical significant difference between both participants and non participants of milk market supply and value addition.

The analysis also showed that 23.26% of milk market supply participants have got access to training, but there was no access to training for non participants of milk market supply and the chi-square test showed there was statistical significance difference at 5% significance level

between the two groups of milk market supply participants and non-participants implying that training affected milk market participation. However, the training access for milk value addition participants and non participants was 13.33% and 25.45%, respectively with no statistical difference between the two groups of participants and non participants of value addition

In case of membership to milk producers cooperative, the findings indicated that 3.49% of milk market supply participants were member to milk producers cooperative while 2.22% and 3.64% of milk value addition participants and non participants were member to milk producers cooperative, respectively with no statistical significant difference between the two groups of participants and non participants of both milk market supply and value addition (Table 9).

4.2. Milk Value Chain Actors and Their Roles

4.2.1. Value chain map

The milk and milk products pass through different marketing agents before reaching the end users. To tackle constraints and access available opportunities by value chain actors, it is necessary to identify the main value chain actors and functions involved in the entire value chain. The main functions in milk value chain are input supply, production, collection, wholesaling, processing, retailing and consumption whereas the major actors in milk value chain are input suppliers, producers, processors, traders (collectors, wholesalers , retailers and Cafe/Hotel owners), and consumers. Based on the roles and functions, the major milk value chain actors and their relationship in Dessie *Zuria* District is shown below using value chain mapping (Figure 4). Value chain mapping is important to easily understand the movement of the product from beginning to end consumer via various actors (McCormick and Schmitz, 2002).

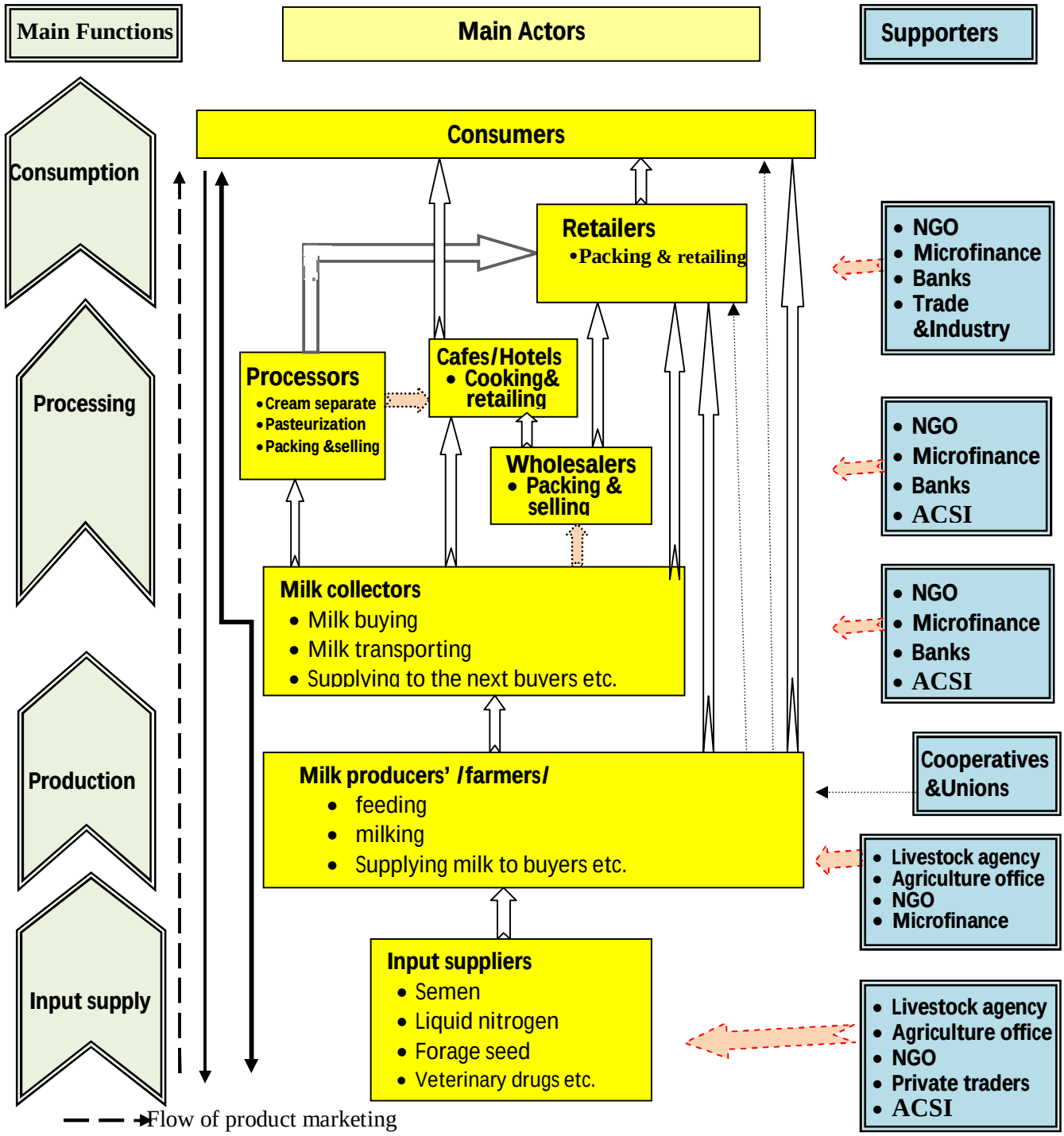


Figure 5: Map of milk value chain

Source: Own map from survey data (2016)

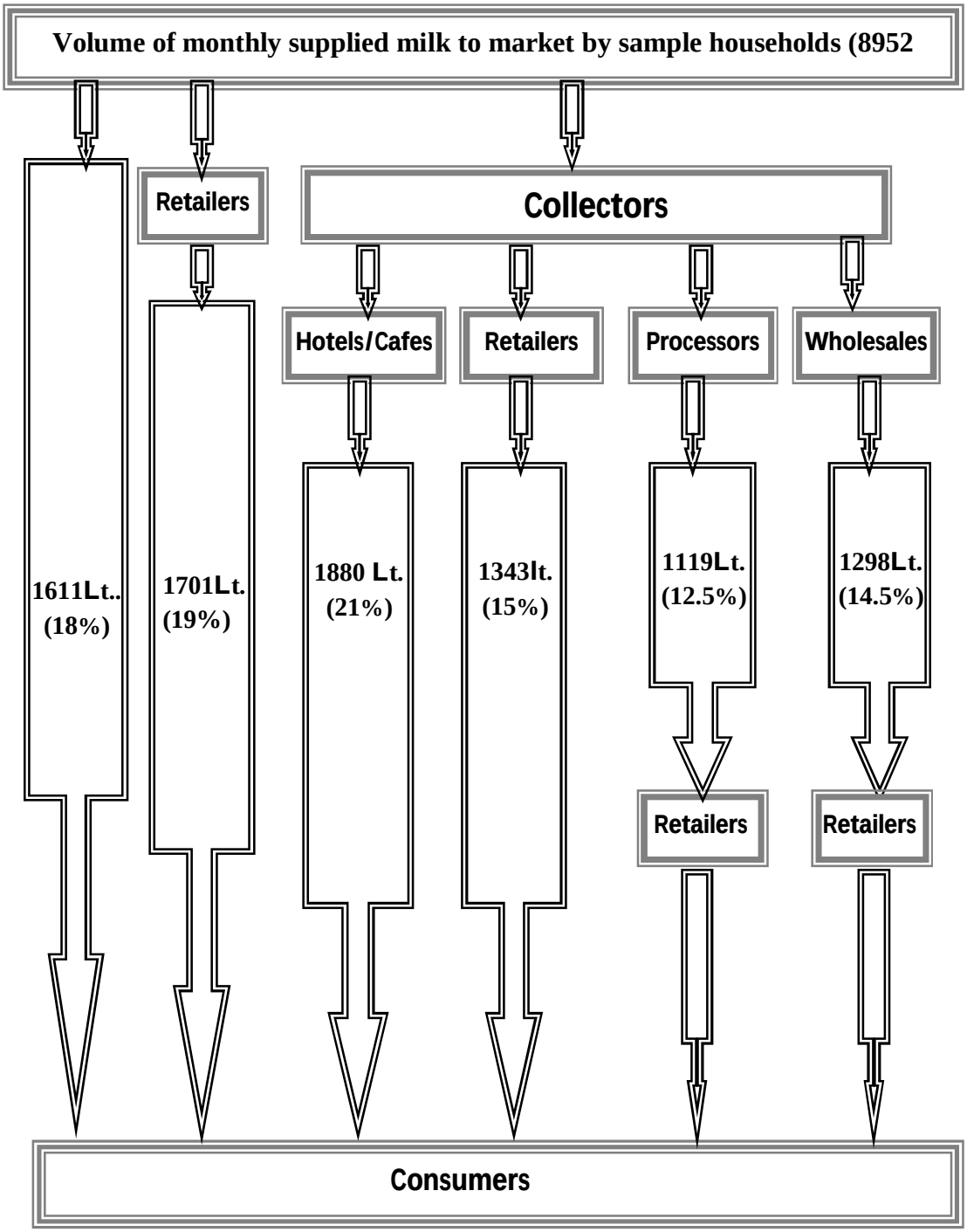


Figure 6: schematic representation of milk marketing distribution channel

Source: result own assessment (2016)

As indicated in the value chain map of figure 5 and distribution channel in figure 6, the highest volume of milk passes via the channel producers → collectors → Cafes/Hotels → consumers channel.

Based on the value chain map indicated above, the major direct and indirect actors, their role and functions are discussed below.

4.2.2. Milk value chain actors

4.2.2. 1. Primary actors

The primary actors of milk value chain indentified in the study area were input (semen, forage seeds, veterinary drugs etc.) suppliers, milk producers, milk processors, milk market intermediaries and consumers.

Input Suppliers

The main inputs used by milk producers in the study area include heifers, bulls, semen (including sexed semen), estrus synchronizing hormone, forage seeds, veterinary drugs, water, land and house (shelter). Currently, the main agricultural input suppliers that were directly or indirectly involved in the study area were Office of Agriculture (at different levels), traders, NGO (LIVES project, East Africa Agricultural Productivity Program: EAAP, German Society for International Cooperation: GIZ, FAO, etc.) and farmer's own source. The inputs; house, water and land are provided by the farmers themselves. In the study area, the house/shelter/ was constructed together with human shelter without separating it and was not well designed by feeding troughs and canals for waste disposal. The source of water for cattle was local watering points from the springs and ponds found in the area and it was managed by the cattle owners. Of the inputs supplied, forage seeds are provided by all actors of suppliers mentioned above. The heifers, bulls and estrus synchronizing hormone were also supplied by NGO (EAAP and LIVES project) and heifers and bulls supplied by farmers own source whereas veterinary drugs and semen were supplied by the government via agricultural offices.

As indicated in table 10, of the total 100 sample households, about 92% households preferred cross breed cow and of 92%, about 22% and 70% of sample households preferred to

inseminate their cow artificially and to mate locally by bull, respectively. On the other hand, about 8(8%) and 78 (78%) of the sample households preferred local breed cows and bull service to mate their cows, respectively. But the chi-square test indicated that there was no statistically significant difference between the two groups of sample households who preferred cross and local breed as well as use of artificial insemination (AI) service and bull service. This means that both households who preferred cross and local breed cows also equally preferred artificial insemination service versus mating by bull.

Table 10: Breed and breeding service preference of milk producers

Breed preference by sample households	Type of breeding service preferred				Total	χ^2 Value
	AI service		Bull service			
	Number	%	Number	%		
Cross breed	22	22	70	70	92	2.45
Local breed	0	0	8	8	8	
Total	22	22	78	78	100	

Source: own computation from survey data (2016)

Based on the survey findings (indicated in table 11), of the 86 milk market participants, 21(24.42%) and 65(75.58%) preferred artificial insemination (AI) service and bull service to mate their cows, respectively. On the other way, of the 14 non participants of milk market, 1 (7.14%) and 13 (92.86%) preferred AI and bull service to mate their cows, respectively. The chi-square test also indicated that there was no statistically significant difference between the two groups of milk market participant and non participant sample households to prefer AI versus bull service. Regarding breed preference, of the 86 milk market participants, about 93.02% and 6.98 preferred cross and local breed cows, respectively whereas of the 14 non participants of milk market supply, about 85.71% and 14.29% households preferred cross and local breed, respectively, but the chi-square result showed the difference is insignificant (Table 11).

Table 11: Type of breeding used by milk producer households

Variables	Participation in milk market supply						χ^2 test
	Participants (N=86)		Non-participants (N=14)		Total (N=100)		
	Number	%	Number	%	Number	%	
Type of breeding preferred							
AI service	21	24.42	1	7.14	22	22	2.094
Locally by bull	65	75.58	13	92.86	78	78	
Total	86	100	14	100	100	100	
Breed preference							
Cross	80	93.02	12	85.71	92	92	0.8739
Local	6	6.98	2	14.29	8	8	
Total	86	100	59	100	100	100	

Source: own computation from survey data (2016)

As indicated in table 12, the total cows owed by households, about 33 (33%), 62 (62%) and 5 (5%) of sample households on average had 1.03, 1.63 and 2.4 only local, cross and both local and cross breed cows with the total average holding of 1.48 cows per sample households. Even though 92% of sample households preferred to have cross breed cows, about 33% of them had local breed cows only implying that there was shortage of supply of cross breed cows and high price.

Table 12: Average cow holdings by breed type

Breed type	Average cows owned per household		
	Number of households	Number of cows	Average holdings
Local breed only	33	34	1.03
Cross breed only	62	102	1.65
Both local and cross breed	5	12	2.4
Total	100	148	1.48

Source: own computation from survey data (2016)

Producers

Producers perform plenty of activities within production stage. Among these functions milking, selling, forage management and harvesting, feeding of cows, housing and taking of cows to veterinary clinic when medication deemed to be important. Hygienic care of milk during and after milking was practiced by the milk producers to keep the neatness of the milk. But, as the respondents said, there was storage problem to store fresh milk safely and to minimize the loss of milk due to its perishable nature especially when there was no market access during fasting time. Instead, producers process their milk using traditional method into different milk products since there was no innovated technology of milk processing at smallholder milk producers level. Of the total milk produced weekly (46.67 liters), about 14.9% per household per week was processed into different milk products. The milk producer households who were participated in milk market were used human labor to transport their milk to the market.

The growing demand for milk and milk products created an opportunity for milk producers to exploit the available market access and increase their income level. However, producers were not encouraged in getting better benefit due to unfair consumer price share for their milk they produce and due to the perishable nature of milk especially during fasting time. As indicated in table 17, the highest share of gross marketing margin was obtained by the Cafes/Hotels owners in channel 3 (63.33%). Furthermore, all milk market participant respondents emphasized and said that inaccessible milk market during Orthodox fasting period was the major problem of milk market in the study area. Since the smallholder milk producers were not well organized, they were not able to bargain and govern the value chain. Thus, milk producers were price takers and could not bargain for their milk price due to low demand during Orthodox fasting time. According to the survey result, the Cafes/Hotels owners were the key value chain governors in the study area and milk producers had no bargaining power and agreed to sell their milk at the price set by Cafes/Hotels owners. However, consumers and collectors blame on the milk quality provided by milk producers as it was adulterated and not-fresh milk.

The survey results (Table 13) indicated that about 27.91% and 21.43% milk market participant and non participant sample households were supplementing concentrate feed for their milking cows, respectively whereas 72.09%, 78.57% and 73% of milk market participant, non participant and total sample households were not supplementing concentrate feed for their milking cows, respectively with statistically insignificant difference between the two groups of milk market participant and non participant sample households. Regarding milk value addition, about 45% of milk market participant sample households were participated in milk value addition whereas about 41% of milk market participant sample households were not participated in milk value addition and there was statistically significance difference between the two groups of milk market participant and non participant households at 1% significance level. Furthermore, about 14% of sample households were participated neither in fresh milk nor value added milk market.

Table 13: Practices of concentrate feeding, milk value adding and health care

Variables	Response	Participation in milk market supply				Total (N=100)		χ^2 test
		Participants (N=86)		Non-participants (N=14)				
		Number	%	Number	%	Number	%	
Supplementation of concentrate feeds	Yes	24	27.91	3	21.43	27	27	
	No	62	72.09	11	78.57	73	73	0.2564
	Total	86	100	14	100	100		
Milk Value adding	Yes	45	52.33	0	0	45	45	
	No	41	47.67	14	100	55	55	13.3192***
	Total	86	100	14	100	100	100	
Regular animal health care taken by household	Yes	21	24.42	4	28.57	25	25	
	No	65	75.58	10	71.43	75	75	2.80
	Total	86	100	14	100	100	100	

*** Represents statistical significance at 1% significance level.

Source: own computation from survey data (2016)

The survey also showed that about 24.42% and 28.57% of milk market participant and non participant sample households have adopted regular animal health care for their livestock

while 75.58% and 71.43% were not, and there was no statistical significant difference between the two groups of milk market participant and non participant sample households.

Collectors

Collectors are those actors who were collecting marketed surplus of milk from smallholder milk producer of rural villages to resell it in the nearby urban milk market centre for the wholesaler, processors and retailers. They use their traditional and practical knowledge to differentiate the milk quality whether it is fresh or not before they buy. They consciously prioritize the areas where there was sufficient supply to assemble enough volume of milk they require. They were on average collecting 5640 liters of milk from producers and reselling to their respective wholesalers, processors, Cafes/ Hotels or retailers in the study area. Collectors packed the milk they bought using plastic vessel (Jerry can) and used horse cart and Bajaj for transportation to nearby market centers (Dessie town) to resell the milk for their respective buyers.

Brokers

Brokers are middlemen who acted in intermediating between the sellers and buyers to negotiate each other for successful agreement among them in relation to selling and buying the milk. Brokers are more important especially when the supply is greater than demand such as in fasting time and in this case they play an important role in linking the milk producers with the potential buyer. But brokers sometimes were not important when supply is very low in the study area. However, the brokers facilitate transaction and sometimes involved in price fixing and gain more benefit by persuading the milk producers to sell their milk to Cafes/Hotels, wholesaler, processors or retailers by the price they set. They mostly involved between Café /Hotel owners and milk producers in search of potential sellers and buyers. Generally, their influence in the study area was limited.

Wholesalers

Wholesalers are actors that are identified in the study area who purchase large volume of milk directly from producers or through local milk collector and finally sell it mainly to milk retailing shops/kiosks and very rarely to milk processing enterprise, organizational consumers like hospitals, Cafeterias/Hotels and. Depending on the demand and supply, they also store

the milk that they purchased using refrigerator mostly for about three days. There are about four wholesalers in the study area and all wholesalers are located in *Dessie* town and hence, they had better storage facility, access of transport and communication than any other traders except processors.

Processors

These are actors who are using processing technology and mostly produce skimmed milk, pasteurized packed milk (prepared for selling in different volume of containers), butter and cheese. The number of processors found in the study area were four and all of them have their own processing technology (such as cream separator, churner, refrigerator, etc.) and processing houses and thereby process different volumes of milk per day and they pack processed milk into different volume for reselling mainly to retailing shops and very rarely to Cafes/Hotels owners, supermarkets and wholesalers and consumers.

Retailers

Retailers are those which include milk retailing shops/kiosks, Cafes/Hotels, and supermarkets. Most of the time, the retailers buy milk from collectors, processors, wholesalers or directly from producers and they sell mostly to urban consumers. The number of legal retailing shops/kiosks in the study area were five and their main activities done by them include buying of processed (from processors) or unprocessed milk (from producers or collectors), testing of milk quality using their traditional knowledge, lactometer, and transport to their retailing shops and selling to consumers. The retailers also prepare large amount of milk into retailing volume and provide it for selling to consumers in small pack containers. They retail either unprocessed (raw milk) or processed (skimmed and pasteurized milk) which is packed in different volumes by different processing centre. These actors are the end intermediary connector of consumers with other intermediaries when the marketing chain goes via retailers.

Consumers

In the study area, consumers are those actors who purchase milk and milk products for their consumption purpose only. Consumers could consume milk in their home and Cafes/Hotels. According to consumers' response, they on average, consume 0.25 liters of milk per day per

household. The trend of milk buying of consumers indicated that they were buying directly from producers or Cafes/Hotels and from retailing shops.

The sample milk producers' households also consume their own milk on average 11.88 liters per household per week. About 86% of sample households consume 10.4 liters per week both in unprocessed and processed or value added form such as yogurt, butter, buttermilk and cheese whereas 14% of sample milk producers consume 16.04 liters per week in unprocessed form (Table 8).

Consumers refer the quality of milk using their own methods such as making yogurt from fresh raw milk and if the milk forms good and semi-solid yogurt, consumers perceive that the milk is non adulterated and good quality. However, consumers and collectors blame on the quality of milk provided by producers which was considered by consumers and collectors as adulterated and non-fresh milk. On the other hand producers strongly complained on consumers and Cafes/Hotel owners especially during Orthodox fasting time for their low milk demand and price.

Table 14: Sources of milk for consumers purchasing

Consumers	Sources of milk for consumers purchase			
	Producers	Retailers	Cafes/hotels	Total
Numbers	2	18	10	30
percentages	6.67	60	33.33	100

Source: own computation from survey data (2016)

4.2.2. 2. Supporting actors

Supporting actors are those actors that provide support services of training, extension, information, financial, research and development services, etc. Access to support services like information, technology and finance determines the success of value chain actors (Martin *et al*., 2007). Office of Agriculture, Office of Cooperatives Society Promotion, Micro Finance,

Research Centres, NGO and Wollo University were main supporting actors in the study area that provide such important services.

Extension Services

The survey results indicated that about 66% of the respondents obtained four times and above service contact frequency of extension from development agent of Livestock sector whereas about 44% of respondents obtained 3 times and below contact, of which 26% have no received contact of extension service. Furthermore, the survey results showed that the monthly average value of service contact frequency of extension of sample households with developments agents was 3.67 times. However, the value of this variable for milk market participants and non participants was 3.88 and 2.36 times per month while 4.04 and 3.36 times per month for milk value addition participants and non participants, respectively (Table 6). The structure of office of agriculture is stretched up to the *kebele* level and gave training and extension service by appropriate technocrat staffs.

Financial services

Office of Cooperatives Society Promotion, Bank and Amhara Credit and Saving Institution (ACSI), relatives and individual lenders were found to be major source of credit for sample households. The survey findings showed that of the total sample households, about 19% said that they do have access to credit from financial institution and of these institutions, Amhara credit and saving institution was found to be the potential creditor than others for all actors while the rest 81% of respondents said that they did not have access to credit service. Among those 19 respondents with access to credit, 15 (79%) and 4 (21%) of them were milk market participants and non participants (Table 9).

4.3. Market Channel and Marketing Margin

4.3.1. Marketing channels of fresh raw milk and value added milk

According to Kotler and Armstrong (2003), marketing channel is a structure of interdependent business organization that facilitates the intention of product movement from its origin to business user or consumer. The organizations are interdependent one to the other and that ease the transfer of ownership as products move from producers to business users or consumers. Its basis is to make products available at the right time at the right place and in the right amounts.

Thus, the identification of marketing channels is used to have an understanding of the flow of goods from their origin or producer to final destination or consumer. The principle of marketing channel is providing contact efficiencies and overcoming discrepancies of gap between demand and supply.

Of the total 100 sample households of the study area, 86% were found to supply their milk to the market in two forms namely: fresh raw milk form (unprocessed) and value added milk form (processed). Of these 86% of milk market participants, about 41% and 45% of them sale fresh raw milk and value added milk, respectively whereas 14% of sample households were not participate either in fresh raw milk or value added milk sale.

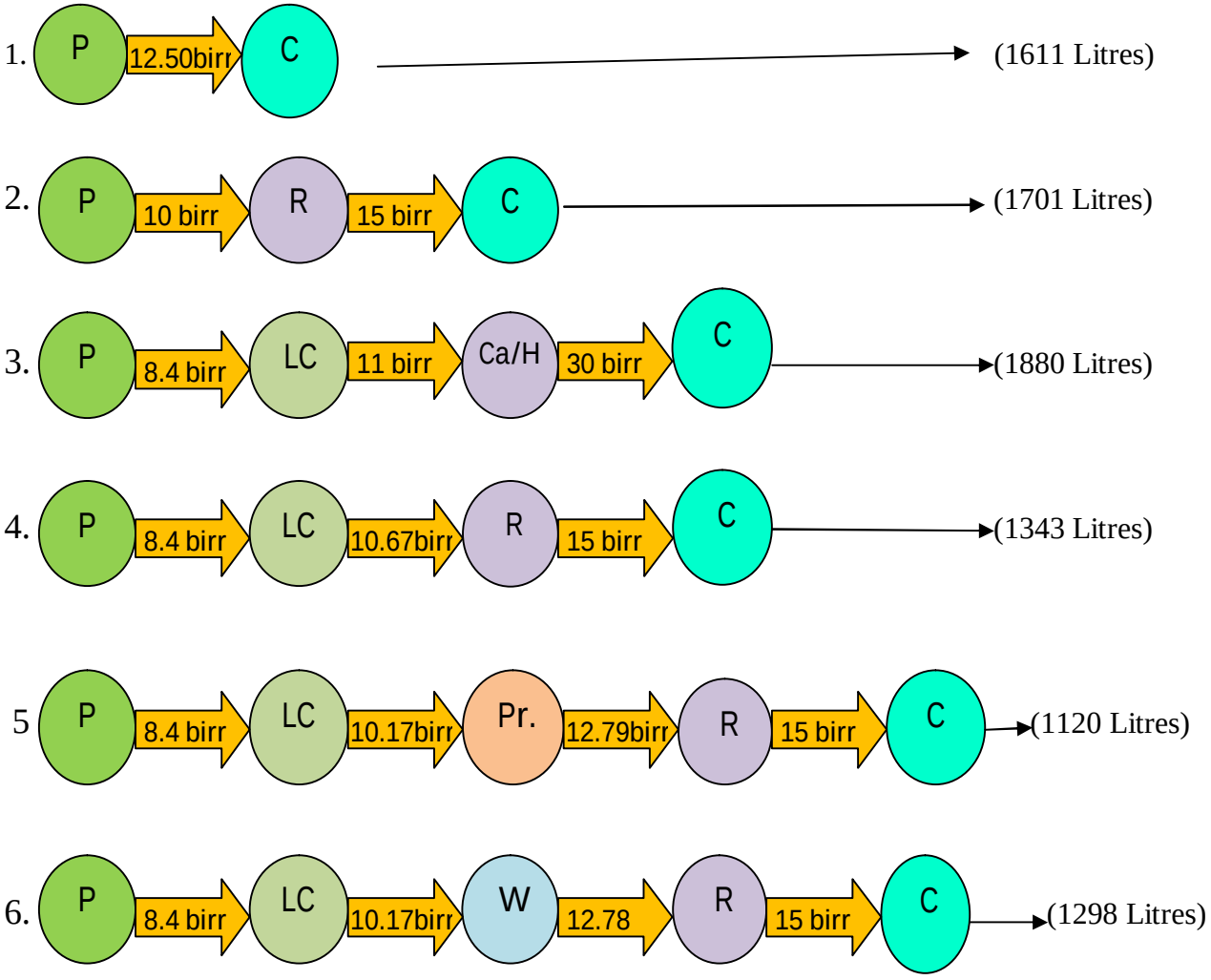
It was estimated that about 11527000 liters of milk produced and 2227000 liters of milk (19.32%) sold both in unprocessed and processed form in *Dessie Zuria* District by the year 2015/2016 (*Dessie Zuria* District and *Dessie* Town Chamber of Trade and Sectorial Society, 2016). From the total quantity of marketed milk (2227000 liters) by the year 2015/2016 in the study area, about 6.43% (143184liters) was supplied by sample respondent households with the monthly marketed volume of milk to be 11932 liters in the form of fresh raw milk and value added milk (8953 liters and 2979 liters, respectively).

4.3.1.1. Marketing Channel of fresh raw milk

According to the survey findings, six alternative main fresh raw milk market channels were identified with an average supply of 8953 liters of raw milk per month by sample respondent households, respectively.

Based on the channel comparison made, volume of milk passed via channels indicated that the main purchaser of fresh raw milk from producers were collectors, retailers and consumers with the estimated percentage share of volume of milk to be 63%, 19% and 18%, respectively.

As indicated in figure 6, the channel that conveys the highest volume of raw milk was channel 3 (producer → local collector → Cafes/Hotels → consumers) followed by channel 2: (producer → Retailers → consumer) and channel 1(producer → consumer) with an average percentage volume of milk estimated in each to be 21%, 19% and 18% of milk, respectively.



Key: P= Producers, R=Retailers, LC=local collectors, Ca/H=Cafes/Hotels, Pr=Processors and W= wholesalers. Numbers in arrows indicate milk price when transferred from one actor to the others

Figure 7: Marketing channel of milk

Source: own computation from survey result (2016)

4.3.1. 2. Market channel of value added milk

The survey results revealed that about 45% of sample milk producer households' process or add value traditionally to their milk by changing the form of raw milk in to butter, butter milk and cheese. The average volume of milk allocated for value addition per week per sample households and per value addition participants was 6.95 liters and 15.43 liters, respectively (Table 8).

According to the respondents saying, about 33 liter of milk was required to get 2 kg of butter. The milk value addition participant households intentionally add value to their milk being market oriented and produce butter and then supply to the market while other milk products such as buttermilk and cheese are consumed at home. Three main butter market channels are identified with an average supply of 179kg of butter (from 2979 liters of milk) per month by sample respondent households. The main butter marketing channels, price of a kg of butter and gross marketing margin in the study area are indicated as follow:

The comparison of butter transaction made among butter market channels showed that the main purchaser of butter from milk producers were retailers and consumers with the estimated percentage share amount of butter sold to be 59.6% and 40.4%, respectively. The channel that carries the highest amount of butter was the producers' → consumers channel followed by producer → Retailers → Cafes/Hotels → consumer.

I. Producers → 150 birr → Consumers → 1204kg (40.4%)

II. Producers → 150 birr → Retailers → 180 birr → Consumers → 733kg (24.6%)

III. Producers → 150 birr → Retailers → 180 birr → Cafes/Hotels → 240 birr → Consumers → 1043kg (35%)

Figure 7: Butter market channel

The share of producer gross marketing margin of butter market in the study area was 100%, 83.3% and 62.5% in channel I, II and III, respectively that implies producers are well benefited when they add value to their milk and contacted directly to the consumers (figure 7).

4.3.2. Performance of milk market

To evaluate the performance of milk market, costs and marketing margins were used. Due to perishable nature of milk, it requires serious care at the time of storing which needs refrigerator shortly after milking until the time of consumption. Computation of marketing margin was employed to show the distribution of benefit share obtained from final selling price captured when milk transferred from producers to final consumers through different

intermediaries of milk market channel along the value chain. The size of gross margin of milk market participants within the market channel indicates that where and what amount of value is added and profit is made in each marketing agent. The average buying and selling prices of milk was used for each marketing agent to calculate the gross marketing margin of actors in the value chain.

Milk marketing costs

The cost incurred beginning from the production of a commodity until it reaches to the end destination of consumers or consumption referred us marketing cost. As indicated in Table15 costs are incurred by each marketing actors such as producers, collectors, wholesalers, processors and retailers for different activities of milk trading. Producers incur costs for fulfilling production inputs such as feed, medicaments, housing, labour etc. The costs belonging to the milk trade intermediaries include costs that are used for transportation, processing, tax, market information such as telephone, material cost, labour and cost of loss from perishable nature of milk. Table 15 below indicated the estimated marketing cost of milk market actors per liter of milk in the study area.

Table 15: Marketing cost of milk market actors in milk value chain (birr/liter)

Items /Particulars/	Actors					
	Producers	Collectors	Retailers	Cafes/Hotels	wholesaler	processors
Production cost	4.00					
Marketing cost						
Labour cost	0.45	0.10	0.2	0.90	0.40	0.10
Transport cost		0.15			0.15	0.10
Loss due to perishable	0.40	0.12	0.60	0.50	0.35	0.25
Information cost/telephone	0.05	0.05	0.10	0.10	0.07	0.05
Processing cost				1.00		0.35
Container/Jerry can cost	0.05	0.05	0.04	0.75	0.05	0.2
Overhead/ Other costs			0.35	2.00	0.50	0.35
Tax		0.02	0.02	0.15	0.05	0.05
Total cost	4.95	0.49	1.31	5.40	1.57	1.45

Source: own computation from survey data (2016)

Milk marketing margin

As indicated in table16, the producers share of consumers price (GMM_p) and net marketing margin (NMM) in milk market channel 1 and 3 were 60.4%, 100% and 11.50%, 28%, respectively which indicate that the net marketing margin and share of end buyer price by producers was very high in channel 1 than other channels since producers contacted directly with the end consumers whereas lower in other channels such as in channel 3 when other marketing actors involved between producers and end consumers.

According to the result of survey findings indicated in table 16, the total gross marketing margin (TGMM) and producers share (GMMp) of consumers price in channel 1, 2, 3, 4, 5 and 6 was 0%, 33.33%, 72%, 44%, 44%, 44%, and 100%, 66.67%, 28%, 56%, 56%, 56%, respectively. From this result, it is possible to conclude that producers have got the highest share of consumers price in channel 1 followed by channel 2 and lowest share in channel 3. Regarding GMM, the highest share of consumers' price by milk traders was captured by Cafes/Hotels in channel 3 (63.33%), retailers in channel 2 (33.33%) and 4 (28.87%) and by wholesalers in channel 6 (17.4%) whereas the lowest GMM was obtained by collectors in

channel 5 and 6 (11.8% and 11.8%) followed by retailers in the same channels with the percentage share of 14.73% and 14.8%, respectively.

Concerning NMM, the highest profit share of consumers' price in channel 1 (60.4%) and channel 2 (33.67%) was captured by producers whereas Cafes/Hotels obtained about 45.33% in channel 3 and retailers have got 24.6% and 20.13% in channel 2 and channel 4, respectively. On the other hand, the lowest share of profit margin from consumers price was obtained by retailers in channel 5 (6%) and channel 6 (6.07%) followed by wholesalers in channel 6 (6.93%) and processors in channel 5 (7.8%).

As milk moves from one actor to another actor, each value chain actors add values to the milk by improving the grade in terms of change the form to skimmed and boiled milk via processing, packing and creating place and time utility.

Table 16: Performance of milk marketing in different channels of the study area

Marketing actors of milk	Descriptions /particulars/	Milk marketing channels					
		Channel 1	Channel 2	Channel 3	Channel 4	Channel 5	Channel 6
Producers	Production cost	4.00	4.00	4.00	4.00	4.00	4.00
	Marketing cost	0.95	0.95	0.95	0.95	0.95	0.95
	Selling price	12.50	10	8.40	8.40	8.40	8.40
	GMMp (%)	100	66.67	28.00	56.00	56.00	56.00
	NMMp (%)	60.4	33.67	11.50	23.00	23.00	23.00
Collectors	Buying price	-	-	8.40	8.40	8.40	8.40
	Marketing cost	-	-	0.49	0.49	0.49	0.49
	Selling price	-	-	11	10.67	10.17	10.17
	GMMc (%)	-	-	8.67	15.13	11.80	11.80
	NMMc (%)	-	-	7.03	11.87	8.53	8.53
Cafes/Hotels	Buying price	-	-	11	-	-	-
	Marketing cost	-	-	5.40	-	-	-
	Selling price	-	-	30	-	-	-
	GMMhc (%)	-	-	63.33	-	-	-
	NMMhc (%)	-	-	45.33	-	-	-
Wholesalers	Buying price	-	-	-	-	-	10.17
	Marketing cost	-	-	-	-	-	1.57
	Selling price	-	-	-	-	-	12.78
	GMMsw (%)	-	-	-	-	-	17.40
	NMMsw (%)	-	-	-	-	-	6.93
Processors	Buying price	-	-	-	-	10.17	-
	Marketing cost	-	-	-	-	1.45	-
	Selling price	-	-	-	-	12.79	-
	GMMpr (%)	-	-	-	-	17.47	-
	NMMpr (%)	-	-	-	-	7.80	-
Retailers	Buying price	-	10	-	10.67	12.79	12.78
	Marketing cost	-	1.31	-	1.31	1.31	1.31
	Selling price	-	15	-	15	15	15
	GMMr (%)	-	33.33	-	28.87	14.73	14.80
	NMMr (%)	-	24.60	-	20.13	6	6.07
TGMM (%)		00.00	33.33	72.00	44.00	44.00	44.00
GMM_p (Share of milk Producers) (%)		100	66.67	28.00	56.00	56.00	56.00
GMM_p +TGMM		100	100	100	100	100	100

Source: own computation from survey data (2016)

4.4. Results of Econometric Analysis

This section contains the results of econometric analysis of determinants of probability and level of participation in milk market supply and value addition. The data was analyzed using Tobit and Heckman two stage regression model and the results of Tobit regression(table 17) showed that about six variables affected significantly the probability and level of participation of smallholder milk producer households in milk market supply while the result of Heckman first and second stage regression results (table 18) indicated that about four and five variables affected significantly the decision of participation and level of participation of smallholder milk producer households in milk value addition, respectively and results are discussed as follow:

4.4.1. Analysis results of factors affecting probability and level of milk market supply

Tobit model was used to identify factors affecting probability and level of participation in milk market supply. Diagnostic tests for multicollinearity and heteroscedasticity were made during analysis using the variance inflation factor (VIF) test and Breusch-Pagan/Cook-eisberg test, respectively. There was no multicollinearity problem since the results of VIF for continuous variables and CC for dummy variables were less than 10 and 0.75 (Appendix table 1 and 2), respectively. However, the tests of Breusch-Pagan/Cook-Weisberg test showed that there was heteroscedasticity problem in the model and hence, the robust standard error was employed as a correction measure of the problems since robust standard error can produce the estimates with smallest possible standard errors.

The fitness and significance of the model was tested using LR chi^2 (12) = 135.88, Prob > chi2 = 0.0000 that indicates the fitness of the model at less than 1% significance level. The log likelihood value: -424.90408 reveal that the assumption of null hypothesis of all explanatory variables involved in the model are collectively equal to zero to be rejected at probability level of less than 1%.

Based on the survey by this study, the results showed that about 86% of sample respondents were engaged in milk market supply participation. The results of Tobit regression model showed that out of twelve variables, about six independent variables namely: land holding size, service contact frequency of extension/visit, number of local breed cows owned, number

of cross breed cows owned, access to market information and level of income from livestock off take rate affected significantly the probability and level of participation of smallholder milk producers in milk market supply.

The results of Tobit regression model (Table 17) regarding the effects of independent variables on both milk market probability of participation and level of participation are discussed as follow:

Land holding size of the household (landhs): as prior expectation, the result of Tobit regression model indicated that land holding size of the household showed inverse relationship with smallholder milk producers' probability and intensity of participation in milk market supply and affected negatively and significantly at less 1% significance level. The relationship between these two variables indicated that land holding size of the household is a determining factor in explaining the probability of participation and level of participation of milk producer households in milk market supply. The marginal effect of land holding size of the household showed that a unit increase in land holding size of the household decreases the probability and intensity of participation of sample milk producer respondents in milk market supply by 14.97% and 37.03%, respectively, keeping other variables constant. The actual quantity of milk supply conditional on decision to participate in the market also decreases by 96.4% if the land holding size increases by a unit. This implies that as land holding size increases, the tendency of households in investing the resources and labour force for crop cultivation also increases which in turn decreases the resource and labour force allocation for milk development and thereby lead to decrease in quantity of milk produced and supplied to the market. This is in line with Berhanu (2012) who indicated that larger land holding size in the study area triggered households to invest on crop production rather than in milk production and market.

Amount of income from sales of livestock and livestock products: contrary to previous hypothesis, the level of income from livestock off take rate affected negatively the probability and intensity of milk producers' participation in milk market supply at 5% probability level. The marginal effect of amount of income from sale of livestock and livestock products indicated that keeping other variables constant, a unit increase in amount of income from sale

of livestock and livestock products decreases the probability and intensity of participation of sample milk producer respondents in milk market supply by 0.003% and 0.23%, respectively. The quantity of marketed supply of milk conditional on decision to participate in milk market supply decreases by 0.16% if the amount of income from sale of livestock and livestock products increases by a unit. The implication is to mean that as the smallholder milk producer households' income level from other livestock off take rate increases, their attention to sufficiently engaged in dairy development sector decreases and thereby milk market supply also decrease.

Number of local breed milking cows owned: contrary to previous hypothesis, number of local breed milking cows owned affected positively and significantly the probability and intensity of milk producers' participation in milk market supply at less than 1% significance level. The marginal effect for the number of local breed milking cows owned indicated that keeping other variables constant, a unit increase in number of local breed milking cows owned increases the probability and intensity of participation of smallholder milk producer households in milk market supply by 26.7% and 6.3%, respectively. Similarly, the volume of marketed supply of milk conditional on decision to participate in milk market increases by 98.8% if the numbers of local breed milking cows owned increases by a unit. This implies that as the number of milking cows owned increases, the volume of milk produced from this increased number of milking cows also increases and thereby the volume of milk supplied to market increases. This result is in line with Meryem (2013) who found the positive correlation of number of local breed milking cows owned with probability and intensity of milk producer households' participation in milk market supply.

Number of cross breed milking cows owned: as prior hypothesis, number of cross breed milking cows owned affected positively and significantly the probability and intensity of milk producers' participation in milk market supply at less than 1% significance level. The result of marginal effect indicated that ceteris paribus, a unit increase in number of cross breed milking cows owned increases the probability and intensity of participation of smallholder milk producer households in milk market supply by 46.3%and 22.08%, respectively. Similarly, the volume of marketed supply of milk conditional on decision to participate in milk market

increases by 69.6% if the number of cross breed milking cows increases by a unit. This shows that as the number of cross breed milking cows owned increases, the volume of milk produced from this increased number of milking cows also increases and thereby the volume of milk market supply increases. This result is in line with Meryem (2013) who found the positive correlation of number of cross breed milking cows owned with probability and intensity of milk producer households' participation in milk market supply.

Access to market information: as expected, access to market information affected positively and significantly the smallholder milk producer households in their probability and level of milk market participation at less than 10% significance level. The marginal effect of access to market information indicated that ceteris paribus, the probability and intensity of participation of milk producer households in milk market supply with access to market information increases by 12.44% and 9.9%, respectively whereas the intensity of marketed supply of milk conditional on decision to participate in milk market increases by 98.6% if milk producer households get access to market information. This implies that as the milk producer households get access to milk market related information, their probability and intensity of participation in milk market supply also increase. This result is in line with the study of Berhanu (2012), Meryem (2013) and Bedilu *et al.* (2014) who found that access to market information showed positive relationship with milk producers' probability and intensity of participation in milk market supply. Better market information in relation to food marketing can significantly enhances the probability of market participation of households (Goetz, 1992).

Service contact frequency of extension per month: as hypothesized, service contact frequency of extension per month affected positively and significantly the probability and intensity of milk producers' participation in milk market supply at less than 5% significance level. The result of marginal effect indicated that ceteris paribus, when service contact frequency of extension per month increases by one, the probability and intensity of participation of smallholder milk producer households in milk market supply also increases by 2.3% and 87%, respectively whereas the intensity of marketed supply of milk conditional on decision to participate in milk market supply, increases by 35.5% if service contact frequency of extension per month increases by one. This implies that as the service contact

frequency of extension per month increases, the probability and level of milk market supply increases. This result is in line with Holloway and Ehui (2002) who identified that extension visit is directly related to capacity of households' skill in dairy production, marketing and value addition. Another study by Meryem (2013) also found the direct relationship between extension visit and milk market supply participation. However, Bpedilu *et al*. (2014) found inverse relation of access to extension service with probability and intensity of milk market supply (Table 17).

Table 17: Results of Tobit regression model for determinants of milk market supply

variable	Marginal effect for E (y*/y>0)	Std. Err.	z	P>z	Marginal effect for Pr(y>0)	Marginal effect for E(y/y>0)
sex	-0.1254	5.2233	-0.02	0.981	-0.0015	-0.0908
edulevel	-0.0258	0.6295	-0.04	0.967	-0.0003	-0.0187
nchilsix	-0.4911	4.7648	-0.52	0.601	-0.0302	-0.8051
landhs	-0.3703	4.5611	-2.71	0.007***	-0.1497	-0.9638
inclsoff	-0.0023	0.0011	-2.03	0.042**	-0.00003	-0.0016
tlocalcow	0.0633	6.0957	3.62	0.000***	0.2670	0.9877
tcrosscow	0.2208	6.0171	6.35	0.000***	0.46261	0.6959
distancehome	-0.2571	0.5183	-0.50	0.680	-0.0031	-0.1863
dairyexpe	0.2098	0.1919	1.09	0.416	0.0025	0.1520
marketinfo	0.0991	6.9258	1.75	0.081*	0.1244	0.9858
membercoop	-0.7501	8.0130	-1.22	0.439	-0.1485	-0.9216
frequexcontact	0.8702	0.7547	2.48	0.013**	0.0226	0.3552

Number of obs = 100, left-censored observations =14, uncensored observations =86, F(12, 88) = 20.09 with Prob > F = 0.0000, LR chi2(12) = 135.88 with Prob > chi2 = 0.0000, Log likelihood = -424.90408, Pseudo R2 = 0.1379, _cons = 0.057

The value ***, ** and * represents level of statistical significance at 1%, 5% and 10%, respectively.

Source: own computation from survey data (2016)

4.4.2. Analysis results of determinants of milk value addition participation

The results of this study showed that about 45% of sample respondents participated in milk value addition practices to convert milk into different milk products such as yogurt, butter, ghee, butter milk and cheese. They mostly supply butter to market while other milk products consumed at home. To analyze determinants of milk value addition, Heckman two stage

model was employed and the outputs are presented in table 18. The test of multicollinearity problem was made before analysis using VIF and CC tests and there was no multicollinearity problem since the results of VIF for continuous variables and CC for dummy variables were less than 10 and 0.75 (Appendix table 3 and 4), respectively. The LR chi2 (11) = 67.76 and Wald chi2(9) = 44.57 were used for testing the overall goodness and significance for the fitness of Heckman regression model and both tests were statistically significant at probability of less than 1% significance level. The Log likelihood = -34.9334 result also rejected that the null hypothesis of all predictor variables involved in the model are jointly zero. Thus, the result of Heckman first stage (Probit regression) model (Table 18) showed that about four independent variables (out of eleven) namely: the volume of milk allocated for home consumption, distance from market/urban centers, volume of milk yield per day in liter and number of children less than six years old in the family affected the participation decision of smallholder milk producers in milk value addition. On the other hand, the second stage Heckman selection regression model also indicated that about five (out of nine) independent variables namely: membership to milk producers cooperative, household size, educational level of the household, number of local breed milking cows owned and land holding size of the household affected the level of participation of smallholder milk producers in milk value addition. Based on the results of Heckman two stage regression model (Table 18), the effects of independent variables on both milk value addition participation decision and level of participation are discussed as follow:

Volume of milk allocated for home consumption in liter: as hypothesized, the volume of milk in liter allocated for home consumption resulted in inverse association with decision of participation in milk value addition and affected at less than 1% probability level. As indicated by the result of marginal effect, the participation decision of milk producers in milk value addition decreases by 2.84% as the volume of milk in liter allocated increases by one liter. This implies that milk producers tends to increase in allocating milk for family consumption either in the form of processed or fresh milk rather than in value addition and supplying to the market. CSA (2015) found out that out of the total annual milk produced in Ethiopia, 46.36% of milk, 59.24% of butter and 79.89% of cheese was used for household consumption.

Distance from market/urban centres (distancehome): as expected, the distance from market/urban centers affected positively and significantly the decision of participation in milk value addition at less than 1% probability level. The result of marginal effect indicated that as the distance from market/urban centers increases by a kilometer, the likelihood of participation in milk value addition increases by 0.0374 (3.74%). The same result was reported by Kumar (2015) and Berhanu (2012).

Volume of milk yield per day in liter: contrary to the hypothesis, the volume of milk yield per day in liter resulted in inverse association with decision of participation in milk value addition and affected at less than 10% probability level. As indicated by the result of marginal effect, the participation decision of milk producers in milk value addition decreases by 4.25% as the volume of milk yield per day increases by one liter. The reason behind might be milk producers tend to increase in decision of participation in milk market supply rather than in value addition as the volume of milk yield per day increases. The study conducted by Berehanu (2012) showed the same findings while the study conducted by Tadele *et al*. (2014) and Kumar (2015) indicated that milk yield per day in liter showed a direct relationship with the probability of milk value addition participation and level of participation of milk producer households.

Number of children under 6 years old: contrary to prior expectation, the result of Heckman first stage (Probit) regression indicated that number of children under 6 years old affected positively the participation decision of smallholder milk producers in milk value addition at less than 1% probability level. The relationship between the number of children under 6 years old and participation decision in milk value addition showed that number of children under 6 years old is a determining factor in explaining the participation decision of households in milk value addition. The marginal effect of number of children under 6 years old indicated that an increase of a child under six years old in a family member increases the probability of participation of milk producers' household in milk value addition by 14.75%. The reason might be due to the fact that the milk producers, who participate in milk value addition traditionally in their home, produce butter, ghee, butter milk and cheese and thereby tend to supply butter for market, but feed other milk products such as buttermilk for their children.

The study conducted by Berhanu (2012) is in line with this result while Kumar (2015) and Meryem (2013) are opposite.

Similarly, the results of Heckman second stage regression model showed that about five (out of nine) explanatory variables namely: membership to milk producers cooperative, family size of the household, educational level of the household, number of local breed milking cows and land holding size of the household affected significantly the level of participation of smallholder milk producer households in milk value addition and are explained below.

Education level of the household: as expected, education level of the household showed positive association with the participation level of smallholder milk producers in milk value addition at less than 1% probability level. This implies that as education level of a household increases by one year formal schooling, the participation level of milk producers increases by 1.54 liters. This result is in line with the study of Kumar (2010 and 2015) and Tadele *et al.* (2014).

Number of total local breed milking cows: Contrary to the previous expectation, number of local breed milking cows owed by milk producers influenced negatively the participation level of smallholder milk producers in milk value addition at less than 10% probability level. The result of Heckman second stage regression model showed that as number of local breed milking cows' owed increase by one, the participation level of smallholder milk producer households in milk value addition deceases by 5.82 liters. The reason behind might be when number of local breed milking cows owned increases, the volume of milk produced also increases and smallholder milk producer households would have a tendency of fresh raw milk market supply participation rather than milk value addition. The result of the study conducted by Tadele *et al*. (2014) showed that number of local breed milking cows affected positively the participation of milk producer households in milk value addition which is different from this report.

Land holding size of the household: contrary to prior expectation, the result of Heckman second stage regression indicated that land holding size of the household affected negatively the participation level of smallholder milk producers in milk value addition at less than 1% probability level. The relationship between the land holding size of the household and

participation level in milk value addition showed that land holding size of the household is a determining factor in explaining the level of participation of the household in milk value addition. This result revealed that as the size of land holding increases by a hectare, the level of participation of milk producers' household in milk value addition decreases by 7.764 liters. The study conducted by Berhanu (2012) is in line with this result.

Membership to milk producers' cooperative: as hypothesized, membership to milk producers' cooperative showed positive relationship with milk value addition practices and affected significantly the level of participation of milk producer households in milk value addition at less than 10% probability level. This implies that as the milk producer household being members of milk producers' cooperative, the level of participation in milk value addition increases by 13.55 liters. The study of Asfaw (2009) found that milk marketing cooperative members produced, consumed and sold more milk than non-member milk producers.

Family size of the household: as prior expectation, the result of Heckman second stage regression indicated that family size of the household affected positively the level of participation of smallholder milk producers in milk value addition at less than 5% probability level. The relationship between the family size of the household and level of participation in milk value addition showed that family size of the household is a determining factor in explaining the level of participation of the household in milk value addition. This implies that as family size of the household increases by one member, the level of participation of milk producer households in milk value addition increases by 1.95 liters. The study of Kumar (2015) disagrees with result.

Lambda: the inverse mills ratio was produced from the regression result of Heckman first stage and incorporated in the second stage of Heckman selection model regression as one of the explanatory variable to correct selectivity bias. Furthermore, the inverse mills ratio was found with positive association to the volume of value added milk and was statistically significant at less than 10% probability level indicating that there was selection bias. This significant result showed that there were unobserved factors that affect the likelihood of both

participation decision and level of participation of smallholder milk producer households in milk value addition practices (Table 18).

Table 18: Results of Heckman two stage model for determinants of milk value addition

Variables	Decision of participation (1st stage)				extent of participation (2nd stage)		
	Coef.	Std. Err.	P>z	Marginal effect	Coef.	Std. Err.	P>z
sex	-0.2352	0.4232	0.578	-0.0461	0.9428	2.9988	0.753
edulevel	0.0524	0.0563	0.352	0.010	1.5423	0.3714	0.000***
tlocalcow	-0.6758	0.4666	0.148	-0.1324	-5.8186	3.0280	0.055*
VMforHC	-0.1449	0.0381	0.000***	-0.0284	-0.1714	0.3735	0.646
landhs	-0.3207	0.3964	0.418	-0.0628	-7.7638	2.9064	0.008**
distancehome	0.1911	0.0539	0.000***	0.0374	0.4487	0.4624	0.332
frequexcontact	0.0212	0.0562	0.705	0.0042	-0.4302	0.3868	0.266
myieldpcow	-0.2169	0.1212	0.074*	-0.0425	-	-	-
breedprefer	-1.1064	0.7119	0.120	-0.2167	-	-	-
age	0.0144	0.0159	0.363	0.0028	-	-	-
nchilsix	0.7531	0.2901	0.009***	0.1475	-	-	-
membercoop	-	-	-	-	13.5521	7.0768	0.055*
thousehsz	-	-	-	-	1.9471	0.8986	0.030**
_cons	1.2814	1.4051	0.362		2.9388	8.6001	0.733
lambda	8.904437	4.739709	0.060*		-	-	-
rho	1.00000				-	-	-
sigma	8.9044369				-	-	-

Number of obs. = 100, Censored obs. = 55, Uncensored obs.= 45, Wald chi2(9) = 44.57, Prob > chi2 = 0.0000,
LR chi2(11) = 67.76, Prob > chi2 = 0.0000, Log likelihood = -34.9334, Pseudo R2 = 0.4924

The vale ***, ** and * represents level of statistical significance at 1%, 5% and 10%, respectively.

Source: own computation from survey data (2016)

5. SUMMARY, CONCLUSION AND RECOMMENDATION

According to the findings of this study, the following points are summarized, concluded and their respective recommendations are drawn to enhance fair benefit share, milk market supply and value addition participation by smallholder milk producer households.

5.1. Summary and Conclusion

Comparing livestock population owned in Ethiopia with the return from this resource, it is not encouraging since the income generated from the resource is too low. The participation decision and level of participation of milk producers in value added milk market supply is not also adequate in the study area. Thus, the study was intended and conducted in Dessie *Zuria* District with the specific objectives of assessing milk value chain actors, their functions and marketing margins along the chain, analyzing determinants of the probability and intensity of milk market supply and value addition participation. Then, 100 randomly selected smallholder milk producer sample households and 69 milk traders were selected to undertake the survey.

The result of the survey findings indicated that about 86% and 45% of sample households were found to be milk market supply and milk value addition participants, respectively.

The mean age, family size and educational level of the total sample household heads were 47.98 years, 5.68 and 4.01 years of formal schooling, respectively. The average distance from the home of sample milk market participant and non participant households to milk market center was 7.65 and 11.07 km, respectively whereas the average distance from the home of sample milk value addition participants and non participants was 10.71 and 6.02 km, respectively. According to respondents, about 76%, 19% and 5% sample households said that their major income source was from crops, sales of livestock and livestock products and off farm activities, respectively. The average landholding size per household, years of experience in dairying and service contact frequency of extension/month were 0.927 hectare, 12.54 years and 3.67 times, respectively.

The mean total milking cow holdings per sample household was 1.48 cows whereas average milk yield per cow per day was 4.55 liters. The average holdings of local and cross breed milking cows per household were 0.39 and 1.09, with an average daily milk yield of 2.22 and

5.89 liters, respectively. The average weekly milk allocation for market supply, value addition and home consumption per sample households in the study area were 27.84, 6.95 and 11.88 liters, respectively.

Mapping of milk value chain showed the main milk value chain actors, their functions and support services. The main milk value chain actors indentified in the study area were input supplier, milk producers, milk processors, collectors, wholesalers, Cafes/Hotels, retailers and consumers. The main milk and butter marketing channels were assessed and identified with their respective marketing margins.

Six milk market channels were identified and of which the producer → collectors → Cafes/hotels → consumers' channel (channel 3) carried the highest volume of milk transaction than other channels and Cafes/Hotels were the leading benefited market actors for the share of GMM (63.33%) followed by producers (28%) and collectors (8.67%) with high variation of benefit/margin share among them within this channel. From the analysis result of milk marketing margins and market channel identified, it was concluded that value chain actors were not supported well and there was disproportionate distribution of benefit or margins among actors. On the other hand, three main butter marketing channels were identified in the study area and the share of producer gross margin was 100%, 83.3% and 62.5% in channel I, II and III, respectively that implies producers were well benefited when they add value to their milk and especially when they contacted directly to the consumers.

To analyze factors determining milk market supply and milk value addition, Tobit and Heckman two stage regression models were used.

Thus, the result of Tobit regression model revealed that land holding size and amount of income from sale of livestock and livestock products affected negatively and significantly both the probability and intensity of participation of sample milk producer households in milk market supply while number of local breed milking cows owned, number of cross breed milking cows owned, access to market information and service contact frequency of extension affected positively. The negative effect of landholding size on milk market supply participation might be due to the reason that most of the share of land was dispossessed for crop cultivation rather than for livestock grazing and hence as the share of grazing land and

other resource allocation for livestock decreases, small number of cows would be kept in small size grazing land which result in low volume of milk production and market supply. The implication of negative effect of level of income from sales of livestock and livestock products is that as the smallholder milk producer households' income level from diversified types of livestock off take rate via diversified engagement activities increases, the limitation of resource and manpower to fully engaged in dairy development sector decreases and thereby milk production and market supply also decrease. Having relatively higher number of either local or cross breed milking cows per household increases the smallholder milk producer households' probability and intensity of participation in milk market supply from the fact that increased number of local or cross breed milking cows would result in increased volume of milk production and thereby triggers producers to participate in milk market supply. The positive and significant effect of access to market information and service contact frequency of extension on smallholder milk producer households' probability and intensity of participation in milk market supply implies that as the milk producer households provided with access to milk market related information and service contact frequency of extension, their probability and intensity of participation in milk market supply also increase. This stands from the reality that access to market information develops a confidence for producer to increase their production whereas extension service builds the households' knowledge and skill thereby participate in marketing of their produce. This also strengthens the importance of extension service to advance consistently the milk business rather than going forth and back.

With regard to results of analysis on determinants of milk value addition participation, the Heckman two stage regression model was used and out of thirteen explanatory variables, four and five variables affected significantly the probability of participation decision and level of participation of sample milk producer households in milk value addition, respectively. The results of Heckman fist stage regression model showed that the participation decision of sample milk producer households in milk value addition was negatively and significantly affected by volume of milk allocated for home consumption and volume of milk yield per cow per day while positively and significantly affected by distance from nearest urban/market and number of children less than six years old. On the other hand, the second stage Heckman regression model indicated that the level of participation of sample milk producer households

in milk value addition was affected positively and significantly by education level of the household, being membership to milk producer's cooperative and family size of the household whereas affected negatively and significantly by number of local breed milking cows owned and land holding size.

The inverse association of volume of milk allocated for home consumption with milk producer households decision of participation in milk value addition implies that milk producers showed more tendency of increasing allocation of milk for family consumption (either in the form of fresh milk or processed into milk products) rather than for value added milk market supply. The positive relationship of distance to market/urban centers and participation decision of smallholder milk producers in milk value addition stands from the reality that as distance from market/urban centers increases, transporting perishable milk for long distance and participating in market supply also decreases and producers would be discouraged to carry and rather prefer to process traditionally at their home. The negative correlation of milk yield/day/cow on the participation decision of milk producers in milk value addition is to mean that when the milk producers' get high volume of milk, their tendency also might be diverted to participate in raw milk market supply rather than milk value addition since milk value addition needs more labour hours than milk market supply. The direct correlation of number of children under 6 years old with the participation decision of smallholder milk producers in milk value addition might be due to the fact that the milk producers who participate in milk value addition produce butter, ghee, butter milk and cheese traditionally in their home and thereby tend to supply butter for market and feed the rest of their milk products such as buttermilk for their children.

The direct relationship of education level with participation level of smallholder milk producers in milk value addition indicated that formal education increases the implementation of innovated technologies and thereby improving producers' attitude in milk business participation. The inverse relationship of number of local breed milking cows owned per household with participation level of smallholder milk producers in milk value addition implies that the increment of local breed cows is directly proportional with the increment of daily milk yield which might in turn increase the tendency of the milk producer households to

participate in raw milk market supply rather than value added milk. The negative effect of land holding size with the participation level of smallholder milk producers in milk value addition is to mean that when milk producer households have relatively large landholding size, they divert their land (including grazing land) and other resources disproportionately for crop production whereby dairy cows remain with low feed source resulting in low volume of milk produced and value added. The positive relationship of being membership of milk producer households with their level of participation in milk value addition indicates that as the milk producer household being members of milk producers' cooperative, the level of participation in milk value addition increases. The direct relationship of family size with level of participation of milk producer households in milk value addition might be due to the fact that as the size of the family increases, the probability of labour force within the family who might participate in milk value addition also increases and thereby volume of value added milk increases.

5.2. Recommendation

Based on the conclusion of findings given, the following recommendations are drawn for future possible intervention measures.

- OCSP should pay an attention in optimizing the benefit share and minimizing disproportionate margins of milk marketing among the market actors via efficient extension service, access to market information and organizing producers to have strong bargaining power and value chain linkage.
- Extension workers of the service provider sectors more appropriately; the Livestock Resource Development Sector and OCSP should divert their sense of urgency in support of smallholder milk producers to have other alternative sources of animal feed such as agro-processing byproducts by connecting milk producers with agro-processing enterprises which in turn underpins the linkage of value chain actors and agricultural led industrialization policy of the country.
- Government sectors (more appropriately agricultural sector) should give technical support on specialization approach of dairy sector for those milk producer farmers having hope to fully engaged in milk production via specialization

- The positive correlation of number of either local or cross breed milking cows owned with the probability and intensity of milk producers' participation in milk market supply demands agricultural sector to give emphasis on timely provision of inputs/heifers (preferably cross breed) and technical support service to increase production of milk per cow and promote producers participation in milk market supply.
- To promote positive relationship of milk market supply with access to market information, information and communication sector along with agricultural sector should mediate in revealing of the availability of the product in one way and accessibility of the market in another way via advertizing the product which might also enhance the actor's linkage among each other.
- Agricultural staffs of extension workers should promote the provision of service contact frequency of extension for milk producers with regard to participation of milk market supply and value addition to boost efficiency and confidence of milk producers in milk market participation and further enhancement of consistently involvement in milk business rather than going forth and back.
- Awareness creation focused on market oriented dairying should be provided by agricultural extension workers for those milk producers who allocated greater amount of milk for home consumption and who did not participate in milk value addition to enable them to participate in milk value addition business activities.
- Emphasis should also be given by OCSP to provide improved milk processing/value addition technologies with an affordable price specifically for those milk producers inhabiting far away from milk market centre and have no market access to sell their raw milk and milk products.
- Extension service provision on market oriented dairying should be addressed for milk producers to aware and enable them comparing benefit cost ratio of their produce and thereby to participate in milk value addition and market supply.
- The practice of feeding milk and diversified milk products for the children should be promoted.

- Strengthening and promoting education level of the milk producers via formal schooling should get an attention by the government sector of capacity building to enhance their participation in milk value addition and thereby increase their income level and self sufficiency in food security.
- Necessary input supply especially small scale milk processing machine should be provided by the governmental (agricultural organization and OCSP) and non-governmental organization to encourage milk producers with relatively higher number of local breed milking cows and milk yield to encourage their level of participation in milk value addition.
- OCSP should organizing milk producers to optimize their efficiency via extension service, timely input provision and access to market information to have strong bargaining power and value chain linkage.
- Awareness creation should be given by agricultural extension workers for milk producers to promote their business oriented skill among family members.

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7. ANNEXES

Annex I: Survey questionnaires used for Data Collection

Jimma University, College of Agriculture and Veterinary Medicine

Department of Agricultural Economics and Extension, MSc. Program

The purpose of this study is to assess the milk value chain actors, analyzing marketing margin along the milk value chain actors, determinants of milk market supply and value addition by the smallholder milk producer households in Dessie Zuria District.

Survey questionnaire for smallholder milk producers' households

Instructions for enumerator

Think about the following before you start interviewing

1. Be well aware of and refresh yourself about all questions and their purpose
2. Give greeting and introduce yourself for the respondents in local language and local way
3. Describe clearly the objective of the study and ask each question briefly and patiently
4. Remember to check that all questions are exhaustively asked and got answer and finally, do not forget to thank the interviewee when you finish

Questionnaire serial No _____

Name of interviewer _____ Date of interviewing _____Signature _____

Part I: General Background of the household

1) Name of respondent _____ Zone _____ District _____
   Peasant Association (*kebele*) _____Sex: 0= female; 1= male _____ Age (yrs) _____
2) Occupation/Livelihood (encircle the best match/es)
   1= Peasant; 2= Trader; 3= Peasant + Trader; 4= other (specify) _____
3) Educational level (Regular schooling): (encircle the best match from the given alternatives)
   0= Illiterate; 1= If regular schooling, mention grade _____
4) Marital status of the household: (encircle the best match)
   1= single; 2= Married; 3= widowed/widower; 4= Divorced; 5= other specify_____
5) Household size _____ (Male_____ Female _____); Children ≤6 years old _____
6) Land holding size (hectare):

Arable land_____ Grazing land _____ Forest covered _____ Total _____

7) Livestock holding (number):

Total Cattle___ **Local Cow ____Cross Breed cow** ____Ox ____bull____ heifer ___calves___

Sheep: Local sheep _____ Improved (Awassi or Dorper cross or pure breed) _____

Goat _____ Equine _____ Bee colony_____ Poultry: Local _____ Improved _____

Part II Livelihoods or Income sources

8) Estimated Annual Income From Agricultural & Non Agricultural Activities:

8.1. Crop Production (Quintal) ____ 8.2. Forest product (Birr)_____8.3. Trade (Birr) ____

8.4. Other (specify) _____

8.5. Livestock Product (Annual)

(a) Livestock offtake (Birr)_____

(b) Income from milk yield (birr) _____ (c) Income from butter yield (birr) _____

(d) Income from ghee yield (birr) _____ (e) Income from butter milk yield (birr) ____

(f) Income from cheese yield (birr) _____

(h) Income from honey yield (birr) _____

9) What is your major annual income source? 1=income from crops; 2=sales of livestock and livestock products; 3= off-farm income; 4=monthly salary; 5=others (specify) _____

10) What is your current main employment of subsector in agriculture?

1= dairy as major means of employment; 2 = Crop-livestock as major means of employment; 3 = Livestock production as major means of employment;

4= others (specify) _____

11) Do you participate in dairy development subsector? (1) Yes; (0) No. If your answer is yes, how many years of dairying experience/ milk production do you have? _____yrs.

12) What is your cow average number of months per lactation?

(1) Local cow _____ (2) cross breed _____

13) How many litres of milk your cow produces daily? _____

(1) From Local cow (lite) _____ (2) from cross breed (improved breed) (litres) _____

14) Which breed do you prefer? 1= Holstein crossbred; 2= local breed;

15) If you prefer Holstein crossbred, why? 1=high yield; 2=relatively larger body size; 3= better draft power; 4= All; 5= other (specify) _____

16) If you prefer local cows, why? 1=high yield; 2=resistance to disease; 3= low consumption of feeds and water; 4= others (specify) _____

17) What are the constraints in dairying practices? 1=no constraints; 2=high price of dairy cow; 3=lack of credit to buy cow and other inputs; 4=disease occurrence; 5=low price of milk and milk products; 6= shortage of feed 7=Absence of milk producers cooperative and milk processing centre; 8=others (specify) _____

18) What are the opportunities to enter dairy production subsector? (1) better market access for milk and milk products; (2) availability of livestock professionals for extension support service; (3) availability of veterinary service; (4)All

19) Do you supply milk to the market? 1= Yes; 0= No

20) If your answer is no, what are/ is the reason that hinders you?

1=the need for family consumption
2=number of children ≤6 years age in home
3= Low milk yield per day
4= Absence/ low market information sharing
5= high distance to the nearest market
6= no milk market channel
7= Influence by culture
8= other (specify) _____

21) If your answer is yes, to whom or what channel and at what price do you sell your milk?

Sell to whom?	Possible fluid milk marketing outlet choices						
	1=for retailers	2=For Cafes or Restaurants	3=for collectors	4= for wholesalers	5=For processors	6= For consumers	7= Specify if any other difference
Milk price per litre							

22) Number of channels used to sell your milk _____. List them _____

23) What is your reason for the choice of the channel you are using to sell your fluid milk?

(Encircle the best match/matches)

1= Fair price
2= member to the cooperative
3= Well access of transport/ infrastructure
4= proximity to marketing centre
5= Presence of market information
6= other (specify) _____

24) What mode of payment do you use to receive your milk sell price?

1= Immediate cash payment
2= future payment
3= Immediate in kind payment
4= other (specify) _____

25) When you are selling your milk, who decides the price? 1= Myself; 2= Retailers; 3= bargaining; 4= collectors; 5= wholesalers; 6= processors; 7= Brokers; 8= other (specify) ___

26) Do you have access of milk market information where and to whom to sell?1=Yes; 0= No

27) If yes, how do you get? 1= via radio/TV, 2= via written pamphlets; 3= from brokers____ 4= retailers; 5= Cafes/Hotels; 6= processors; 7= other (specify)___

28) Is there a possibility to get market access for your milk? 1= Yes; 0= No If your answer is No, what is the reason? 1= No credit access for traders; 2= high distance between market place and my residence; 3= no access of market information; 4= no fair price of milk

29) Of the total weekly produced milk, what amounts of milk do you allocate?

(1) For home fluid milk consumption (liter) _____(2) for market supply (liter) _____

(3) For further processing to get other milk products (liter) _____

30) If you allocate for home consumption, who consume more in your family members from daily allocated milk? (encircle the best match)

1= Children less than 6 years old; 2= housewife; 3= Household head;

4= All members equally use; 5= Specify if any other difference_____

31) Do you further process fresh milk into other milk products? 1= Yes; 0= No

32) If your answer is no, what are/ is the reason that hinders you? (Choose the best match/matches)

1=low milk yield per day 5= Low dairying experience

2=Absence of formal Training 6= Low education level

3=Unfair/low price of milk products 7= low family size/Lack of laborer

4=no market for milk products 8= other (specify) _____

33) If your answer is yes, what type/types of processing do you practice? (Encircle the best match/matches)

1= simply converting into yogurt (*ergo*) 2= by churning soured milk

3= by using cream separator 4= all types

5= Specify if any other method _____

34) If you are participating in one of the above processing alternative methods, what milk

Product/products do you get from processing?

1=Butter 2= Ghee 3= butter milk (*arera*) 4= yogurt

5= Cheese 6= All except "5" 7= All except "2" & "5" 8= All

35) For what purpose do you use the above milk products that you obtain from processing? Use the following table to answer the questions.

Used for what?	Milk products (put ✓ sign for the respective use of products)					
	Yogurt	Butter	Butter milk	Cheese	Ghee	other (specify)
1=Home Consumption						
2=Market supply						
3=Further Processing						
4=for home consumption & further Processing						
5=for home consumption & market supply						

36) Who perform more activities in milking and milk related activities?

1= women 2= men 3=boys 4= girls

37) If you sell your milk product that you obtain from processing, to whom/what channel/ and at what price do you sell? Use the following table to answer the questions.

Milk products	Milk products marketing outlet and price per unit						
	1=for retailers	2=For Cafes or Hotels	3=for collectors	4= for wholesalers	5=For processors	6= For consumers	7= Specify if any other …
1) Yogurt (litre)							
2) Butter (kg)							
3) Butter milk (litre)							
4) Cheese (kg)							
5) Ghee (kg)							

38) What is your reason for the choice of the channel you are using to sell your milk products above?

1= Fair price 4= having of market information

2= Low transportation cost 5= proximity to marketing centre

3= Well access of transport/ infrastructure 6= specify if any other _____

39) What mode of payment do you use to receive your milk product sell price?

1= Immediate cash payment 3= Immediate in kind payment

2= future payment 4= other specify _____

40) Are you member of any of the cooperatives? 1=Yes; 0= No.

41) If yes, to which cooperative? (encircle the best match)

1= Member of milk producer cooperative 2= member of milk producers cooperative

42) If you are a member to either of one, for how many years are you engaged in as a cooperative member ____ Give the benefit you get from being a member 1= bargaining power; 2= better profitability, 3=able to process into different milk products; 4= other specify __ If you are not a member, specify the reason: 1= not profitable and no fair price; 2=cooperative is not well established;3=no difference between members and non members; 4=other specify_____

43) How many kilometer your home far from the nearest milk market place/centre? _____km.

44) What type of transport do you use for your milk and milk products?

1= Public transport; 2= pickup truck; 3= horse cart;

4= Carrying by human labour; 5= other specify _____

45) What costs do you incur for a litre of milk production? _____

46) Do take your animals to veterinary clinics for the health care of your cows/animals? 0= No, 1= yes. If yes, at what frequency you take…….

47) Do you feed your animals supplement/concentrate feed? 0=No, 1= yes. If, yes what are the concentrate feed types you feed? Specify …….

Part III support services

48) Are there financial institutions in your locality that provide you credit access?1=Yes;0= No

If yes, who is more important creditor? 1= Amhara credit and saving institute; 2=Bank; 3= relatives and friends; 4= other (specify)_____

49) Are you getting regular extension service? 1=Yes; 0= No. If yes, by whom?

1= Government organization (agriculture office); 2=LIVES project; 3=others (specify) ____

50) If your answer for Q47 above is yes, how frequency of contact? (number of visits per month) ____

51) Do you get technical assistance (training) on milk production from government organization such as agricultural office? 1= Yes; 0= No

52) Is milk value chain linkage among the actors improved? 1= Yes; 0= No.

53) What type of breeding do you use for your dairy animals?

1=government AI service; 2= locally by bull; 3= private AI service; 4= other specify___

Part four actor's relation

54) Is there any problems regarding consumers? 1= Yes; 0=No If yes, what are the problems? 1. _____ 2. _____3. _____

What measures do you think to solve such problems? 1._____ 2._____3._____

55) Is there any problems regarding collectors? 1= Yes; 0=No If yes, what are the problems? 1. _____ 2. _____3. _____

What measures do you think to solve such problems? 1._____ 2._____3._____

56) Is there any problems regarding retailers? 1= Yes; 0=No If yes, what are the problems? 1._____ 2. _____ 3. _____

What measures do you think to solve such problems? 1._____ 2._____3._____

57) Is there any problems regarding cafes/bars? 1= Yes; 0=No If yes, what are the problems? 1._____ 2. _____ 3. _____

What measures do you think to solve such problems? 1._____ 2._____3._____

58) Is there any problems regarding wholesalers? 1= Yes; 0=No If yes, what are the problems? 1._____ 2. _____ 3. _____

What measures do you think to solve such problems? 1._____ 2._____3._____

59) Do you have any problems with processors? 1= Yes; 0=No If yes, what are the problems? 1._____ 2. _____ 3. _____

What measures do you think to solve such problems? 1._____ 2._____3._____

Thank you for your collaboration and sacrifice of precious time!!!

QUESTIONS FOR MILK COLLECTORS

Questionnaire serial No _____

Name of interviewer _____ Date of interviewing _____Signature _____

Part I: General Background of the household

1) Name of the respondent _____ Zone _____ District _____ *kebele* _____ Sex of the respondent: 0= female; 1= male _____ Age (yrs) _____
2) Educational level of the respondent (Regular schooling): (encircle the best match from the given alternatives) 0= Illiterate; 1= If regular schooling, mention grade _____
3) Marital status of the respondent: (encircle the best match)
   1= single; 2= Married; 3= widowed/widower; 4= Divorced
4) Family size of the respondent: Total _____ (Male_____Female_____)
5) How many years of milk trade experience do you have? _____
6) From whom do you regularly buy milk for trade purpose? 1= from milk producers;
   2=other (specify) _____
7) When you are buying your milk, who decides the price? 1= Myself; 2= producers;
   3= brokers; 4=other (specify) _____
8) At what price do you buy a liter of milk? _____.
9) To whom do you sell your milk? 1= to retailers; 2=to wholesalers; 3=other (specify)_____
10) At what price do you sell a liter of milk? _____. What is the marketing cost for a liter of milk? _____.
11) When you are selling your milk, who decides the price? 1= Myself; 2= to retailers;
   3= wholesalers; 4= Brokers; 5=other (specify) _____
12) How many liters of milk do you buy per day? ____? Per month? _____? Per year?_____
13) Where do you take your milk after you buy? 1=I store for a while to wait good price;
   2= I sell it immediately; 3=other (specify)_____
14) If you store your purchased milk, do you have storing facilities such as refrigerator and room? 1= Yes; 0=No
15) Is there any credit access to support your milk trade? 1= Yes; 0=No
16) If your answer is yes, who is more important creditor? 1= Amhara credit and saving institute;
   2=Bank; 3= relatives and friends; 4=other (specify)_____
17) Do you have market information fo**r** your milk marketing? 1= Yes; 0=No
18) If your answer is yes, what means do you use to get such information? 1=Radio/TV; 2= Brokers; 3= Consumers; 4=Hotel /cafes; 5= other (specify) _____
19) Do you have market access for your milk marketing? 1= Yes; 0=No

20) If your answer is No, what is the reason? 1= No credit access for traders; 2= high distance between market place and my residence; 3= no access of market information

21) What are the opportunities for entering milk market business? _____

22) What are the constraints in milk marketing and linkage along the chain? 1= No credit access for traders; 2= no access of market information; 3= weak linkage among the chain actors; 4=other (specify) _____

Part four actor's relation

23) Is there any problems regarding producers? 1= Yes; 0=No If yes, what are the problems? 1. _____ 2. _____3. _____

What measures do you think to solve such problems? 1._____ 2._____3._____

24) Is there any problems regarding retailers? 1= Yes; 0=No If yes, what are the problems? 1. _____ 2. _____3. _____

What measures do you think to solve such problems? 1._____ 2._____3._____

25) Is there any problems regarding cafes/bars? 1= Yes; 0=No If yes, what are the problems?

1._____ 2. _____ 3. _____

What measures do you think to solve such problems? 1._____ 2._____3._____

26) Is there any problems regarding wholesalers? 1= Yes; 0=No If yes, what are the problems?

1._____ 2. _____ 3. _____

What measures do you think to solve such problems? 1._____ 2._____3._____

27) Is there any problems regarding processors? 1= Yes; 0=No If yes, what are the problems?

1._____ 2. _____ 3. _____

What measures do you think to solve such problems? 1._____ 2._____3._____

28) Do you have any problems with consumers? 1= Yes; 0=No If yes, what are the problems?

1._____ 2. _____ 3. _____

What measures do you think to solve such problems? 1._____ 2._____3._____

Thank you for your collaboration and sacrifice of precious time!!!

QUESTIONS FOR MILK WHOLESALERS

Questionnaire serial No _____

Name of interviewer _____ Date of interviewing _____Signature _____

Part I: General Background of the household

1) Name of the respondent _____ Zone _____ District _____ *kebele* _____
   Sex of the respondent: 0= female; 1= male _____ Age of the respondent (yrs) _____
2) Educational level (Regular schooling): (encircle the best match from the given alternatives)
   0= Illiterate; 1= If regular schooling, mention grade _____
3) Marital status of the household: (encircle the best match)
   1= single; 2= Married; 3= widowed/widower; 4= Divorced
4) Family size: Total _____ (Male_____Female_____)
5) How many years of milk trade experience do you have? _____
6) From whom do you regularly buy milk for trade purpose? 1= from milk producers; 2= Local Collectors; 3= All; 4=other (specify) _____
7) When you are buying your milk, who decides the price? 1=Myself; 2= brokers; 3= collectors;
   4=producers; 5= other (specify) _____.
8) At what price do you buy a liter of milk? _____.
9) To whom do you sell your milk? 1=retailers; 2=consumers; 3=processors;
   4=other (specify)_____.
10) At what price do you sell a liter of milk? _____. What is the marketing cost for a liter of milk? _____.
11) When you are selling your milk, who decides the price? 1= Myself; 2= Brokers;
   3=consumers; 4=processors; 5=other (specify) _____
12) How many liters of milk do you buy per day? _____? Per month? _____? Per year?_____
13) Where do you take your milk after you buy? 1=I store for a while to wait good price; 2= I process it into different milk products and sell; 3= I sell it immediately?
14) If you store your purchased milk, do you have storing facilities such as refrigerator and room?
   1= Yes; 0=No
15) Is there any credit access to support your milk trade? 1= Yes; 0=No
16) If your answer is yes, who is more important creditor? 1= Amhara credit and saving institute;
   2=Bank; 3= relatives and friends; 4= other (specify)_____
17) Do you have market information for your milk marketing? 1= Yes; 0=No
18) If your answer is yes, from whom do you get such information? 1=Radio/TV; 2= Brokers;

3= Consumers; 4=Hotel /cafes; 5= processors; 6= other (specify) _____

19) Do you have market access for your milk marketing? 1= Yes; 0=No

20) If your answer is No, what is the reason? 1= No credit access for traders; 2= long distance between market place and my residence; 3= no access of market information; 4=other specify)_____

21) What are the opportunities for entering milk market business?_____

22) What are the constraints in milk marketing and linkage along the chain? 1= No credit access for traders; 2= no access of market information; 3= weak linkage among the chain actors; 4=other (specify) _____

Part four actor's relation

23) Is there any problems regarding producers? 1= Yes; 0=No If yes, what are the problems? 1. _____ 2. _____3. _____

What measures do you think to solve such problems? 1._____ 2._____3._____

24) Is there any problems regarding collectors? 1= Yes; 0=No If yes, what are the problems? 1. _____ 2. _____3. _____

What measures do you think to solve such problems? 1._____ 2._____3._____

25) Is there any problems regarding retailers? 1= Yes; 0=No If yes, what are the problems? 1._____ 2. _____ 3. _____

What measures do you think to solve such problems? 1._____ 2._____3._____

26) Is there any problems regarding cafes/bars? 1= Yes; 0=No If yes, what are the problems? 1._____ 2. _____ 3. _____

What measures do you think to solve such problems? 1._____ 2._____3._____

27) Is there any problems regarding processors? 1= Yes; 0=No If yes, what are the problems? 1._____ 2. _____ 3. _____

What measures do you think to solve such problems? 1._____ 2._____3._____

28) Do you have any problems with consumers? 1= Yes; 0=No If yes, what are the problems? 1._____ 2. _____ 3. _____

What measures do you think to solve such problems? 1._____ 2._____3._____

Thank you for your collaboration and sacrifice of precious time!!!

QUESTIONS FOR MILK PROCESSORS

Questionnaire serial No _____

Name of interviewer _____ Date of interviewing _____Signature _____

Part I: General Background of the household

1) Name of the respondent _____ Zone _____ District _____ *kebele* _____
   Sex of the respondent: 0= female; 1= male ____ Age of the respondent (yrs) ___
2) Educational level (Regular schooling):
   0= Illiterate; 1= If regular schooling, mention grade _____
3) Marital status of the household: 1= single; 2= Married; 3= widowed/widower; 4= Divorced
4) Family size: Total _____ (Male_____Female_____)
5) How many years of milk trade experience do you have? _____
6) From whom do you regularly buy milk for trade purpose? 1= from milk producers; 2= Local Collectors; 3= All; 4=other (specify) _____
7) When you are buying your milk, who decides the price? 1=Myself; 2= brokers; 3= collectors;
   4=producers; 5= other (specify) _____.
8) At what price do you buy a liter of milk? _____.
9) Do you process milk into milk products? 1= Yes; 0=No
10) If your answer is yes, what type/s of processing method do you use? 1= Simply converting into *yogurt* (ergo) 2= By churning soured milk 3= By using cream separator; 4= All types
    5= Specify if any other method _____
11) What are the milk products you obtain from milk processing?
    1= butter; 2= butter milk; 3= skimmed milk; 4=cheese; 5=other (specify)_____
12) How many liters of milk do you process per day? _____
13) What costs do you incur to process a liter of milk?
14) To whom do you sell your milk products? 1=retailers; 2=consumers; 3=other (specify)__.
15) At what price do you sell your milk products? ____. Use the following table to give your answer.

Milk products	Milk products marketing outlet and price per unit						
	1=for retailers	2=For Cafes or Restaurants	3=for collectors	4= for wholesalers	5=For processors	6= For consumers	7= Specify if any other …
1) Yogurt (litre)							
2) Butter (kg)							
3) Butter milk (litre)							
4) Cheese (kg)							
5) Ghee (kg)							
6) Skimmed milk(litre)							

16) When you are selling your milk products, who decide the price? 1= Myself; 2= collectors; 3= Wholesalers; 4= Brokers; 5=other (specify) _____

17) How many liters of milk do you buy per day? _____? Per month? _____? Per year?_____

18) Where do you take your milk after you buy? 1=I store for a while to wait good price; 2= I process it into different milk products and sell; 3= I sell some amount immediately and process the rest?

19) If you store your purchased milk, do you have storing facilities such as refrigerator and room? 1= Yes; 0=No

20) Is there any credit access to support your milk trade? 1= Yes; 0=No

21) If your answer is yes, who is more important creditor? 1= Amhara credit and saving institute; 2=Bank; 3= relatives and friends; 4= other (specify)_____

22) Do you have market information for your milk products marketing? 1= Yes; 0=No

23) If your answer is yes, from whom do you get such information? 1=Radio/TV; 2= Brokers; 3= Consumers; 4=Hotel /cafes; 5= other (specify) _____

24) Do you have market access for your milk products marketing? 1= Yes; 0=No

25) If your answer is No, what is the reason? 1= No credit access for traders; 2= no access of market information; 3=other specify)____

26) What are the opportunities for entering milk market business?

27) What are the constraints in milk marketing and linkage along the chain? 1= No credit access for traders; 2= no access of market information; 3= weak linkage among the chain actors; 4=other (specify) _____

Part four actor's relation

28) Is there any problems regarding producers? 1= Yes; 0=No If yes, what are the problems? 1. _____ 2. _____3. _____

What measures do you think to solve such problems? 1._____ 2._____3._____

29) Is there any problems regarding collectors? 1= Yes; 0=No If yes, what are the problems? 1. _____ 2. _____3. _____

What measures do you think to solve such problems? 1._____ 2._____3._____

30) Is there any problems regarding retailers? 1= Yes; 0=No If yes, what are the problems? 1._____ 2. _____ 3. _____

What measures do you think to solve such problems? 1._____ 2._____3._____

31) Is there any problems regarding cafes/bars? 1= Yes; 0=No If yes, what are the problems? 1._____ 2. _____ 3. _____

What measures do you think to solve such problems? 1._____ 2._____3._____

32) Is there any problems regarding wholesalers? 1= Yes; 0=No If yes, what are the problems?

1._____ 2. _____ 3. _____

What measures do you think to solve such problems? 1._____ 2._____3._____

33) Do you have any problems with processors? 1= Yes; 0=No If yes, what are the problems?

1._____ 2. _____ 3. _____

What measures do you think to solve such problems? 1._____ 2._____3._____

34) Do you have any problems with consumers? 1= Yes; 0=No If yes, what are the problems?

1._____ 2. _____ 3. _____

What measures do you think to solve such problems? 1._____ 2._____3._____

Thank you for your collaboration and sacrifice of precious time!!!

QUESTIONS FOR MILK RETAILERS

Questionnaire serial No _____

Name of interviewer _____ Date of interviewing _____Signature _____

Part I: General Background of the household

1) Name of the respondent _____ Zone _____ District _____ *kebele* _____
   Sex of the respondent: 0= female; 1= male _____ Age of the respondent (yrs) _____
2) Educational level (Regular schooling): (encircle the best match from the given alternatives)
   0= Illiterate; 1= If regular schooling, mention grade _____
3) Marital status of the household: (encircle the best match)
   1= single; 2= Married; 3= widowed/widower; 4= Divorced
4) Family size: Total _____ (Male_____Female_____)
5) How many years of milk trade experience do you have? _____
6) From whom do you regularly buy milk for trade purpose? 1= from milk producers; 2= Local Collectors; 3=from Wholesalers; 4= All; 5=other (specify) _____
7) When you are buying your milk, who decides the price? 1= Myself; 2= local collectors; 3=producers; 4= brokers; 5=other (specify) _____
8) At what price do you buy a liter of milk? _____.
9) At what price do you sell a liter of milk for consumers? _____. What is the marketing cost for a liter of milk? _____.
10) When you are selling your milk, who decides the price? 1= Myself; 2= local collectors; 3= wholesalers; 4= Brokers; 5=other (specify) _____
11) How many liters of milk do you buy per day? ____? Per month? _____? Per year?_____
12) Where do you take your milk after you buy? 1=I store for a while to wait good price; 2= I process it into different milk products and sell; 3= I sell it immediately?
13) If you store your purchased milk, do you have storing facilities such as refrigerator and room? 1= Yes; 0=No
14) Is there any credit access to support your milk trade? 1= Yes; 0=No
15) If your answer is yes, who is more important creditor? 1= Amhara credit and saving institute; 2=Bank; 3= relatives and friends; 4= other (specify)_____

16) Do you have market information for your milk marketing? 1= Yes; 0=No

17) If your answer is yes, what is the means of getting such information? 1=Radio/TV; 2= Brokers; 3= Consumers; 4=Hotel /cafes; 5= other (specify) _____

18) Do you have market access for your milk marketing? 1= Yes; 0=No

19) If your answer is No, what is the reason? 1= No credit access for traders; 2= high distance between market place and my residence; 3= no access of market information

20) What are the opportunities for entering milk market business?

21) What are the constraints in milk marketing and linkage along the chain? 1= No credit access for traders; 2= no access of market information; 3= weak linkage among the chain actors; 4=other specify _____

_____

Part four actor's relation

22) Is there any problems regarding producers? 1= Yes; 0=No If yes, what are the problems?
1. _____ 2. _____3. _____

What measures do you think to solve such problems? 1._____ 2._____3._____

23) Is there any problems regarding collectors? 1= Yes; 0=No If yes, what are the problems?
1. _____ 2. _____3. _____

What measures do you think to solve such problems? 1._____ 2._____3._____

24) Is there any problems regarding cafes/bars? 1= Yes; 0=No If yes, what are the problems?
1._____ 2. _____ 3. _____

What measures do you think to solve such problems? 1._____ 2._____3._____

25) Is there any problems regarding wholesalers? 1= Yes; 0=No If yes, what are the problems?
1._____ 2. _____ 3. _____

What measures do you think to solve such problems? 1._____ 2._____3._____

26) Is there any problems regarding processors? 1= Yes; 0=No If yes, what are the problems?
1._____ 2. _____ 3. _____

What measures do you think to solve such problems? 1._____ 2._____3._____

27) Do you have any problems with consumers? 1= Yes; 0=No If yes, what are the problems?
1._____ 2. _____ 3. _____

What measures do you think to solve such problems? 1._____ 2._____3._____

Thank you for your collaboration and sacrifice of precious time!!!

QUESTIONS FOR CAFES/HOTELS OWNERS

Questionnaire serial No _____

Name of interviewer _____ Date of interviewing _____Signature _____

Part I: General Background of the household

1) Name of the respondent _____ Zone _____ District _____ *kebele* _____
   Sex of the respondent: 0= female; 1= male _____ Age of the respondent (yrs) _____
2) Educational level (Regular schooling): (encircle the best match from the given alternatives)
   0= Illiterate; 1= If regular schooling, mention grade _____
3) Marital status of the household: (encircle the best match)
   1= single; 2= Married; 3= widowed/widower; 4= Divorced
4) Family size: Total _____ (Male_____Female_____)
5) How many years of milk trade experience do you have? _____
6) From whom do you regularly buy milk for trade purpose? 1= from milk producers; 2= Local Collectors; 3=from Wholesalers; 4=processors 5= All; 6=other (specify) _____
7) When you are buying your milk, who decides the price? 1= Myself; 2= local collectors; 3=producers; 4= brokers; 5=Wholesalers; 6=processors 7=other (specify) _____
8) At what price do you buy a liter of milk? _____.
9) At what price do you sell a liter of milk for consumers? _____. What is the marketing cost for a liter of milk up to you sell it? _____.
10) When you are selling your milk, who decides the price? 1= Myself; 2= consumers; 3= Brokers; 4=other (specify) _____
11) How many liters of milk do you buy per day? _____? Per month? _____? Per year?____
12) Where do you take your milk after you buy? 1=I store for a while to wait good price; 2= I process it into different milk products and sell; 3= I sell it immediately?
13) If you store your purchased milk, do you have storing facilities such as refrigerator and room? 1= Yes; 0=No
14) Do you process your milk into different milk products? 0= No, 1= yes.
15) If you process, what type of processing do you use? Specify _____
16) What types of milk products do you get from processing? Specify _____
17) Price of milk products after processing: for _____type_____ birr/unit
    for _____ type _____birr/unit

18) Is there any credit access to support your milk trade? 1= Yes; 0=No

19) If your answer is yes, who is more important creditor? 1= Amhara credit and saving institute; 2=Bank; 3= relatives and friends; 4= other (specify)_____

20) Do you have market information for your milk marketing? 1= Yes; 0=No

21) If your answer is yes, what is the means of getting such information? 1=Radio/TV; 2= Brokers; 3= Consumers; 4=Hotel /cafes; 5= other (specify) _____

22) Do you have market access for your milk marketing? 1= Yes; 0=No

23) If your answer is No, what is the reason? 1= No credit access for traders; 2= high distance between market place and my residence; 3= no access of market information

24) What are the opportunities for entering milk market business?

25) What are the constraints in milk marketing and linkage along the chain? 1= No credit access for traders; 2= no access of market information; 3= weak linkage among the chain actors; 4=other specify _____

_____

Part four actor's relation

26) Is there any problems regarding producers? 1= Yes; 0=No If yes, what are the problems?
1. _____ 2. _____3. _____

What measures do you think to solve such problems? 1._____ 2._____3._____

27) Is there any problems regarding collectors? 1= Yes; 0=No If yes, what are the problems?
1. _____ 2. _____3. _____

What measures do you think to solve such problems? 1._____ 2._____3._____

28) Is there any problems regarding wholesalers? 1= Yes; 0=No If yes, what are the problems?
1._____ 2. _____ 3. _____

What measures do you think to solve such problems? 1._____ 2._____3._____

29) Is there any problems regarding processors? 1= Yes; 0=No If yes, what are the problems?
1._____ 2. _____ 3. _____

What measures do you think to solve such problems? 1._____ 2._____3._____

30) Do you have any problems with consumers? 1= Yes; 0=No If yes, what are the problems?
1._____ 2. _____ 3. _____

What measures do you think to solve such problems? 1._____ 2._____3._____

Thank you for your collaboration and sacrifice of precious time!!!

QUESTIONS FOR MILK PRODUCERS AND/OR MARKETING COOPERATIVES

Questionnaire serial No _____

Name of interviewer _____ Date of interviewing _____Signature _____

Part I: General Background of the household

1) Name of the respondent _____ Zone _____ District _____ *kebele* _____ Sex of the respondent: 0= female; 1= male _____ Age (yrs) _____
2) Educational level of the respondent (Regular schooling): (encircle the best match from the given alternatives) 0= Illiterate; 1= If regular schooling, mention grade _____
3) Marital status of the respondent: (encircle the best match)
   1= single; 2= Married; 3= widowed/widower; 4= Divorced
4) Family size of the respondent: Total _____ (Male_____Female_____)

Are you member of milk producers/marketing cooperative? 1= Yes; 0=No

5) If your answer is yes, to cooperative your membership belongs? 1=milk producers cooperative; 2= milk producers cooperative
6) If your answer for question 4 is yes, how many years of membership experience do you have? __
7) What is your responsibility in the cooperative? 1= leadership; 2=membership only
8) How many members your cooperatives have? _____
9) When your cooperative is established?_____
10) When you are buying your milk, who decides the price? 1= cooperative members; 2= cooperative leaders; 3=producers; 4=other (specify) _____
11) At what price do you buy a liter of milk? _____.
12) To whom do you sell your milk? 1= to retailers; 2=to wholesalers; 3=other (specify)____
13) At what price do you sell a liter of milk?_____. What is the marketing cost for a liter of milk? _____.
14) When you are selling your milk, who decides the price1= cooperative members; 2= cooperative leaders; 3=other (specify) _____
15) How many liters of milk do you buy per day? _____? Per month? ____? Per year?_____
16) Where do you take your milk after you buy? 1=we store for a while to wait good price; 2= we sell it immediately; 3= we process it into milk products; 4=other (specify)_____
17) If you store your purchased milk, do you have storing facilities such as refrigerator and room? 1= Yes; 0=No

18) Is there any credit access to support your milk trade? 1= Yes; 0=No

19) If your answer is yes, who is more important creditor? 1= Amhara credit and saving institute; 2=Bank; 3= relatives and friends; 4=other (specify)_____

20) Do you have market information for your milk marketing? 1= Yes; 0=No

21) If your answer is yes, what means do you use to get such information? 1=Radio/TV; 2= Brokers; 3= Consumers; 4=Hotel /cafes; 5= other (specify) _____

22) Do you have market access for your milk marketing? 1= Yes; 0=No

23) If your answer is No, what is the reason? 1= No credit access to support us; 2= high distance between market place and my residence; 3= no access of market information; 4=other____

24) What are the opportunities for entering into your cooperative?_____

25) What are the constraints for entering into your cooperative and to be functional?_____
_____

26) What are the constraints in milk marketing and linkage along the chain? 1= No credit access for traders; 2= no access of market information; 3= weak linkage among the chain actors; 4=other (specify) _____

Part four actor's relation

27) Is there any problems regarding producers? 1= Yes; 0=No If yes, what are the problems? 1. _____ 2. _____3. _____

What measures do you think to solve such problems? 1._____ 2._____3._____

28) Do you have any problems with consumers? 1= Yes; 0=No If yes, what are the problems?

1._____ 2. _____ 3. _____

What measures do you think to solve such problems? 1._____ 2._____3._____

29) Is there any problems regarding retailers? 1= Yes; 0=No If yes, what are the problems? 1. _____ 2. _____3. _____

What measures do you think to solve such problems? 1._____ 2._____3._____

30) Is there any problems regarding cafes/bars? 1= Yes; 0=No If yes, what are the problems?

1._____ 2. _____ 3. _____

What measures do you think to solve such problems? 1._____ 2._____3._____

31) Is there any problems regarding wholesalers? 1= Yes; 0=No If yes, what are the problems?

1._____ 2. _____ 3. _____

What measures do you think to solve such problems? 1._____ 2._____3._____

32) Is there any problems regarding processors? 1= Yes; 0=No If yes, what are the problems?

1._____ 2. _____ 3. _____

What measures do you think to solve such problems? 1._____ 2._____3._____

33) Do you have any problems with consumers? 1= Yes; 0=No If yes, what are the problems?

1._____ 2. _____ 3. _____

What measures do you think to solve such problems? 1._____ 2._____3._____

QUESTIONS FOR MILK CONSUMERS

Questionnaire serial No _____

Name of interviewer _____ Date of interviewing _____Signature _____

Part I: General Background of the household

1) Name of the respondent _____ Zone _____ District _____ *kebele* _____

   Sex of the respondent: 0= female; 1= male; Age of the respondent (yrs) ____

2) Educational level (Regular schooling):

   0= Illiterate; 1= If regular schooling, mention grade _____

3) Marital status of the household: 1= single; 2= Married; 3= widowed/widower; 4= Divorced

4) Family size: Total _____ (Male_____Female_____)

5) Is there milk market supply access in your locality? 1= Yes; 0=No

6) Do you consume milk? 1= Yes; 0=No

7) If your answer is no, what is the reason? 1=I fill discomfort when I consume milk; 2=economic inability to buy milk; 3= I am not much interested to consume milk 4=other (specify) _____

8) If your answer is yes for question 6, at what frequency do you consume?

   1=daily; 2=rarely; 3=other (specify) _____

9) If you consume milk, from whom do you get? 1=from my own cow; 2= from Cafes and Hotels; 3=from milk producers via monthly contract payment; 4=from other (specify)____

10) If your answer is via monthly contract payment, how many years of milk buying contract experience do you have? _____

11) From whom do you regularly buy milk for consumption purpose? 1= from milk producers;

    2= from retailers; 3= from Cafes and Hotels; 4=All; 5=other (specify) _____

12) At what price do you buy a liter of milk? _____.

13) How many liters of milk do you buy per day? _____? Per month? _____? Per year?____

14) When you are buying your milk, who decides the price? 1=Myself; 2= brokers;

    3=producers; 4= other (specify) _____.

15) What are the milk products that you buy from milk processor/or others?

    1= butter; 2= butter milk; 3= skimmed milk; 4=cheese; 5=other (specify)_____

16) From whom do you buy milk products? 1=retailers; 2=consumers; 3=other (specify)____

17) At what price do you buy milk products? _____. Use the following table to give your answer.

Milk products	Milk products marketing source and price per unit				
	1=from retailers	2=from collectors	3=from wholesalers	4= from processors	5= Specify if any other …
1) Yogurt (liter)					
2) Butter (kg)					
3) Butter milk (liter)					
4) Cheese (kg)					
5) Ghee (kg)					
6) Skimmed milk(liter)					

18) When you are buying milk products, who decide the price? 1= Myself; 2= processors; 3= wholesalers; 4= Brokers; 5=other (specify) _____

19) Do you have market information for milk and milk products marketing? 1= Yes; 0=No

20) If your answer is yes, from whom do you get such information? 1=Radio/TV; 2= Brokers; 3=Hotel /cafes; 4= producers; 5= other (specify) _____

21) Do you have access of milk products market supply? 1= Yes; 0=No

22) If your answer is No, what is the reason? 1= No credit access for traders; 2= no access of market information; 3=other specify)____

23) What are the opportunities for entering milk market business?

24) What are the constraints in milk marketing and linkage along the chain? 1= No credit access for traders; 2= no access of market information; 3= weak linkage among the chain actors; 4=other (specify) _____

Part four actor's relation

25) Is there any problems regarding producers? 1= Yes; 0=No If yes, what are the problems?
1. _____ 2. _____3. _____
What measures do you think to solve such problems? 1._____ 2._____3._____

26) Is there any problems regarding collectors? 1= Yes; 0=No If yes, what are the problems?
1. _____ 2. _____3. _____
What measures do you think to solve such problems? 1._____ 2._____3._____

27) Is there any problems regarding retailers? 1= Yes; 0=No If yes, what are the problems?
1._____ 2. _____ 3. _____
What measures do you think to solve such problems? 1._____ 2._____3._____

28) Is there any problems regarding cafes/bars? 1= Yes; 0=No If yes, what are the problems?
1._____ 2. _____ 3. _____
What measures do you think to solve such problems? 1._____ 2._____3._____

29) Is there any problems regarding wholesalers? 1= Yes; 0=No If yes, what are the problems?
1._____ 2. _____ 3. _____
What measures do you think to solve such problems? 1._____ 2._____3._____

30) Do you have any problems with processors? 1= Yes; 0=No If yes, what are the problems?
1._____ 2. _____ 3. _____
What measures do you think to solve such problems? 1._____ 2._____3._____

Thank you for your collaboration and sacrifice of precious time!!!

Annex II: Human population of sample kebeles of the study area

S.No	Name of kebe	Population	S.No	Name of kebe	Population
1	Kelina	358	4	Boru Silassie	1175
2	Abaso kotu	1186	5	Kurkur	1793
3	Harawabello	1055	6	Kelem Dereba	640
	Total	6207			

Annex table 1: Tests of multicollinearity for continuous explanatory variables of milk market supply participation

Variable	VIF	1/VIF
tcrosscow	2.10	0.477069
inclsoff	1.81	0.552602
tlocalcow	1.59	0.628536
edulevel	1.31	0.764802
distancehome	1.27	0.787530
nchilsix	1.11	0.898096
landhs	1.08	0.925380
frequexcon~t	1.07	0.938807
dairyexpe	1.06	0.941102
Mean VIF	1.38	

Annex table 2: Tests of multicollinearity for dummy explanatory variables of milk market supply participation

Coupled Variables	Value of Contingency Coefficient
sex Vs marketinfo	-0.0836
sex Vs membercoop	-0.0338
Membercoop Vs marketinfo	0.3311

Annex table 3: Tests of multicollinearity for continuous explanatory Variables of milk value addition participation

Variable	VIF	1/VIF
myieldpcow	2.34	0.427530
tlocalcow	1.58	0.632576
edulevel	1.53	0.652302
distancehome	1.47	0.678556
age	1.41	0.711042
VMforHC	1.37	0.727950
thousehsz	1.27	0.789307
landhs	1.24	0.809556
frequexcontact	1.16	0.858457
nchilsix	1.16	0.865153
Mean VIF	1.45	

Annex table 4: Test of multicollinearity for dummy explanatory variables of milk value addition participation

Coupled Variables	Value of Contingency Coefficient
sex Vs membercoop	-0.0338
sex Vs breedprefer	-0.0851
membercoop Vs breedprefer	-0.0519