Accès des petits exploitants à la chaîne de valeur des produits laitiers et sécurité alimentaire et nutritionnelle des ménages une étude des systèmes agricoles mixtes des districts de Kimbibit et Bahirdar-Zuria en Ethiopie

Elias Geday

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Présentée par **Elias Abiyou GEDAY**

SMALLHOLDERS' ACCESS TO DAIRY VALUE CHAIN FOR HOUSEHOLD FOOD AND NUTRITIONAL SECURITY IMPROVEMENT: A STUDY IN MIXED FARMING SYSTEM OF KIMBIBIT AND BAHIRDAR-ZURIA Districts in Ethiopia.

Soutenue le 16 Décembre 2016 devant le jury composé de

M. Jose Maria Alvarez Coque: Professeur at the University of Valencia (Spain)	Rapporteur
Mme. Dominique Barjole: Professeur ETH Zurich	Rapporteur
M. Guillaume Duteurtre: Researcher CIRAD UMR Selmet	Examinateur
Mme. Martine Padilla: Professeure-associée, scientific director, CIHEAM-IAM Montpellier	Co-Directeur
M. Degefa Tolossa: Professeur-associé, Addis Ababa University	Examinateur
M. Etienne Montaigne: Professeur SupAgro-MOISA	Directeur

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List of Acronyms and Abbreviations

AA	Addis Ababa
ATT	Average Treatment on Treated
CSA	Central Statistical Authority
EARO	Ethiopian Agricultural Research Organization
ETB	Ethiopian Birr
FAO	Food and Agriculture Organization
FNS	Food and Nutritional Security
FGD	Focus Group Discussion
GVC	Global Value Chain Approach
GAFVC	Global Agri-Food Value Chain
GDP	Gross Domestic Product
Ha	Hectare
HH	Household
HVAFVC	High Value Agri-Food Value Chain
IFPRI	International Food Policy Research Institute
ILRI	International Livestock Research Institute
IPMS	Improving productivity and Market success
kms	Kilometers
MoARD	Ministry of Agriculture and Rural Development
NGO	Non-Governmental Organization
PA	Peasant Association
PRA	Participatory Rural Appraisal
PSM	Propensity Score Matching Model
RMMA	Rapid Milk Market Appraisal
SPSS	Statistical Package for Social Sciences
SSA	Sub Saharan Africa
TGMM	Total Gross Marketing Margin
TLU	Tropical Livestock Unit
WoARD	Woreda Office of Agriculture and Rural Development

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ABSTRACT

The purpose of this study was to analyze the structure of dairy value chain, determinants and impact of smallholders' participation in formal dairy value chain. Qualitative data collected from purposely selected key informants and quantitative data collected from 60 and 333 randomly selected dairy traders and smallholder households respectively. Content analysis was employed to analyze the qualitative data, while descriptive statistics and regression analysis were used for quantitative data analysis. The result shows that the largest (70%) of sampled smallholders participated in informal dairy value chain, while 30% of smallholder participated in formal fluid milk value chain. Shortage and high cost of feeds, shortage of artificial insemination supply, low productivity, insufficient extensions and business support services and high transaction were major constraints of dairy value chains. The two step binary logit analysis result shows that the largest portion (65%) of samples smallholders were not participate in fluid milk sales. Of the total fluid milk market participated smallholder households, 86.1% participated in formal milk value chain; while 13.9% participated in informal milk value chain. The results shows that transaction costs factors such as distance to milk collection center, nearest town and cooperative membership; resource factors such as costs of concentrates feeds, cross breed cow size, quantity milk yield per day and; access to veterinary services are significantly determines smallholders' milk sales decisions and access to formal milk value chain. The propensity matching model analysis result shows that participation in formal milk value chain has a significant positive impact via income on food security and nutrition improvement of smallholder households through better calorie intake and diet diversity consumption. On the other hand, the study finds that access to modern milk value chain has a significant negative impact on the household milk consumption. The study confirms that the dairy value chain predominately traditional and loosely coordinated.

Key words: Smallholder, access, dairy, value chain, food security, nutrition.

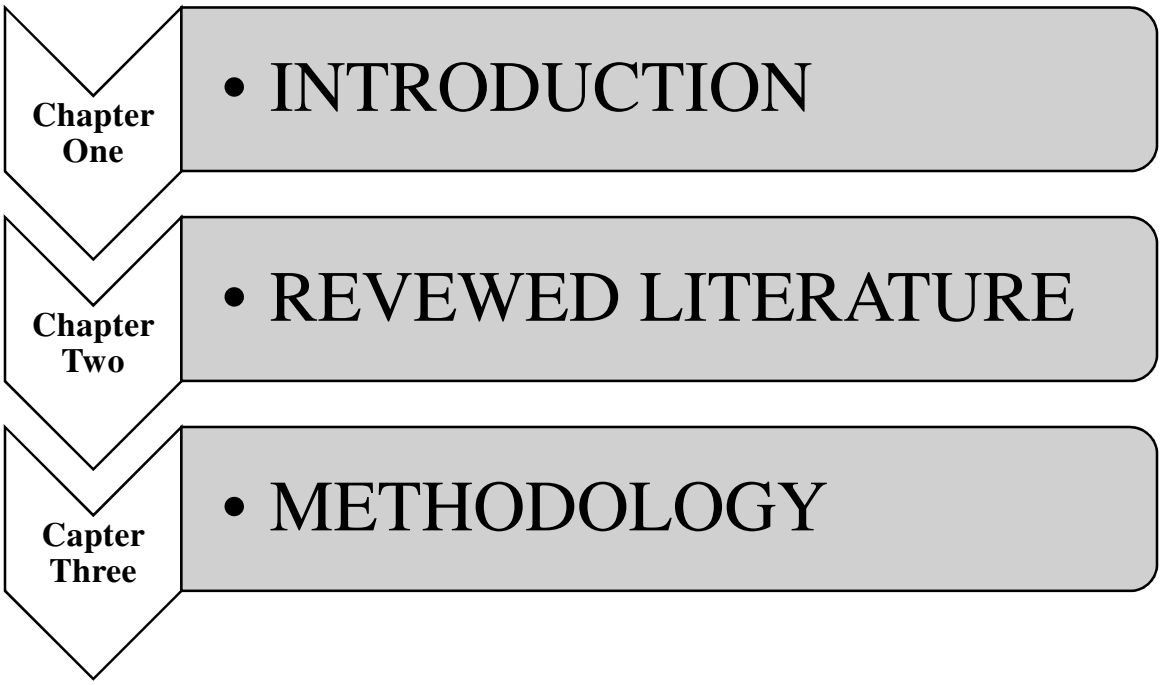
RESUME

Le but de cette étude été d'analyser la structure de la chaîne de valeur des produits laitiers, les déterminants et l'impact de la participation des petits exploitants dans la chaîne de valeur formel du lait. L'étude est basée sur des données qualitatives recueillies auprès de personnes-ressources clés et sur des données quantitatives obtenues à partir d'entretiens structurés avec 60 commerçants de produits laitiers et 333 ménages de petits exploitants sélectionnés de manière aléatoire. L'analyse de contenu a été utilisé pour analyser les données qualitatives, tandis que des statistiques descriptives et des régressions ont été utilisées pour l'analyse des données quantitatives. Les résultats montrent que la majorité (70%) des petits exploitants échantillonnés participe à une chaîne de valeur laitière informelle, alors que 30% participe à une chaîne de valeur formelle de lait liquide. La faible disponibilité et le coût élevé des aliments, la pénurie de l'offre en insémination artificielle, la faible productivité, le manque d'activités de vulgarisation et de services de soutien aux entreprises et des coûts de transaction élevés sont les principales contraintes pesant sur les chaînes de valeur des produits laitiers. Les résultats de l'analyse logit binaire à deux étapes montrent que la plus grande partie (65%) de l'échantillon de petits exploitants a participé à la vente de lait liquide. Sur l'ensemble des petits exploitants qui sont connectés au marché du lait, 86,1% participe à une chaîne de valeur laitière formel ; alors que 13,9% participe à une chaîne de valeur informel de lait liquide. Les résultats montrent également que les facteurs influençant les coûts de transaction, tels que la distance au centre de collecte de lait, à la ville la plus proche, et l'adhésion à une coopérative; les facteurs relatifs aux ressources tels que le coût des aliments pour les animaux, de nombre de vaches de race améliore des races de vache, la production journalière de lait et l'accès aux services vétérinaires influencent de manière significative les décisions de mise en marché du lait des petits exploitants et leur accès aux chaînes de valeur modernes du lait. Les résultats de l'analyse de « propensity score matching » montrent que la participation des petits exploitants agricoles à la chaîne de valeur formel du lait a un impact positif significatif, via l'amélioration du revenu, sur la sécurité alimentaire et, grâce à une meilleure consommation de calories et diversité alimentaire, sur la nutrition des ménages. D'autre part, l'étude conclut que l'accès à la chaîne de valeur formel du lait a un impact négatif significatif sur la consommation de lait des ménages. L'étude confirme également que les principales chaînes de valeur laitières sont traditionnelles et peu coordonnées.

Mots clés: Petits exploitants, accès, produits laitiers, chaîne de valeur, sécurité alimentaire, nutrition.

PART ONE

INTRODUCTION, LITERATURE REVIEW AND METHODOLOGY



CHAPTER ONE
GENERAL INTRODUCTION

1. General Introduction

1.1. Study Motivation

1.1.1. Global Context: Why Pro-poor agri-food value chain is important?

Poverty still remains a major challenge in rural livelihoods (Turner et al. 2013). 58 % of developing world populations are rural people and, out of these, over 70 % are poor (World bank, 2015). An estimated of 793 million people are chronically undernourished. More than three quarter of those living in extreme poverty are in rural area and nearly two thirds of the extremely poor earn a living from agriculture.

Worldwide, an estimated of 2.6 billion people livelihood is dependent on agriculture. Smallholder farmers dominate the sector and they account 85 % of total farms worldwide. They produce the largest amounts of global food production, around 60% of the arable land worldwide. Agriculture continues to provide a critical source of food and income for the majority of the rural poor (Poole et al. 2013). IFAD estimated that there are around 500 million smallholder farms in developing countries, supporting almost 2 billion people (FAO, 2009; World bank 2015). Studies show that growth generated by agriculture is up to four times more effective in reducing poverty than growth in other sectors (Haddad 2000). Smallholder agricultural, is however, subsistent production that is characterized as poor production and productivity and, limited access to inputs and markets (Barrett et. al. 2010).

Cognizant of this fact, it has been long since recognized that smallholder agriculture development as a key avenue to address poverty and food insecurity in SSA countries (Issues 2014). The transition of smallholder agriculture from subsistence to market-oriented production system is therefore one of an important smallholder agriculture development strategy in SSA (Tegegne et al. 2013; Poole et al. 2013; Gebremedhin et al. 2008).The transition to market-oriented production require engagement with global or national agri-food value chain industry that connects agricultural producers to final consumers via various incremental value adding steps, such as product aggregation, storage, processing, distribution, wholesaling and retailing (Holste 2015; Gebremedhin et. al. 2010; Jabba 2010).

Linking smallholder farmers to modern national/global agri-food value chain industry in SSA however is constrained by different factors relate to unfavorable institutions setup in terms of

high standard requirements (Jaffee et al. 2011; Swinnen 2014; Mungandi et al. 2012; Stringer et al. 2009; Gómez et. al. 2013;) , high transactions costs (Burke 2009; Leonardo et al. 2015; Holloway et al. 1999; Anon 2010; Staal et al. 2006; Poole et al. 2013), poor resources endowment of smallholder farmers (Ayalew 2015; Boughton et al. 2007; Leykun et. al. 2014; Tegegne et al. 2013; Staal et al. 2006) and poor rural infrastructures (Onoja et al. 2012; Boughton et al. 2007; Gebremedhin et.al. 2010; Torero 2011; Kiprono 2014). High standard requirements of end market in buyer-driven chain is the first factor that excluded smallholder farmers from high value global/national food chain market (Jaffee et al. 2011; Swinnen 2014). The retail global food markets on high value foods such as fruits, vegetables, meats and dairy requires high safety standards in terms of quality, production standards and safe deliver relates to health issue (Saenger et al. 2013; Gómez et.al. 2013; Kaganzi et al. 2009). The requirements are also dynamic and smallholder farmers couldn't meet the requirements and hence this institutional standards (Dominique et. al. 2002) leads to exclusion of the smallholder from supplying to the export market in high value global food chain (Álvarez-Coque et. al. 1994; Álvarez-Coque et. al. 2015). High transactions costs and poor infrastructure are also the other constraints of smallholder farmers' participations in high value global/national food chain market. In agri-food value chain, down streams buyers may expose to high transactions costs if they are directly buying products from smallholder farmers (Kherallah et al. 2015; Barrett et.al, 2010). Because smallholder farmers' supplies are constrained by high fragmentation and high fluctuations, as well as, low volume supply and; this in turn result in exposing the buyer to incur high searching, enforcing and monitoring costs. Poor rural infrastructures also expose both suppliers and buyers to high transactions and marketing costs. Because of these costs related factors, down streams buyers shift towards vertical integration or sourcing from larger suppliers, and hence in the exclusion of smallholders from the formal global/national food chain market (Boniphace et al. 2015; Omiti et al. 2009; Kiprono 2014). Capacity and assets constraints of smallholder farmers are also the other factors that excluded smallholder farmers from the food value chain. Because smallholder farmers are facing constraints that involve capital, land, technology as well as knowledge and skills that are important competency factors to meet the entry point of the value chain, and hence this leads exclusion of smallholder from the food value chain (Barrett et. al. 2010; Poole et al. 2013; Dayanandan 2011; Bahta et.al. 2007). Lastly, institutional business support services constraints such as poor finance and extensions services, constraining smallholder farmers' participation in the value chain (El-Sayed et al. 2015; Ade et al. 1998; Alwang et al. 2012; Berhanu et. al. 2014; Degu 2012; Boniphace et al. 2015).

On the other hand, there are also opportunities that provide enabling business environments to link smallholder farmer to the global/national high value food chain industry in SSA. The rising of middle class population and rapid urbanization in developing countries creates high demand opportunity for high value modern retail food market in these countries (Holste 2015; Gaull et. al 1993). As the result, it attracts investment in general and foreign direct investment in particular to invest on agro-processing industries and, because of this high demand growth potential, smallholder farmers involvement is happening in the modern food value chain. For instance, the dairy industry in east Africa particularly in Kenya are largely involving smallholder into the formal/modern dairy value chain (Chege *et al*. 2015). Moreover, high value global food chain are facing challenges of supply shortage and high prices in global food market due to factors relates to climate change effect, high population growth and rising of middle class. These constraints in the global food market will creates opportunities for smallholder farmers to supply their products to the export global food market and hence inclusion of smallholders to global agri-food value chain (Kaganzi et al. 2009; Holste 2015).

Given smallholder farmers could play in supplying foods to the world in the global food chain market and more importantly the role they could play in addressing poverty and food insecurity, linking smallholder to the global/national formal agri-food value chain has been becoming important development agenda in SSA in particular (Kherallah et al. 2015; Barrett et. al 2010; Torero 2011; Esenaliev et. al. 2013; Stifel et. al. 2015). This lead to the development of pro-poor Global Agri-Food Value Chain (GAFVC) approach. It is inclusive agri-food value chain approach that provides better understanding on how to link smallholder farmers to the global/national modern/formal food chain industry and how to promote inclusive global/ national food chain (Generic et. al. 2002; CARE 2008; UNIDO 2011; Manson et. al. 2014; Kaplinsky et. al. 2000; Nangole et al. 2011; Stamm 2004; World bank 2015; Mitchell et al. 2002). Development agents like IFAD, World Bank, USAID and FAO largely use this approach in their development innervation programs. The approach has four key elements of analysis that involves product selection, structure of the value chain, dynamics of the value chain and economic effects of participation in the value chain (UNIDO 2011; Haggblade et. al. 2012; Generic et. al. 2002; Mitchell et al. 2002; FAO 2014). The approach has multiple role in addressing poverty and food insecurity issues: First, role in improving food supply/availability at global, national, local and household level due to smallholder farmers' improvement in production efficiency /productivity. The improvement could be achieved through upgrading programs of pro-poor agri-food value chain, and hence it has a positive effect on food supply and food price at all level. This has a direct positive effect on food security and nutrition on society in general on smallholder farmer in

particular (Hawkes et. al. 2011; UNIDO 2011; Turner et al. 2013; Mitchell et al. 2002). Second, role in improving income of smallholder farmers household who are participating in the value chain either in supplying products or engaging in agricultural and agro-food processing labour market. And this in turn has positive effect on food security and nutrition of the participant households through improving the households food access capacity (UNIDO 2011; Hawkes et. al. 2011; Turner et al. 2013; Chege et al. 2015; Kherallah et al. 2015; Torero 2011); third, it provides employment opportunities both at household level due to labour intensive productions system character and at firm level due to expansion of agro-processing industries (UNIDO 2011); Fourth, role in improving innovation mainly through technology and input transfer at all level, particularly in upstream actors such as input suppliers and smallholder producers and, this in turn bring positive effect on sustainable food system (Dayanandan 2011; Generic et. al. 2002); Fifth, role in reducing gender disparity in rural areas through its inclusive approach in which upgrading strategies gives emphasis on rural women's economic empowerment (Bolwig et al. 2008; CARE 2008; Hawkes et. al. 2011). In short, pro-poor agri-food value chain approach is a promising avenue to get out of the poverty trap and food insecurity in most developing countries particularly in Sub-Saharan Africa countries like Ethiopia (Tefera et al. 2008; Tegegne et al. 2013; Dayanandan 2011).

1.1.2. National Context: Why pro-poor dairy value chain is important in Ethiopia?

Ethiopia with an estimated population of 90 million is the second populous country in Africa. More than 85% are rural population and the remaining is urban population (CSA, 2014). Ethiopia is an agrarian economy based country where the agricultural sector plays an important role in the national economy, livelihood and socio-cultural system of the country. The sector supports employment of over 80% of the population, accounts for 45-50% of the national Gross Domestic Product (GDP) (CSA, 2014).

The country is renowned for its highly dependent on agriculture. According to CSA 2014, 83.8% of the population of the country derives its livelihood from agriculture, which is entirely dependent on rain fed. Of the 4.3 million hectares of the potential of irrigable agriculture only 5% is currently utilized. Small peasants also dominate the sector. Smallholder farmers cultivate about 95% of the land. Indeed agriculture is the main source of income and employment but it has been highly constrained by various constraints and thus leaves the country to remain food insecure (Devereux 2000). To address the food security problems, the government designed different policies and interventions; among the others the one is that promotes commercialized

agriculture through market-oriented smallholder livestock production system. Empirical research also showed that in Sub-Saharan Africa in general in Ethiopia in particular, livestock sector has a huge potential in addressing poverty reduction and food insecurity (Berhanu et.al. 2014).

Ethiopia holds the largest livestock population in Africa estimated at about 35 million heads of cattle, 2 million camels, 22.5 million sheep, 17 million goats, 55 million chicken, 2.75 million horses, 5.2 million asses and 0.63 million of mules (CSA, 2014).

The livestock sector plays a vital economic role at both macro and micro level in Ethiopia. At micro or household level, livestock are an important source of food, particularity of high quality protein, minerals and vitamins. As a source of income, it is most important cash generating activity for purchase of food, agricultural inputs and other family needs. In the generation of employment, increased production implies higher employment in the production, processing and marketing sector. Livestock as supplier of inputs and services for crop production is worth mentioning where draught power, manure, fuel, and recycling of own secondary products (Degu 2012; Tegegne et al. 2013). In short, the sector has a significant direct and indirect positive effect on smallholder household food security and nutrition.

Similarly, the sector has been plying significant role to the macro economy of the country as source of foreign exchange and revenue. The sub sector contribution to the total and agricultural GDP accounts were 12% and 33% respectively and, accounts for 12–15% to the total export earnings (Degu 2012) .

Despite its huge resource and such significant contributions to the national economies of the country, the sector has received less than 3% of the recurrent agricultural expenditures in Ethiopia. As a result, the existing income generating capacity of livestock and livestock products as compared to its immense potentials in the country has not exploited. The primary reason among others seems to be the inefficient livestock production and value chain marketing characterized by low productivity, high margins and poor marketing facilities and services (Degu 2012; Megersa et al. 2013).

Dairy production is an important sub-sector of the livestock production systems in Ethiopia. Cattle, camel and goats are the main livestock species that supply milk, with cows contributing 81.2% of the total milk output. In the highlands where the subsistence smallholder farmers are predominant, crop and livestock production are an integral part of their livelihood. In the lowlands the nomadic pastorals subsist almost entirely on milk and livestock for food supply and

trade of livestock and livestock products to purchase food grains and other necessities (Ahmed et al. 2004; Tegegne et al. 2013).

Ethiopia dairy value chain industry is the least developed among Sub-Saharan African (SSA) countries and, it is excluded from the global dairy value chain industry. This is because production, processing and marketing are dominated by poor traditional systems as well it is loosely coordinated with a very few value addition activities. The Production system categorized as traditional smallholder production (dominant in the rural area) and modern production systems. The traditional production systems are the dominant that makes up the largest milk source of (98% of the total milk production) the national milk production. It includes subsistence smallholder farmer mixed crop-livestock production system, pastoralist and agro-pastoralist productions systems. The modern production system is the second production system that produced very small size (2 percent of the total milk production) of the national milk production. It includes both small and large scale commercial private urban and pre-urban production (Yilma et al. 2011a). Productivity in traditional system is very low (1.5 litter per cow per day production capacity) due to poor production system that use local zebu cattle and poor inputs and technology. Whereas productivity in modern production system is at least four times better than traditional system and, it use cross-breed cows, better inputs and technology. In terms of production orientation, the traditional system is subsistent production in which milk is primarily produced for household consumption purpose. The surplus is processed into traditional soured butter, ghee, cheese and sour milk and sold through informal market. Whereas, modern production system is market-oriented in which milk produced in large volume primary for market (Ahmed et al. 2004; Yilma et al. 2011).

Dairy processing system is also categorized as traditional and modern processing systems. The traditional processing is the dominant one that processed 95 percent of milk that producing in traditional production system. It is a small scale processing at farm household level and, it is labour intensive and manual system processing with poor capacity and high wastage. Traditional soured butter, ghee, cheese and sour milk are the dairy products that processed in the traditional system (Gebiremedhen et. al. 2014). On the other hand, modern processing system processed only 5 percent of milk that supplying from both formal and informal milk market channels. It includes both small and large scale modern processing industries and, producing dairy products such as pasteurized milk, cheese, flavored yoghurt, table butter and creams (Tegegne et al. 2013; Dayanandan 2011; Tefera et al. 2008; Seifu et. al 2014; Ahmed et al. 2004).

The dairy marketing is also characterized as largely informal and poorly coordinated. Milk and milk products are marketing through both formal and informal market channels. The informal marketing channel is the dominant market channel that characterized as traditional marketing system that involves sales direct from producers to final consumers or indirect sales through market intermediaries in rural area (Tegegne et al. 2013; Tefera et al. 2008). Because of their long shelf life capacity, traditional butter and cheese are dominant dairy products supplying in the traditional channel. Whereas because liquid milk is highly perishable and no access to cooling store or refrigerator in traditional channel, very small size of fresh milk (less than 3 %) is supplying in the traditional channel (Tegegne et al. 2013; Ahmed et al. 2004). Smallholder rural producers and intermediaries are major actors in the traditional/informal channel (Yilma et al. 2011). The formal market channel is the second dairy market channel that characterized as modern marketing system, which usually serves the urban/peri-urban clients, involves organized milk collection, processing and distribution (Yilma et al. 2011). Pasteurized milk is the dominant dairy products supplying in the formal channel and followed by supplying of dairy products such as cheese, flavored yoghurt, table butter and creams to consumers in the urban areas largely (Seifu et. al. 2014; Steen et. al. 2014). In Ethiopia, 95% of the national milk is marketed through informal channels after traditionally processed into traditional butter and traditional cheese. Only 5% of the milk produced is marketed as liquid milk due to underdevelopment of infrastructures in rural areas. The rural smallholder farmers provide the largest bulk of milk (98 % of the total liquid) both to the formal and informal marketing system. The rest 2 % liquid milk supplies from small and large scale commercial producer in pre-urban and urban areas. Hence, the informal market has remained dominant in Ethiopia (Tegegne et al. 2013; Dayanandan 2011; Ahmed et al. 2004). Collective action, through smallholder farmers' marketing cooperative, is dominant vertical integration mechanism of smallholder farmers in to modern dairy value chain (Francesconi 2009; Debele et. al. 2014). To some extent the government extension services and NGOs are providing some capacity building support to smallholder farmer. However, smallholder farmers are still marginalized in terms of participation and benefits in the formal dairy value chain.

Dairy consumption varies across seasons, ages and urbanization, livelihood system and, very small by African standard. During fasting seasons of Ethiopian orthodox religion (accounts 200 days per year), no dairy products and any animal products are consumed by the followers. As a result, demands of dairy products are significantly declining in most mixed farming system of highland areas and in most orthodox dominant areas (Tefera et al. 2008; Hoddinott et al. 2013;

Ahmed et al. 2004; Makoni et al. 2013). To overcome this constraint, smallholder farmer processed their milk into traditional butter to supply in the local market. The traditional soured butter with additional traditional processing (through boiling and adding some mixed spices), it have a longer shelf life that can stay more than six months. The traditional soured butter is therefore dominating the dairy value chain in Ethiopia, particularly the traditional value chain. It consume through adding in to traditional souse "*wott*" as a flavor ingredients by all ages groups except children less than two years old (Yilma et al. 2011; Gebirmedhen et.al. 2014). Similarly, except children less than two years, traditional cheese is also consumed by all age's groups as a side dish. Liquid milk consumption varies between rural and urban people in which milk largely consumed by children and women in rural areas, but in urban areas adults are also significantly consume liquid milk. Similarly, rural areas consume non pasteurized milk, whereas urban consumers largely consume pasteurized milk. Consumption of milk and milk products also varies between mixed farming livelihood and pastoral livelihood system in which dairy is a major source of food in pastoral system whereas it is additional source of food in a mixed farming system. Milk consumption in Ethiopia is very low. Ethiopia still remains the lowest both by world standard and African standard in terms of per capita milk consumption (19 liters per capita milk consumption) (Ahmed et. al. 2003;Tegegne et. al 2013; Yilima et. al. 20011; Seifu et. al. 2014).

Women play an important role in dairy activities dealing with production management, transformation and marketing. Identifying and supporting the roles, decision-making and capabilities of women as cattle owners, processors and users of dairy products are key aspects to promote women's economic and social empowerment and consequently a rural women's ability to break the cycle of poverty and food insecurity (Steen et. al. 2014). In short, the dairy value chain in Ethiopia is constrained by poor production and productivity; traditional marketing system; limited access of smallholder farmers to modern value chain due to factors related to high transaction costs and poor infrastructures and; poor business support services, traditional processing with poor value addition and shortage of large modern processing industries, quality problems and adulterations and; poorly coordinated. On the other hand, growing demand of dairy products due to urban population and middle income growths and; favorable agro climate zone and government policies and programs are the major favorable enabling business environment that provides opportunities for the dairy value chain development in the country.

To enhance the contribution of dairy subsector for rural development and food security in Ethiopia, there is a need to understand how to promote smallholder farmer participation and competency in dairy value chain industry. To this end, pro-poor dairy value chain analysis is

important in better understanding of constraints of smallholder framers' participation and benefits in formal dairy value chain. Hence, it helps to understand better the pro-poor dairy value chain development strategies for poverty reduction and rural development process of the country.

1.2. Statement of the problem

Linking smallholder farmers to modern dairy value chain industry to enhance the potential role that dairy sub sector could play in addressing poverty and food security issue is still the main development agenda of Ethiopia. This is because the dairy sub sector is dominated by traditional production system (98% of the total production system) in which milk produced by smallholders farmers are primarily meat for household consumption purpose. The surplus is processed into traditional soured butter, ghee, cheese and sour milk and sold through informal market (Yilma et al. 2011). The traditional system is characterized as a subsistence production system with: less access to household asset endowment and to public assets and; greater poverty and vulnerability (EADD, 2009). Within this livelihood context, smallholder farmers are facing challenges to transform in to market-oriented dairy production system to participate and benefit in the formal dairy value chain industry. Empirical studies shows factors related to household asset limitations, high transactions, poor infrastructures, poor and limited business development support services and, poor institutional arrangement are constraints of smallholder farmer participation in the formal dairy value chain (Tegegne et al. 2013; Tassew et. al. 2009; Ahmed et al. 2003; Geleti et al. 2014). These factors in turn affects the development of dairy value chain industry and its role in addressing issues such as poverty and food security (Ahmed et al. 2004; Yilma et al. 2011; Ahmed et al. 2003)

Pro-poor dairy value chain development is one of the promising avenues to improve food security and livelihood of rural households in Ethiopia (Ahmed et al. 2004; Tegegne et al. 2013; Ahmed et al. 2003). Because in Ethiopia, particularly, the highland mixed crop-livestock area, have huge untapped potentials for market-oriented smallholder dairy production development (Ahmed et al., 2004). Linking smallholder farmers to a formal dairy value chain could bring significant positive economic contribution particularly in rural areas through: improving production and productivity, improving the availability or the supply of dairy and dairy products which are rich in micro-nutrient and minerals, improving incomes through market participation with better returns, provides employment opportunity, improving food security and nutrition status of smallholder farmers through income effect and, enhancing the links between the input

and output sides of agricultural markets. In short, it is a key factor to get out of poverty trap and improve food security status for rural households.

Cognizant of these facts, the Ethiopia ministry of Agriculture has formulated a strategy to improve milk marketing and processing in the villages. The strategy is to develop an environment for smallholder dairy farmers, which enables farmers to immediately respond to the market demand. Moreover, the past and present national development strategies of the country, known as Plan for Accelerate and Sustainable Development for Eradication of Poverty (PASDEP) and Growth and Transformation plan (GTP) respectively, emphasizes on pro-poor, gender-responsive and sustainable commercialization of smallholder agriculture (Berhanu et. al. 2014). Development of high-value commodities, value chain development and export-oriented investments have been identified as major tools for achieving smallholder agricultural commercialization (World Bank 2015). The development of smallholder dairy value chain is thus consistent with the national agenda and aspirations.

Nevertheless, it has long been recognized that the potential role of dairy value chain development would play in poverty alleviation and rural development process of the country. However, the sub-sector is still dominated by subsistent-oriented production system. The traditional smallholder dairy system makes up the largest part (98 %) of the dairy production system (Yilma et al. 2011).

There are a few empirical studies on smallholder farmers' participations in dairy market in Ethiopia so far. These studies however are limited to market participation determinants analysis. Mitigating the market access problem of poor smallholder dairy farmers to reach markets, and promoting pro-poor dairy value chain development strategy, is therefore one of the most pressing rural development challenges of Ethiopia. The research questions such as how to expand smallholder farmers' participation in dairy value chain and how to link the smallholders to the formal dairy value chain and, how to promote the competency and benefits of smallholder farmer in dairy value chain have been and still, are critical issues that need to address in pro-poor dairy value chain development process.

Empirical evidence shows pro-poor Global Agri-food Value Chain (GAFVC) approach provides a framework for better understanding on how to link the smallholders to modern/formal global value chain and then enhancing the role of the agri-food value chain in addressing poverty and food insecurity (Mitchell et al. 2002; UNIDO 2011; Generic et. al 2002). Because the approach of using smallholder farmer as an entry point/focal point, gives better understanding to develop

upgrading strategies for dairy value chain development in general and smallholder farmer participation and benefits in the value chain, in particular. Through mainstreaming smallholder farmer, the approach is important to understand the structure and dynamics of the dairy value chain. The approach also provides a framework to analyze economic effects of participation in the value chain. The structure and dynamic of dairy value chain analysis help us to understand the constraints of smallholder farmers' participation and benefits in a formal dairy value chain. Consequently, the approach also helps us to develop upgrading strategies to promote dairy value chain development in general and smallholder participation and benefits in particular (Mitchell et al. 2002; Generic et. al. 2002; CARE 2008; Kherallah et al. 2015).

However, there is a dearth of information on how the dairy value chain structured; how smallholder's functions in this dairy value chain and; what are the factors that influencing smallholder farmers dairy marketing behaviors particularly participation and benefits in a formal dairy value chain. There is empirical research gap also on the economic effects of smallholder participation in dairy value chain. Most of the previous empirical studies predominately limited to smallholder dairy production and market participation issues (Tegegne et al. 2013; Kuma 2012; Ahmed et al. 2003).

To address constraints of smallholder farmers to participate and benefits in a formal dairy value chain, it is thus important to understand structure and dynamics of dairy value chain. Under such cases, unless understood how the value chain structured that provides information on constraints then up-grading strategies at each level of the chain; as well as analysis of what determines smallholders' dairy marketing behaviors in the chain are considered, analyses on promotion of smallholder dairy production and marketing alone may lead to erroneous conclusions and derived policy implications.

Furthermore, much less is known on impact pathways linkage between smallholder farmer access to a formal dairy value chain and poverty and food security in Ethiopia (Hoddinott et.al. 2013). The direct nutrition impact pathway of the smallholders' participation in the dairy value chain is still not very well understood through empirical studies. Direct nutrition impacts might be positive, because the smallholder participation in dairy value chain contributes to high productivity/availability and then consumption of dairy products. But the impacts might also be negative, as smallholder participating in dairy value chain could potentially reduce household dairy products consumption due to high cash demand for other household expenditure purpose. This is particularly true when the households are exposed to crisis or harvest failure. There is

one study that shows a negative relationship between market access and milk consumption in Ethiopia (Hoddinott et al. 2015). But the study was an intra-household level analysis that focus on the nutritional impact of cow ownership on children in the rural community of four major regions of Ethiopia. The study found out that cow ownership has a significantly positive effect on reducing stunting levels through milk consumption among children aged 6 to 24 months. The study also found that milk consumption among children is lower in the village with market access than non-market access. There is little empirical studies also on indirect food security and nutrition impact pathways of smallholder farmers' participation to modern dairy value chain. Thus there are limited empirical studies in Ethiopia so far that have analyzed the impact pathways linkage of smallholder farmers' access to formal dairy value chain and food and nutritional security. This is particularly true in the two selected study areas whereby smallholder participation in dairy value chain and its contribution for producer household food security are not well known. Given such backdrops, this study thus analyzed the dairy value chain structure and determinants of smallholders' milk market participation behaviors in dairy value chain. It also assessed the food and nutritional security effects of smallholder's participation in a formal milk value chain at the two purposefully selected districts (Bahir-Dar Zuriya and Kimbibit) of mixed crop-livestock production system of Ethiopian highlands.

1.3. Research Questions

The central research questions of this study were:

1. How the dairy value chain is structured in the two districts, Bahir-Dar Zuria and Kimbibit? What are the constraints of dairy value chain development in the two districts?

2. What factors affect smallholder farmers' milk sales decision? What factors influence smallholders' access to a formal milk value chain?

3. What is the food and nutritional security impact pathways linkages of smallholders' participation in a formal milk value chain?

1.4. Objectives of the study

The study was seeking to analyze the linkages between smallholder farmers' access to a formal dairy value chain and household food and nutrition security in highland of mixed farming system of rural Ethiopia. It aimed at a better understanding of the structure of dairy value chain, the

determinants of milk sales decision and a formal milk value chain participation choice of smallholders. The research also examines how participation affects farm household food and nutritional security improvement.

The key objectives of the study were to:

1. Examine the structure of dairy value chain;

2. Analyze the determinants of milk sales decision and formal milk value chain choice of smallholder households

3. Analyze the food and nutritional security effects of smallholders' participation in the formal milk value chain

1.5. Scope and limitations of the study

The study focused on analysis of dairy value chain structure, smallholder farmers' access to formal milk value chain and, food and nutritional security effects of smallholder participation in a formal milk value chain. Owing to resources limitation, the dynamics of dairy value chain analysis has not covered the whole levels of the chain rather it focused on the upper stream chain particularly the dynamics of smallholder farmers' milk market participation behaviors. Moreover, due to imputed nature of most of the marketing costs of dairy traders, profit margin analysis of actors along the chain was considered gross profit analysis and excluded net profit analysis.

Two districts, Bahir-Dar Zuria and Kembibit from Ahmara and Oromia regional state of Ethiopia, respectively were selected as learning sites area of the study. From the total of 29 and 22 *kebelles,* for formal survey this study narrowed its scope to only 3 and 4 sampled rural kebelles in Kimbibit and Bahir-Dar Zuria districts, respectively. These sampled rural *kebelles* were selected due to their rich potential for the dairy value chain development. These *kebelles* were thus believed to offer a fair view of understanding on the two districts milk value chain structure and, smallholder farmers' access to formal milk value chain and its effects on smallholder household food and nutrition security improvement.

Finally, the study's emphasis was also limited in a time by the fact that it was mainly based at cross-sectional survey data, except some questions in the survey which required the respondents to recall the changes in certain variables over a specified period of time.

1.6. Definition of Important Terms

A formal milk value chain channel refers, in this study, to a formal and contractual milk marketing system whereby smallholders market their raw milk product collectively through a framers' group milk marketing cooperative to modern milk processors and then the processors further processed the raw milk in to pasteurized milk and to other dairy products and finally the processors market it through retailers to urban consumers.

An informal milk value chain refers to a spot milk marketing system whereby smallholders market their raw milk product either directly to neighboring rural consumers or indirectly, and inconsistently, through local collectors to urban consumers without any further value added.

1.7. Organization of the Dissertation

The dissertation has been structured in two main parts, part one and part two. Part one has been organized in to three chapters that includes introduction, literature review and methodology. This first chapter is general introduction that gives an overview of the study focusing on motivation of the study, statement of the problem, the research questions, and objectives of the study, scope and limitation of the study. Chapter two present the reviewed literatures focus on concepts, theories, and empirical studies in which the analytical framework of this study has built upon. This literature review section first gives highlights on GVC and pro-poor GAFVC approaches, conceptualization of factors that affects smallholders' participation and benefits in agri-food value chain, collective action as pathways to link smallholder to the formal value chain, food security measurements and food and nutrition security impact pathways of smallholder' participation in a formal high value food value chain in case of Ethiopia. Then, it presents empirical studies that focus on smallholder and agricultural value chain as well as an overview of the dairy sub-sector in Ethiopia. Finally, it discusses on the analytical framework of the study and pointed out hypothesis of the study. Chapter 3 introduces background information about the study area and verifies philosophical stand in mixed methods

research design applications to the study and, the methods of data collection and data analyses used to this study.

Part two has been organized in to four chapters including chapter 4, 5, 6 and 7. Chapter 4 focuses on the structure of dairy value chain analysis. It discusses how input-output structure of the dairy value chain structured; the role of cooperatives and business support environment in promoting smallholders' participation and benefits in a formal milk value chain; profit margin distributions along the dairy value chain actors, smallholders' position in profit margin distribution share and, identify the difference of smallholders' profit margin share between formal and informal milk value chain and; constraints of pro-poor dairy value chain development.

Chapter 5 discusses on determinants of smallholders' market participation behaviors in milk value chain. It explain key determinists that relates to smallholders' household specific factors such as age, sex, education and smallholder resource endowments factors such as cross breed cows size and investment for concentrate feeds ; high transaction cost factors such as distance to milk collection centers, asphalt roads and nearest town and milk cooperative membership; and access to institutional business support services such as credit, veterinary and agricultural extension determined smallholders' participation in milk output market and access to a formal milk value chain.

Chapter 6, discusses the two Food and Nutrition Security (FNS) impact pathways of smallholders' participation in a formal milk value chain. The first impact pathway is milk production volume and productivity to milk consumption effect that explain how getting access to a formal milk value chain affect smallholders' milk production volume and productivity and, how this in turn affect milk availability and consumption at farm household level. The second impact pathway is milk income to food purchasing power effect that explain how getting access to a formal milk value chain affect smallholders' household income and, how this milk income in turn affect their access to sufficient food and diversified diet.

Chapter 7, focuses on summary of the study, general conclusions and recommendation, suggestion for further research and final remark of the study.

CHAPTER TWO
LITERATURE REVIEW

2. Introduction

This section is a review of Global Value Chain (GVC) and pro-poor Global Agri-food Value chain(GAFVC) theories, constraints of smallholder participation in High Value Agri-food Value Chain(HVAFVC) and Food and Nutritional Security (FNS) impact pathways of smallholder participation and Ethiopian dairy sub sector upon which the theoretical and analytical frameworks of this study has built on. First, it presented a brief overview of historical development of the GVC approach and; followed by the discussion on the key analytical concepts that make up Global value chain (GVC) framework. Next it discussed on the pro-poor GAFVC development framework and; conceptual review on constraints of smallholder participation and benefits in agri-food value chain. Then, it presented literatures on the empirical evidence of smallholder farmers and agricultural value chain; conceptual impact pathways linkages of smallholder participation in high value formal agri-food value chain and food and nutritional security and; a brief review of Ethiopian dairy sector. Finally it presented the analytical framework of the study that explained operationalization and application of the concepts discussed under the theoretical framework section.

2.1. Global Value Chain Approach (GVC)

2.1.1. An Overview of Historical Development of GVC Approach

The concept global value chain is derived mainly directly and indirectly from the three analytical approaches namely the French filière, value chain and global commodity value chain. These three approaches developed at various time that have been applied in some different context related to product/commodity production-distribution system (Liu 2013; Raikes et al. 1999; Bair 2005; Gereffi et al. 2001).

The French filière approach is the first indirect driver for global value chain theory development. In 1960s, the two French agricultural research institutes (INRA and CIRAD) developed the filière approach to analyze the controlling system of agricultural products production process from production to consumption in developing countries setup. It is mainly based on a quantitative analysis that focused on the understanding of vertical integration process that how flows of physical inputs and services from production to consumption goes effectively. However it has viewed as the approach has limitation on explaining the dynamic of value chain analysis where

how actors' relationship and networking affect the structure and how structure affect actors' function and performance (Raikes et al. 1999; Montaigne et. al. 2012).

Porter's value chain is the second indirect driver that contributed to develop global value chain approach. In the mid-1980s, Porter introduced the term value chain for the first time. He developed the value chain approach to identify competitive advantage of the firm by disaggregating and quantifying core activities within the firm (Raikes et al. 1999; Gereffi et. al. 2016). In this approach, he utilized a 'value system' in which it can identify the added value of each step in the production process of the firm (from production to distribution). Here a value system include all activities in the production process of the firm. He categorized all activities or 'value system' of the firm in to two as primary and supportive activities. Primary activities are a sequential activities, which directly contribute to add value in the production process of the firm. Whereas supportive activities indirectly contribute to add value in the production process of the firm (Plahe 2005). The primary activities includes inbound logistics, operations, outbound logistics, marketing, and sales. On the other hand. Supportive activities includes (strategic planning, human resource management, technology development, and procurement. Porter's value chain approach however, limited to intra-organizational analysis of production process at firm level only. It ignored production, processing and distribution process linkage analysis at intra-organizational level. It is therefore absence of both up and down streams activities in the value chain analysis is the major limitation of porter's value chain approach (Bair 2005; Gereffi et al. 2001).

Gereffi's global commodity chain (GCC) approach is the third driver and a direct theoretical foundation for global value chain concept development. In the 1990s, Gereffi developed the global commodity chain concept that was built upon the world system theory (Raikes et al. 1999). The global commodity chain analysis is a multi-sectorial approach aimed to analyze the inter-linkages among all actors, networks and all value adding activities by all parties in the commodity chain industry. Gereffi categorized the GCC as producer-driven and buyer-driven GCCs. Producer-driven chain refers to a GCC in which the manufacturer/supplier play a leading role in determining the governance structures and distribution pattern of the product in the commodity chain industry. Most high capital and techno intensives industries like automobile and aircraft are producer-driven chain. On the other hand, buyer-driven chain refers to those global commodity chain in which the end market such as large retailers (like Wal-Mart), marketer and branded manufactures (like Nike) determines the governance structure of the

commodity chain industry. Buyer-driven GCC are mostly high labor intensive industries who produce consumer products like cloths, shoe, toy and etc. (Plahe 2005; Gereffi et al. 2001).

The GCC, however, has limitation on operationalization of key term definition for empirical studies application. The global commodity chain is mostly defined as 'a network and relationship of labor and production processes from primary commodity to the final output delivery. There is ambiguity on defining the term commodity which in turn creates problem in defining the length of each segment of a commodity chain industry. Because the term commodity can be both as a primary product as inputs (example agricultural staples like oil seeds for feeding commodity industry, or as a consumer product (example T-shirt as a commodity garment). Rigid chain calcification criteria is the other limitation of GCC approach. The GCC approaches has limitation on operationalizing between producer-driven and buyer driven key terms for empirical studies application (Bair 2005; Kaplinsky et. al. 2000; Montaigne et. al. 2012). This is particularly true in agricultural commodity chain where some commodities are neither producer-driven nor buyer-driven if we stick to this classification. As a result scholars suggested there is need of expanding the typology of GCC. Little application of quantitative analysis is also the other drawbacks of the GCC approach. The approach largely focused on the qualitative description of power relation and institutional mechanisms in the commodity chain industry. But, less attention has been given to analyze the quantification of economic distribution in the chain through detail profit margin analysis. The last but not the least limitation of GCC concepts related to institutional context like regulation and institutional factors have not been factored into theory (Liu 2013).

In short, the three approaches such as the French filière, Porter's value chain and GCC are the theoretical foundation that directly and indirectly contributed to develop the global value chain approach. The French filière developed for agricultural commodities whereas the value chain and GCC were developed for industrial commodities. Porter's value chain has strategic management perspective that limited on firm level competitive advantage identification. Whereas both the French filière and GCC have development perspective in which multiple-firms business relationship is the central issue.

2.1.2. A Brief overview of GVC Approach

The concept GVC development traced back to the development of filière approach in 1970s. However, it is an extension of Gereffi's GCC approach. In early 2000s the concept of GVC was

introduced by a group of researchers who have tracked the global spreads of industries and their implications (Gereffi et al. 2001). The GVC approach provides both conceptual and methodological tools for better understanding of how the global industries are organized. Although the term GVC is defined differently by different scholars, we used the following most commonly use definition of Kaplinsky and his colleague, a value chain is "the full range of activities which are 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), delivery to final consumers, and final disposal after use" (Kaplinsky et. al. 2000). It involves a sequential activities such as material and product design, production, processing distribution and marketing including final delivery and final disposal after use. It also involves intra and inter firms' interactions and reactions in these activities.

The approach analyzes the structure and dynamics of the global industry (Gereffi & Fernandez-stark 2016; Kaplinsky et. al. 2000). The structural analysis examines activities, added values, actors, information flows, business support and enabling environments, and resource allocation from the inception of a product/service to the final delivery and final disposal of after use stages of the value chain industry. It also involves the examination of economic gain or profit distributions along the value chain actors and, identification of the vertical and horizontal structure of the value chain (Kaplinsky et. al. 2000; Gereffi et. al. 2016). The dynamics analysis largely focus on the governance of the value chain, which involves coordination mechanisms, intra and inter firms' power relations and entry barrier. The analysis also involves performance evaluation and identification of upgrading strategies. The performance of GVC analysis mainly focuses on actors' competitiveness and its driver in the value chain industry and, economic performance of the value chain. The economic performance analysis commonly practice for development driven GVC analysis of developing countries. The analysis focus on the welfare effect of participation in the GVC that measures in terms of effects on income distribution. It is, therefore, the new paradigm of GVC analysis goes beyond global industries and trade and, it also involves the global social and economic environments (Kaplinsky et. al. 2000; Gereffi et al. 2001).

2.1.3. Domains of GVC Conceptual framework

Global value chain approach is a framework for understanding how products/services transform from inception to final output; how the product/service then moves physically from the producer to the customer; how value increases along the way and; how economic gain distributions along

the chain is. It is also meant for understanding how intra and inter firm linkages interact and react; how these power relation and interaction determine rules of participation in a GVC industry. Two frameworks developed by Kapimisk et. al. (2000) and, Gereffi (2016) are the basic foundation of GVC analysis that goes beyond industry and profit level analysis. Rather it has a development perspectives in which it also includes an analysis of social and economic development at national and international level. Elements of value chain analysis, governance, upgrading and methodological approaches are the four key domains GVC analysis that are discuss in detail below as follows.

1. Elements of GVC analysis

kaplimisk et. al. (2000) identified three key elements of GVC analysis which involves entry barriers and economic gain, governance and type of value chain.

I. Entry barrier and Economic gain: It is the first key elements of GVC analysis that helps to understand structure of the value chain. It specifically helps to understand the distribution of returns or economic gain arising from the various functions of the chain involves product design, production, processing, distribution and marketing. The returns or economic gain results from participation in the value chain industry depends on the competitive performance of the firm or actor in the value chain industry. Entry barriers refers to factors that determine the economic gain distributions along the chain. The entry barriers categories as endogens and exogenous factors. The endogenous factors of entry barrier refers to ownership of scare attributes that helps actors to maintain the competitive advantage in a GVC industry. It usually relates to entrepreneur's innovativeness of the firm that gives best competitive advantages in the chain industry. The attributes that gives better competitive advantage than competitors involves having better: technology, skilled manpower, organization, marketing capacity and inter-firm relationship than competitors in the chain industry. Exogenous factors of entry barrier refers to factors external to the value chain actors that can influence the economic gain distribution. It involves factors relates to having better access to business support and business enabling environments than competitors in the chain industry. Having better access to business support environment involves gain better financial, technical support and etc. services than competitors. On the other hand, better access to business enabling environment involves having better access to: physical resources, hard and soft infrastructures and; operating in a better policy environment like favorable trade policy, than competitors. Entry barriers not only determine the

economic gain distribution the chain industry, but also they determine the participation status of actors in the value chain (Kaplinsky et. al. 2000).

II. Governance: It is the second key element of GVC analysis that helps to understand dynamics of the value chain. It focuses on intra and inter actors' power relations and interaction along the value chain. Kaplinsky and Morris (2000) identified three forms of value chain governance namely legislative, judicial and executive (see the detail under next subtopic discussion).

III. Differentiate type of value chain industry: It is the third key elements of GVC analysis that help to understand the dynamics of the value chain. Differentiating between producer-driven and buyer-driven types of value chain is important in framing the research question of GVC analysis. Because type of value chain influence the governance structure and power relations along the value chain industry (Kaplinsky et. al. 2000).

On the other hand, Gereffi identified four dimensions of GVC analysis including input-output structure, territorial, governance and institution (Gereffi et al. 2001; Gereffi et. al. 2016). (1).Input-output structure analysis- a descriptive structural analysis of production process of a specific commodity from its conception to the final output in the commodity chain industry, (2) territorial (geographical) structure analysis focus on geographical configuration of specific chains, (3) institutional context analysis- describes how policies at different level , norms and condition at each stage of the chain influence in shaping the commodity chain, and (4) governance structure analysis- describes how the coordination mechanism and inter-firm relationships are determined. Gerefii with his collogues identified five type of governance in GVC involves market, modular, relational, captive and hierarchical (Gereffi et. al. 2016) (see the next sub topic for detail).

2. Governance

Governance is a key concept of GVC analysis that help to understand the dynamic of the value chain. It is defined as an intra and inter firms' power relationship that determine entry barrier, coordination mechanisms and economic gain distributions of the GVC industry (Gereffi et. al. 2016).

Based on civil society government structure, Kaplinsky and Morris (2000) identified three forms of value chain governance involves legislative, judicial and executive. The first is *legislative governance*: refers to 'rule making' through setting standards that determine rule of participation in GVC industry. It involves both internal and international standards. Internal standards are

specific standards relates to the price, quality and reliable delivery of the product/service. International standards are standards such as international environmental standards (ISO 14000), quality standard (ISO 9000), and labour standards (SA8000) and, more specific to food processing standards (photo sanitary). The second is *judicial governance* which refers to controlling and auditing actors' performance in meeting the rules of participation in GVC. It involves internal and international control. Internal control refers to monitoring the performance of suppliers in meeting the internal standards. International control is auditing actors' performance in meeting the international standards through monitoring conformance to ISOs and SA 8000 standards. It is also control through auditing industry specific standards. The third is '*executive governance'* which refers to executing activities to help actors to meet the standards through internal and external proactive governance strategies. The internal strategy can be either directly by providing supports to supplier to achieve standards or indirectly by forcing a first-tier supplier to assist a second tier supplier. The external strategies can be providing business support services and creating business enabling environment that helps to meets the standards. The *executive governance'* strategies are key determinants in both participation and competency of actors in a GVC industry. Collaborative based strategies that provides support to meet standards are important in promoting participation and competency in the value chain. In short, these three type of GVC governance issues determine the inclusion and exclusion of actors or parties in the value chain industry.

Gereffi and others build on to their earlier works and identify five basic types of value chain governance, namely (Plahe 2005):

I. Markets- here price is a means of coordination mechanism and, the cost of switching to new partners is low for both parties involved in the transactions.

II. Modular value chain- this involves suppliers in the chain making products based on customer specification, which may be more or less detailed. In the case of turn-key services, the supplier takes full responsibility of competencies surrounding technology, use generic machinery that limits transaction costs and materials on behalf of customers.

III. Relational value chain- here, there exists complex relationships between buyers and sellers which creates mutual dependence.

Iv. Captive value chains- here small suppliers are dependent on much larger buyers. The suppliers face high switching costs and are therefore 'captive'. Such networks are characterized by a high degree of monitoring by lead firms.

V. Hierarchy- this is characterized by full vertical integration with managerial control as the dominant form of governance

The conditions under which the above forms of governance apply are dependent on three factors identified by Gerefi and his collogue (Plahe 2005). First, the complexity of the information and knowledge transfer required to sustain each transaction (product and process specification); second, the extent to which information and knowledge can be codified and therefore transmitted efficiently without transaction specific investments between the parties to the transaction and the third, the capabilities of actual potential suppliers in relation to the requirements of the transaction.

3. Upgrading

Upgrading is another concept of GVC analysis and, it was first introduced by Gereffi. It is a classic approach used to identify the possibilities for producers to move up the value chain hierarchy. Value chain actors 'are said to upgrade when they acquire new capabilities by making products that have more value added or improve the existing ones' (Plahe 2005). Various scholars have identified the following four upgrading trajectories or opportunities (Gereffi et. al. 2016; Plahe 2005; Kaplinsky et. al. 2000):

a) Process upgrading- increasing the efficiency of internal processes to the extent that they are better than those of rival firms.

b) Product upgrading- this involves introducing new products or improving old products with complex content

c) Functional upgrading- this involves increasing value added by changing the combination of activities within the firm

d) Inter-chain/ chain/ inter-sectorial upgrading- this involves moving to a new values chain/sector based on the competencies gained in another chain/sector.

Upgrading in the GVC analysis therefore provides a framework to identify strategies for the industry development. In short, GVC analysis is designed to develop upgrading strategies of the

chain industry through: analyzing the nature and determinants of competitiveness; and identifying which activities are subject to increasing returns, and which are subject to declining returns.

4. Methodological approach of GVC analysis

GVC analysis is a complex process that deals with understand geographically dispersed multiple firms and functions of business linkages in which each firm and function has its own particular character and work environment. To this end GVC analysis require a systemic research methods that can apply multi-disciplinary approaches. Given multi-disciplinary requirement to understand the complex business linkages, (Kaplinsky et. al. 2000) developed a methodology guideline for GVC analysis. The guideline outlined the following seven issues to use in GVC analysis research. These issues are as follows:

I. The point of entry for value chain analysis: It is an identification of which chain/chains is/are subject of inquiry that depends on the research objectives for GVC analysis. (Kaplinsky et. al., 2000) identified ten possible points of entry that including: the global distribution of income, retailers, independent buyers, key producers, sub-suppliers, commodity producers, agricultural producers, small farms and firms, informal economy producers and traders, women, children and other marginalized and exploited groups;

II .Mapping value chains: It is a descriptions of inputs-outputs business relations through systematic mapping of actors, functions, value added, information flows, product volume and flows, gross and net outputs, and sales destinations;

III. Product segments and critical success factors' in final markets: It focuses on the understanding of how each product segment critical market success factor's matched with the end market requirement. It can be done through mapping analysis of market size and market growth. The reason that this analysis based on end market because of the assumption that contemporary production system tend to be more of buyer-driven than producer-driven. As a result, critical market success factor's most of the time refers to price, quality and reliable delivery requirements of the end market. Generally, the critical success factors are grouped into two as factors that makes producers to qualify for participation in the GVC and, factors that make to succeed to win competition in the market.

IV. How producers access final markets: It is analysis of a point of entry for producer to participate in GVC and; how intermediaries affect term of entry in to GVC and the capacity of producer to upgrade. The analysis can involves key buyer identification, analysis of dynamics of buyer functions, identification of the critical success factors of each buyer, identification of possible winner for sources of supply, analysis of supply chain management policies and then analysis of supply chain upgrading policies;

V. Benchmarking production efficiency: It is the analysis of productive efficiency of actors/firms along the value chain. It is strongly related to/ and defined by the critical success factor. The efficiency determined by factors in relation to quality, cost of competitiveness, proactive response to customer's satisfaction, capacity to upgrade and innovation capacity (Kaplinsky et. al. 2000).

VI. Governance of value chains: It is the analysis of power relations between firms and within firms in multiple-firm business relations process of global value chain. It manly focus on process of how rules of participation are set, control and execute in the value chain, and then how these process influence in shaping governance structure of the chain. It also analyze the governance structure that defined lead firms and how lead firms influence rule of the game, resource allocation, benefit distributions and relationship in the chain.

VII. Distributional issues and upgrading strategies: It is the analysis use to understand how to develop upgrading strategies of the value chain. To this end, there is a need to conduct assessments of positive and negative factors for product and process improvement, introduce new functions of the product and introduce new product. Moreover, it also includes identification of economic gain distribution and entry barriers along the value chain and; then to develop a win-win competitive upgrading strategies.

2.2. Pro-poor Global Agri-Food Value Chain (GAFVC) Approach

2.2.1. Introduction

GVC approach has development perspective that goes beyond profit and industry level analysis and, it also includes social and economic development analysis at national and international level. GVC approach to development is an approach that applies the concept of value chains and value-chain analysis to creating new and different forms of value chains to enhance development (Kaplinsky et. al. 2000). Poor smallholder farmers have become an important

entry-point in GAFVC. As a result, currently there is increasing interest from international research institutes, international development organizations and academic institutions to work on pro-poor GAFVC approach (Mitchell et al. 2002; UNIDO 2011). This section reviews different understandings and applications of GVC approach for pro-poor agricultural value chain development. To this end, this section is organized as follows: elements of pro-poor GAFVC analysis, constraints of smallholder farmers' participation in GAFVC, the linkage of agri-food value chain and food security and nutrition and, empirical evidence of smallholder farmer participation in agri-food value chain.

2.2.2. Elements of Pro-Poor GAFVC Analysis

The aim of pro-poor GAFVC analysis is to identify leverage points along a chain for improving poor producers or smallholder farmers' participation and benefits in the value chain. Leverage points can indicate intervention potential for pro-poor global agri-food value chain development option. Pro-poor GAFVC development is herein defined as a positive or desirable change through inclusive value chain participation of smallholder farmers that enhances economic growth, reduces poverty, and bring sustainable development particularly sustainable rural development (UNIDO 2011; Mitchell et al. 2002; Generic et. al. 2002).

Inclusive value chains seem to be the keyword in recent agricultural development debates, often in conjunction with rural economic development and agribusiness promotion (World bank 2015). The term inclusive value chain here refers to a system that promote poor producers or smallholder farmers' participation and competency in the value chain through involving smallholder farmers, local associations and cooperatives, private traders, processors, service providers, government and various development agents. In the application of pro-poor agri-food value chain approach, scholars and development agents (2001) pointed out that there is a need to conduct four key analyses such as product selection, structure, dynamics and economic effect of the GVC (UNIDO 2011; Mitchell et al. 2002; Generic et. al. 2002; CARE 2008).

1. Value chain product selection analysis: The first step in Pro-poor GAFVC research is conducting product selection analysis. It is a participatory product selection process that is based on the scope and the objectives of the research, inclusiveness of product in both –in linking or it's potential to link smallholder farmer to the value chain and; product importance in rural livelihood and development (UNIDO 2011; Mitchell et al. 2002).

2. Analysis of value chain structure: It is the second step analysis that describe structure of the value chain through both qualitative and quantitative analysis. It includes mapping, economic gain distribution and upgrading analyses. First, value chain mapping analysis that involves mapping of vertical linkage that describe actors and functions from primary production to end product; horizontal linkages that describe actors linkages within the same functions and; mapping of profit and cost structures, flows of products and information throughout the chain, volume of the product and the value added at each stage of the value chain, relationship between actors, business support services and business enabling environment, geographic flow of product and volumes of product for domestic and export market (Kaplinsky et. al. 2000; Gereffi et. al. 2016; UNIDO 2011; Mitchell et al. 2002). Second, analysis of benefit distribution of actors' particularly poor producers benefits in the chain through the analysis of margins and profits within the chain, to determine who benefits from participation in the chain and which actors could benefit from increased support or organization. Third, Upgrading assessment through identifying constraints and opportunities for value chain upgrading. Upgrading means acquiring the technological, institutional and market capabilities that allow actors particularly poor producers to improve their competitiveness and move into higher-value activities (UNIDO 2011; Mitchell et al. 2002; Generic et. al. 2002). Approaches that are particularly relevant for improving the participation and economic gain of poor producers include (Humphrey et. al., 2002): (i) process upgrading (to organize productive activities more efficiently within individual links in the chain and between links in the chain); (ii) product upgrading (to achieve higher prices through improved quality or quantity, value addition, standards, or certification); (iii) functional upgrading (to acquire new functions and, hence, higher margins, which were previously functions of forward chain actors); (iv) integration through vertical or horizontal integration1, contracts between actors in the value chain, or linkages (to bring stability, transparency, and efficiency to the long rural to urban value chain linkages of local products and services); (v) market upgrading (to identify new or untapped consumers, as well as to improve access to already existing markets). In short, upgrading is the process of trading up, which allows poor people to access viable value chains or improve their position in existing value chains (Holste 2015).

3. Dynamics of value chain analysis: Is the third key element of the value chain analysis that mainly focuses on analysis of governance structures in the value chain to understand the relationships and coordination mechanisms that exist between actors in the chain and how these may need to be restructured to improve the chain (Kaplinsky et. al 2000). Analysis of

governance structure includes factors among others entry barriers, power asymmetry, rule-making, sanctions, and degree of trust and dependence between the different parties. In agri-food GVC, leads firms are key player in shaping governance structure of the value chain.

Based on (Gereffi et. al 2016; Plahe 2005) governance classification, five forms of governance structure or coordination mechanisms that can happen in agri-food value chain of developing countries are: market, modular, relational, captive or hierarchical. Market and hierarchical are two extreme spectrum of coordination mechanisms in the value chain. Market is one end of governance spectrum that involves relatively minimal coordination and high transaction cost with price being the main coordination mechanism. It is characterized by high risk due to information asymmetry, minimum asset specificity and luck of repeated transaction (low transaction frequency). It is most commonly practice in the traditional or informal agricultural value chain where spot-market is the major outlet. Product typically produced and traded in market governance include staple root vegetables, cereals and pulses (Marwa 2007). Hierarchical governance is the other end of the spectrum that characterized by full coordination, low transaction costs and authority based relationship with a company (Swinnen et al. 2010). Hierarchical complements products which are most economically produced at scale, such as sugarcane, oil palm, and rubber, as well as commodities which have high operational standards (Swinnen et al. 2010). In between the two extreme spectrums, the three forms of governance structures (modular, relational and captive) are contractual and relational based business relationship between supplier and buyer in the value chain. Modular governance occurs when there is production based contractual relationship between buyer and supplier, in which production takes place based on the buyer's specification. Relational governance involves frequent interactions and information that is not easily transmitted, giving importance to mutual trust and social ties. Captive governance involves many small suppliers that heavily depend on one or few buyers and the operations of the suppliers are heavily influenced by the requirements of the buyers (Plahe 2005). In this spectrums of governance structure, asset specificity and coordination are increasing when move from market to hierarchy. This implies that the more invest on asset specific to particular business transaction, less likely to switch off from the transaction as well as less likely to switch to other buyer/supplier. This leads to frequent transaction and then high coordination.

Issues that need to involve to analyze governance structure of pro-poor GAFVC development are: Frist, entry barrier/ market participation analysis that help to understand constraints of smallholder farmers' participation in the value chain; second, analyze the value chain

governance structure to understand coordination mechanisms of smallholder farmers and its determinants and; third, analyze inter-firms relationship to identify constraints and opportunities of collaborative relationship for sustainable and inclusive agri-food GVC development (Kaplinsky et. al. 2000; UNIDO 2011).

3. Economic effects of the value chain: It is poverty impact pathways analysis of participation in the value chain industry. It is mainly focuses on income, food security and nutrition and, employment opportunity impacts of smallholder farmers' participation in the value chain (Kaplinsky et. al. 2000; UNIDO 2011; Mitchell et al. 2002; Generic et. al. 2002; Bolwig et al. 2008).

2.2.3. Constraints of Smallholder Farmers' Participation in Global/National High Value Agri-Food Value Chain (HVAFVC): Brief Conceptual Review

Linking smallholder farmers to global/ national formal agri-food value chain has been identified as a key pathways to get out of poverty trap and sustainable rural development in most developing countries in particular in least developed countries (Kherallah et al. 2015; Barrett et. al. 2010; Torero 2011). Smallholder farmers however, are facing challenges to participate in High Value Agri-Food Value Chain (HVAFVC) and, this is particularly true in most Sub-Saharan African smallholder farmers (Stifel et. al 2015; Kherallah et al. 2015; Poole et al. 2013). Given imperfect market environment they are living in, market-orientation behaviors of asset poor smallholder farmers constrained by different factors and hence these constraints affect smallholder participation and benefits in formal HVAFVC (Dries et al. 2009; Saenger et al. 2013; Poole et al. 2013; Torero 2011). Market orientation here in this study refers to a four step mutually inclusive production and marketing decisions that smallholder farmer makes in HVAFVC and, it involves a decision what to produce, how to produce, producing whether for market or producing for self-consumption and/or producing for both consumption and market , and how to market or where to sell the product. When the farmers make production decisions on what to produce and how to produce, they also at the same time try to seek to address the others economic questions or marketing decisions such as decision to produce whether for their own household self-consumption only, or produce for market only or produce for both-consumption and market (Dayanandan 2011; Poole et al. 2013; Gebremedhin et. al. 2010). Their production decision also affects by on their pre-determined supply channel choice decision whereby they face production decisions challenge- whether their production is oriented to supply for formal market or their production oriented to supply for the informal market.

Because such kind of production decisions have a direct influence on their market-oriented resource allocation decision and then their participation and competency in the formal HVAFVC (Barrett et. al. 2010; Alemye 2011; Gebremedhin et. al. 2010). If they are producing to supply for a formal market, they need to invest on modern technology and inputs to meet high standard requirements of formal or modern HVAFVC. In this case they are market oriented whereby their production decisions largely depend on the modern market demand so that they can penetrate the entry point (high entry barrier) to participate in modern/formal HVAFVC. On the other hand, in subsistence oriented production, smallholder are primarily producing to satisfy their own household food demand and then market the surplus. In this case, smallholders' production decision is not depend on market demand and requirements, rather it is largely depend on their food demands and resources, and they market the surplus to local informal market most of the time. These subsistence smallholder choose to supply their surplus product to local informal market because it has low entry barriers. Smallholders production behaviors such as decisions on what to produce and how to produce, are thus determined by their production orientation choices such as decision to produce whether for self-consumptions, or produce for market and/or for both and; decision to whether produce for supply to the local, or produce to supply for formal national and export market (Barrett et. al 2010; Burke 2009). In short, smallholder faces production, marketing and coordination constraints that affect smallholder participation and benefits in HVAFVC.

Generally, the constraints of smallholder farmers' participation and benefits in the formal HVAFVC can be categorized as internal and external constraint. Internal constraints are factors related to the socio-economic characteristics of smallholder farmers. It refers to production efficiency determinants in agri-food value chain, particularly factors related to smallholder farmers' asset status and their ability to market-oriented resource allocation decisions (Boughton et al. 2007). External constraints refers to factors beyond the control of smallholder farmers that affect production, marketing and coordination efficiency of smallholder farmers in agri-food chain environment. It involves factors related to market access, infrastructures, product specificity, transaction costs and institution (Emilia Schmitt al. al. 2016). The discussion below explain how these internal and external constraints affecting smallholder farmers' participation and benefits in high value agri-food value chain (Tegegne et al. 2013; Ayalew 2015; Poole et al. 2013; Kherallah et al. 2015).

1. Smallholder Resource Constraints

Resources related to production factors particularly land, capital, human capital and technology are critical competency factors for production efficiency in agricultural production. Most of smallholder farmers in developing countries in particular in SSA however facing constraints of these resources in their market oriented resource allocation decisions (Tegegne et al. 2013; Boniphace et al. 2015; Boughton et al. 2007). Smallholder are heterogonous in which they are differ in resources and capabilities. Smallholder with critical constraints to production efficiency adversely affect their competency to meet the market requirement of formal high value agri-food value chain that needs constant and bulk supply of high quality products. Because of their poor efficiency in production resulting from poor access to resources, smallholder facing constraints to supply such as low quality and quantity as well as inconsistent supply. Resources constraints therefore impeding smallholder farmers' competency to participate and benefits in the formal agri-food value chain (Saenger et al. 2013; Burke 2009; Barrett et. al 2010; Bahta et. al. 2007).

2. High Transaction costs

High transactions costs due to factors related to poor rural infrastructures (Kiprono 2014; Tefera et al. 2008; Onoja et al. 2012), information asymmetries (Urquieta et al. 2009; Dries et al. 2009; Haggblade et. al. 2012), poor production efficiency of smallholder and high perishable nature of high value food products (Chagomoka et al. 2014; Kaganzi et al. 2009), hindering smallholder participation in a formal high value agri-food value chain. Transaction costs as defined by Williamson (1981), refers to the costs that are inherent to conducting a transaction - an exchange of good and/or services between buyers and sellers (suppliers). Transaction theory, is a part of New Institutional Economic (NIE) theory, has become important framework to analyze marketing transaction in general and agricultural marketing transaction of developing countries in particular. Because there is imperfect market environment dominancy in most developing countries agricultural marketing system. In application and operationalization of the theory to agricultural value chain, as Key et al (2000) classified transaction costs can be categorized as fixed and proportional costs. Fixed transactions costs refers observable costs that don't vary with the volume of the transactions and, it includes information search, negotiation and monitoring costs (Alemu et al. 2012; Faure et al. 2007). Proportional transactions costs are observable costs and it vary with the proportion of the volume of the product under transaction. It refers to logistics/ marketing relates costs that include transport, storage, handling, and communication costs (like telephone costs) and so forth (Leonardo et al.

2015). Poor rural infrastructure development is one of the key driver of high transaction costs that impeding smallholder to participate in HVAFVC. Rural infrastructures of SSA countries characterized as poor rural roads networks, poor telecommunication infrastructures, insufficient power and water provisions; as well as long distance to modern market center. Because of rural infrastructures constraints, smallholders therefore facing high transport costs and limited access to market information and, hence they are facing high transaction costs due to high information search and transport costs (Årethun 2012; Kiprono 2014; Boniphace et al. 2015). Factors associated with their dispersal settlement and low economic scale in their input and output marketing activities are also the other driver for high transaction cost they faced that impeding smallholders to participate in the value chain. Smallholders are located in much dispersed places and their supply are constraints by low quality and quantity with inconsistent supply. Smallholder facing these supply constraints in the agri-food value chain is because they are poorly endowed in production resources. In the context of high value agri-food value chain, it is assumed that value chains are buyer-driven, in such a way that the participation of smallholder farmers will largely be a function of the procurement decisions of buyers rather than the market choices of small-scale producers (Miyata et al. 2009; Dries et al. 2009; Saenger et al. 2013). Hence modern HVAFVC market of most SSA countries characterized by monopsony market-where there is large number of smallholder supplier and a very few buyers. These large number of smallholder farmers are heterogonous who are geographically fragmented and differ in supply of food products with low quality and quantity as well as inconsistent supply (Barrett et. al. 2010; Haggblade et.al. 2012; Saenger et al. 2013; Muchopa 2013). In this context, buyer procurement decisions to choose the supplying sources is largely depend on transaction costs minimization. Due to high transaction cost, buyers therefore choose to buy from large scale producer or farmers' organization, and excluded smallholder from high value modern agri-food value chain. The transaction costs that specifically emerge from dealing with large numbers of smallholders are as follows (Poole et al. 2013; Kherallah et al. 2015; Torero 2011). (Urquieta et al. 2009) information search costs associated with searching geographically fragmented producers and communicate with them; screening costs associated with uncertainties about reliability of smallholder producers' capacity to deliver based on end market requirements; negotiation costs associated with managing agreements and coordinating integrated production, processing, and marketing; monitoring costs linked with controlling each transaction accordance to agreements and; transferring costs associated with the legal or physical constraints on the movement and transfer of goods (Birachi 2006; Leonardo et al. 2015; Miyata et al. 2009; Faure et al. 2007). Product specificity factors relates to high risk profile and bulky nature of high value

food products such as fruits and vegetables, meats and dairy products is the next driver for high transaction costs in a formal agri-food value chain (Kaganzi et al. 2009; Chagomoka et al. 2014; Jaffee et al. 2011; Mungandi, Conforte et. al. 2012). Due to high risk relates to the perishability nature of high value food products, there is high transaction costs relates to screening, controlling and handling costs. Screening and controlling costs of these highly perishable products are high because it requires critical examination and expertise to screen the reliability of suppliers' capacity if they can meet safety standards and, then it requires also controlling each transaction if it is accordance to the agreements and standard through monitoring supplier production and marketing coordination. Given this high level screening and controlling requirements, buying from large number of fragmented smallholder farmers with poor production capacity will aggravate buyer's transaction costs relates to screening and controlling. And hence this leads to exclusion of smallholder from supplying to the formal value chain. On the other hand, high transactions costs relates to higher production costs and handling costs of high value food products impeding smallholder participation in the formal food value chain (Jaffee et al. 2011). Supply requirement particularly high quality with bulk constant supply is one of critical entry point requirements that smallholder should meet in a formal high value agri-food value chain market. To meet this requirement, smallholder farmers should upgrade their production efficiency and hence make specific asset investment on improve seeds/breeds, land, technology and so forth. Because of high perishability nature of high value food products that needs high standard handling system, it also needs investment on cooling store/equipment like refrigerator. Resource poor smallholder farmers however are facing constraints to make critical choice in their market oriented resource allocation decision for the investment to participate in the value chain. Resource constraints is therefore critical problem that impeding smallholder to make investment and then to participate in the formal value chain (Collaboration et. al 2013). Uncertainty about market demand and price is the other critical factors that adversely affecting smallholder market oriented resource allocation decision to participate in the value chain. Due to long distance to modern market center and poor infrastructures, smallholders face information constraints to make investment decision or market oriented resource allocation decision (Årethun 2012; Kiprono 2014; Boniphace et al. 2015). Hence this leads to high information searching costs that impeding smallholder to participate in the formal value chain. Moreover, poor rural roads network aggravated the risk of product perishability that smallholder will face for the supply of high value foods to modern market and at the same time it incur them high transport costs. High transport costs and perishability risk

constraints that smallholder face due to poor rural roads network are also critical factors that impeding smallholders' participation in the value chain.

3. *Institutional constraints*

Institution is a key factor either to promote or demote smallholder farmers' participation and benefits in high value formal agri-food value chain. We follow (Scott, 1995) definition of institution who distinguished institution as regulative, normative, or cognitive institutions. Regulative institutions represent government regulations and policies that value chain actors must comply with. Normative institutions are business practices, business policies, and ethical standards. Cognitive institutions represent the way people interpret the world around them as the basis of rules, which encompasses the diverse cultural belief systems, values, and identities that inform people in different roles (Scott, 1995).

To better understand institutional constraints that impeding smallholder participation and benefits in a formal HVAFVC, it is important to classify the constraints as follows:

a) High safety food standards as an entry barrier: In relation of health issue, the use of public and private food standards is increasing in modern retail global/national markets for high value food products (Álvarez-Coque et. al. 1994; Álvarez-Coque et. al. 2015; Barjolle et. al. 2002). This high standards involves operating/production and safe delivery standards that smallholder couldn't meet because of their poor competency position and, thus they excluded from formal agri-food value chain (Jaffee et al. 2011; Swinnen 2014; Kaganzi et al. 2009).
b) Government policies constraints: Luck of favorable government policies in relation to trade, infrastructure development and natural resource management are the other institutional constraints that impeding smallholder' participation in a formal agri-food value chain. Luck of incentives in trade policies that could promote smallholder competency, public-private partnership and collective action; luck of legal rule that protect standards, licensed organization and farmers organizations and; poor rural development policies that gave less attention to rural hard and soft infrastructures developments and less attentions to agricultural and rural research and development investments and; insufficient property rights and land policies that could adversely smallholder productivity and market orientation are among other factors of government policies constraints that impeding smallholder' participation in the formal value chain (Kaplinsky et. al 2000; Marwa 2007; Stamm 2004) .

c) Business support services constraints: Poor business support services such as poor financial and agricultural extension services also critical problems that impeding smallholder participation in the value chain. Poor financial services limited smallholder access to credits/finance for their investment in agribusiness development or market-oriented production system (Ade et al. 1998; Boughton et al. 2007). Similarly poor agricultural extension services limited smallholder access to market information, technology, technical support and innovation practices that are crucial to transform into market-oriented production (Ferris et al. 2014; Martey et al. 2014; Boughton et al. 2007; Kherallah et al. 2015). In short, poor business support services impeding smallholder transformation into market oriented production and, thus excluding from a formal agri-food value chain.
d) Poor institutional arrangements: Constraints relates to poor institutional arrangements also critical in adversely affecting smallholder participation and benefits in the formal value chain. Institutional arrangements refers to power relationship between and along the value chain actors. Collaborative base relationship has a positive effect for smallholder sustainable participation whereas competitive relationship that based on opportunistic behavior of lead firms has a negative effect on smallholder sustainable participation and benefits in the value chain (Kaplinsky et. al. 2000; Marwa 2007; Gereffi et. al. 2016).
e) Constraints relates to informal institution: It refers to values, norms, taboos, cultures, traditions and so forth that have negative effect on smallholder production and marketing decisions and, thus impeding smallholder participations in the formal value chain (Gebremedhin et. al. 2010; Gebremedhin et. al. 2008).

In short, there is a need to upgrade institution to address the above mentioned constraints and hence to promote inclusive agri-food value chain development in developing countries. Because it has five potential roles in strengthening smallholders' participation in the formal value chain: reducing transaction costs; managing risk; building social capital; enabling collective action; and redressing missing markets. On the other hand, theoretical and empirical studies shows that collective action through farmers' group cooperative is a promising pathway to link smallholder to a formal agri-food value chain.

2.2.4. Collective action as a pathway to link smallholder into formal agricultural value chain

Collective action can be defined as “voluntary action taken by a group to achieve common interests” (Francesconi et. al. 2007).

Studies indicate that farmer organizations – as the most common form of collective action – offer opportunities for smallholder farmers to participate in a formal agri-food value chain more effectively. Such forms of collective action can reduce transaction costs of accessing inputs and supplying outputs, obtain market information and increase bargaining power. Collective action can fill the gaps in imperfect markets (e.g. improving efficiency of logistics and accessing financial and information services) and improve market systems (e.g. creating innovations in processing and value addition, enhancing economies of scale and coordination of marketing activities). Farmer organizations and other forms of collective action are, therefore, preferred partners of other agents in the market system (Markelova et al., 2009). To deal more effectively with leading firms in the agricultural market and value chains and to upgrade their own contribution to value chain operations, many producers are building horizontal linkages to improve their positions within the chain. These include producer associations, cooperatives and business associations (Rubin et al., 2009).

The literatures on collective action (Fischer et. al. 2014; Francesconi et. al. 2007; Kaganzi et al. 2009; Fischer et. al 2012; Bernard et. al. 2009; Verhofstadt et. al. 2013)

1. Capacity-building: facilitated access to technology, access to extension services providers.
2. Access to resources, including knowledge: access to storage facilities, technical expertise, market knowledge
3. Access to finance: pooling resources as a group to finance operations or acquire credit
4. Reduced marketing costs: organising to transport produce, sharing processing facilities to add value
5. Improved coordination: coordination for quality control, bulk sale of food grains
6. Increased bargaining power: obtaining better terms of trade with downstream purchasers, selling wholesale when seasonal prices have gone up, selling further along the value chain (avoiding farm-gate sale)

7. New markets: producers' group can sell to new buyers (supermarkets, processors, food chains) as they can offer a more stable supply and better quality of product; shared transaction costs for market development

8. Building trust with other chain actors: development of new business contacts, trust-based relations with buyers, quality certification agencies

9. Building social capital: networks for information diffusion and social learning

Collective action is commonly supposed to assist smallholders' engagement in a formal agri-food value chain markets, contributing to improvements in rural economies. Like in many other developing countries, this perception largely shared also amongst policy- makers in Ethiopia, who do not hesitate to express their overwhelming confidence in cooperative organizations as a driving force for rural development. The perception that collective action may contribute to boost the Ethiopian rural economy, also holds true for the dairy sector (Tassew et. al. 2009). Collective action by resource poor farmers is often developed through and/or draws on larger social networks that allow them to enter new markets. Collective action, therefore, has to be considered in the larger context of both formal and informal groups.

2.2.5. A conceptual Impact Pathways Linkages of Smallholders Participation in a Formal HVAFVC and Food and Nutritional Security (FNS): case of Ethiopia

"Access to sufficient food of adequate quality is a basic human right, and the Right to Food an accepted concept" (FAO, 2004).

Despite worldwide efforts, food insecurity and hunger remains one of the most pressing development challenges in most SSA countries in particular in Ethiopia. Ethiopia has been experiencing food insecurity for decades, as the country is mostly dependent on drought-exposed, rain-fed agriculture, and high transaction costs that inhibit trade in staples (Beyene 2010). Both availability and access issues underpin Ethiopia's food security challenges. According to the FAO (2010), 41% of the Ethiopian population lives below the poverty line and more than 31 million people are undernourished. The country is suffering from both transitory and chronic food insecurity (Devereux 2000; Degaga 2005; Megersa et al. 2013). Chronic food insecurity is households' long term inability to meet the minimum diet/food requirement either from buying or own production due to overwhelming poverty. Transitory food insecurity is a temporary decline in household's access to enough diet/food because of manmade problems

like wars/conflicts and food price crisis; as well as because of natural shocks like drought and floods (Vaitla et al. 2015; Maxwell et al. 2013; Bakar 2010; Saad, 2009). The concentrations of food insecurity and malnutrition are prevalent in rural areas with a population of six to seven million chronically food insecure and up to 13 million seasonally food insecure. According to 2016 FAO situation report of Ethiopia, due to El Niño climate change effect, food insecurity and malnutrition rate are alarming in rural areas in 2015 and 2016. An estimated of 10.2 million are exposed to food insecurity, 2.2 million farmers and herders need immediate humanitarian agricultural production support and Crop production has dropped by 50–90% in some areas and failed completely in others.

Empirical studies show multiple and complex long aged factors derived a country in to food insecurity and poverty traps. These factors involve Malthusian crisis of high population growth (Degaga 2005; Megersa et al. 2013); high production resources constraints in rural households and poor rural infrastructures; rain-fed subsistence smallholder agriculture; poor and erratic rainfall; high rate of natural erosions, floods and recurrent droughts; high rate of illiteracy among rural community; poorly developed marketing system; institutional constraints relates to poor governance and unfavorable enabling environments, and interstate conflicts and wars (Degaga 2005; Devereux 2000; Beyene 2014; Dercon et. al. 2009; Maxwell et al. 2013; Abadi et al. 2013; Beyene 2010).

Similar to other SSA countries, in Ethiopia also there is a strong direct linkage between smallholder agriculture, food security and nutrition (Stifel et. al. 2015; Tolossa 2006; Berhanu et.al. 2014). Agriculture has been the core driver of Ethiopia‘s economic growth and long-term food security, in Ethiopia. Of the total 90 million populations of the country, 80% of the population livelihood is depends on agriculture. Of this, 98% are rural smallholder households (CSA 2013). Agriculture is the primary source of food and essential nutrients as well as an important source of income for these smallholder farmers. Smallholder agriculture and rural development thus seem to have a key role in reducing hunger and malnutrition. Despite of efforts that have been made so far, yet smallholder agriculture is far from playing its role in addressing food insecurity and poverty. Because it largely depends on traditional subsistent rain-fed production system and, it has limited access to modern inputs and outputs markets (Tolossa 2006; Abebaw et al. 2010; Gebru 2006; Gezimu et.al. 2012).

Linking smallholder farmers to a formal agri-food value chain has been considered as a key pathway to get out of food insecurity and poverty trap in Ethiopia. Because, it has a direct

positive effect on smallholder food production/productivity, availability and affordability of diversified foods, income and employment opportunity as well as on rural development (Tegegne et al. 2013; Gebremedhin et.al. 2010). However, there is empirical evidence gap on the impact pathways linkages of smallholder participation in a formal high value agri-food value chain and Food and Nutritional Security (FNS) (Stifel et.al. 2015).

Given its multidimensional nature, conceptual understating of food security is an important and priority step to analyze the impact pathways linkages. Food security is commonly defined as:

"*Food security is a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life*"(FAO, 1996).

Food insecurity exists when people do not have adequate physical, social or economic access to food as defined above. There are four dimensions of food security include availability, access to, utilization of food and the stability of the food supply.

1. *Availability of food*: it refers to physical availability of food at national, regional and local level through from domestic production, trade import and foreign aid.

2. *Food access*: is households' ability to acquire adequate food regularly through combination of sources such as own food production, food purchase, gifts and aid.

3. *Food utilization*: is households' or individuals biological proper use of foods. It refers to capacity of proper food utilization through quality and healthy nutrient food consumption for proper heath function and active life.

4. *Food stability*: is stable access to food over a period of time in spite any potential shocks.

Household level food security can be defined as 'household food security exists when all the people living in the household have physical, social and economic access to sufficient, safe and nutritious food at all times that meets their dietary needs and food preferences for an active and healthy life' (FAO, 1996). Rural farm household food security determined by combination factors such as their own food production/productivity; farm, non-farm and off incomes; aid and gifts, food physical supply and its prices in terms of availability and affordability to the farms households and; proper food utilization capacity and food preferences of farm households(Cintron et al. 2013)

Given this multidimensional nature of food security/insecurity, it needs to understand the impact pathways linkage from food system perspective that deals the whole food system process from primary production to final consumption (Graef et al. 2014; Miguel et. al. 2013; Haddad 2000; Berry et al. 2015). Pro-poor global agri-food value chain approach has become important to understand the impact pathways linkages of smallholder participation in a formal agri-food value chain and food and nutritional security (UNIDO 2011; Mitchell et al. 2002; Generic et.al. 2002; Kherallah et al. 2015; Haggblade et.al. 2012; World bank 2015). Because the approach provides a framework from a food system perspective to better understand how each stage of high value agri-food value chain such as production, marketing, processing, distribution and final delivery to consumers and; how actors relationships along and between the value chain affect the four pillars of food security such as availability, access, utilization and stability. Activities such as production, marketing, processing and distribution, and the relationship along these activities affect food availability, access and stability in smallholder farmer households either positively or negatively (Haddad 2000; Haggblade et.al. 2012; Graef et al. 2014). On the other hand, processing, storage, shelf life and safe delivery affect food utilization and then health. Thus, this study adopted an inclusive agri-food value chain approach for the FNS impact pathways of smallholder participation in a formal HVAFVC analysis because of the following reasons. First, the approach can identify factors for availability/unavailability of diversified foods at local, regional and national level through analyzing endogenous and exogenous constraints and opportunities for market-oriented production and productivity of smallholder farmers (Turner et al. 2013; Hawkes et. al 2011). Second, the approach provides a better understanding factors for affordability/unaffordability of the available diversified food for rural communities in general and poor smallholder farmers in particular. Third, the approach can be used to identify if, where, and how the nutrient quality of the food changes through the chain and how nutrient losses can be prevented (Fischer et.al. 2012; Turner et al. 2013; Simons et al. 2005). Fourth, it can identify distribution of economic returns or benefits of participation in the value chain along the value chain actors particularly for smallholder farmers; how coordination and power relationship along and between the value chain participants affect the economic returns of smallholder farmers and; how this economic returns affect smallholder income and how this income is translated to household food and nutritional security improvement of smallholders (Simons et al. 2005; Hawkes et. al. 2011; Mungandi, et.al. 2012). Fifth, it can identify how women economic empowerment achieved through using gender as a cross cutting issue; given the leading roles women in rural household of Ethiopia playing in food allocation and food utilization, in turn it help us to understand how women's economic empowerment affect food utilization of the farm

households (Bolwig et al. 2008; Stifel et. al. 2015). Six, it help us to understand how the geospatial food supply difference or availability/unavailability of foods supply as well as how income earned from the value chain participation affect food access stability of smallholder households (UNIDO 2011; Mitchell et al. 2002; World bank 2015; Turner et al. 2013; Chege et al. 2015). Lastly, it help us to identify upgrading strategies for policies uptakes to address food and nutritional security problems of smallholder farmers through promoting smallholder participation and benefits in a formal agri-food value chain (UNIDO 2011; Mitchell et al. 2002).

Hence, smallholder household food security in rural Ethiopia is determined by a combination of factors such as: farm household food production; household assets (food stock, other assets and capital) and aids that may serve as a buffer in periods of food shortages; farm, off-farm and non-farm incomes and; proper food utilization capacity and food preferences of the farm households (Tolossa 2006; Maxwell et al. 2013; Megersa et al. 2013; Beyene 2010). Given these multiple drivers of rural farm household food security, the FNS impacts pathways linkages of smallholder participation in a formal HVAFVC is not always linear. Generally, there are three possible FNS impact pathways of smallholder participation in a formal HVAFVC in rural Ethiopia. These are: 1) Food production/productivity to consumption pathway; 2) income to food and health care purchases pathway and; 3) women empowerment to food utilization pathway.

1) Food Production/productivity to consumption impact pathway

Smallholder food production/productivity is very critical to rural household food and nutritional security in general and food availability in particular (Tolossa 2006; Beyene 2010). Because smallholders represent the largest food supply sources of the country, Ethiopia. The smallholder market-oriented food production decision is however constrained by poor production resources, poor business support services such as finance and agriculture extension services, lack of market information and poor infrastructures, limited access to input and output markets and technology and; thus it is poor in productivity and high production fluctuation (Gebru 2006; Gebremedhin et.al. 2010; Gebremedhin et.al. 2008; Tegegne et al. 2013; Tefera et al. 2008). Link smallholder farmers to a formal high value agri-food value chain has positive impact pathways in improving food availability particularly at local areas through improving high value food production and productivity and, stabilizing food prices at all level. Linking the smallholder to the formal agri-food value chain is a key avenue in improving smallholders' food productivity through enhancing their access to food production factors and business support services such inputs and agricultural extension services; access to finance, technology, market information

and markets (UNIDO 2011; Kherallah et al. 2015; Steen et.al 2014; Hoddinott et.al 2013; World bank 2015). The smallholder food production and productivity improvement has thus a positive effect on the availability of specific high value food products which is rich in nutrition for their own consumption. The smallholder food production and productivity improvement has also a direct positive effect on the improvement of sufficient food supply at local, regional and national market. On consequence, it has positive effect on the food price stability and thus a positive effect on affordability of the food for smallholder farmers and hence most smallholder are net food buyers. Linking smallholder to the formal value chain market has a positive influence on their food production diversification strategies through promoting smallholders to produce a diversified food and; thus a positive effect on the availability of diversified food at the local, regional and national markets (Graef et al. 2014; World bank 2015; Simons et al. 2005; Hawkes et.al. 2011).

2) Income to food and health care purchasing power impact pathways

Most smallholder in Ethiopia are subsistence farmers who largely produced staple food primarily for their own consumption and the surplus is marketed to the traditional market with low quality and quantity as well as with low return (Tolossa 2006; Tegegne et al. 2013; Devereux 2000). However, linking smallholder to a formal agri-food value chain market has a positive effect in improving their supply quality, quantity and consistency, thus a positive effect on their economic return or profits from participation in the value chain (Hawkes et. al. 2011; Simons et al. 2005; Chege et al. 2015; Haggblade et.al. 2012; UNIDO 2011). Smallholder participation in a formal agri-food value chain has thus a positive effect on improving their income and; in turn it has positive effect on improving their FNS and wellbeing through improving their food and non-food purchasing power (Miyata et al. 2009; Kabunga et al. 2014; Fischer et.al. 2012; Hoddinott et.al. 2013; Stifel et.al. 2015). Food purchase decisions may prioritize food quantity or calorie intake over food quality (diet diversity). Food purchases are also influenced by taste, preference, custom, and norms including food taboos, and by food company marketing strategies. Purchasing power is greatly affected by income, prices, and the quantity and quality of food available in the market. Smallholder spending decision on health care issue such as potable water and sanitation are also important for nutritional wellbeing of the farm households (Hawkes et.al. 2011; Turner et al. 2013; Nangole et al. 2011).

3) Women empowerment to food utilization impact pathway

Linking smallholder to a formal high value agri-food chain market provides opportunity to increase agricultural income that women can control (like dairy income) (Bolwig et al. 2008; CARE 2008; Graef et al. 2014). Hence, women in rural Ethiopia has a leading role in household food allocation and utilization as well as in health care decisions and; income controlled by women is more frequently used on food and health care for the family, particularly for children (Dayanandan 2011; Hoddinott et. al. 2013; Ahmed et al. 2004). Women's income enables that to expend it on food and health care, thus affecting the farm household food utilization diet and health status (Smith et. al. 2003; UNICEF, 2011). However, most rural women luck awareness on the nutritional value of high value food products thus contributing for micronutrient deficiency in rural households of Ethiopia.

2.2.6. Empirical studies review on smallholders and agricultural value chains

Empirical studies on smallholder in agricultural value chain in developing countries are limited. In the following sub section available empirical literatures on issues such as constraints and opportunities of smallholder access to the value chain market, market channel choices and benefit in the chain as well as the economic effects of participation are briefly reviewed.

Using a nonlinear programming approach with the General Algebraic Modelling System (GAMS), (Tovignan 2010) evaluated the Shea butter value chain in case of Benin. The results show that the global added value generated yearly along the Shea supply chain is approximately 304,848 FCFA (approximately 470 Euros). From this amount, collectors' gain 10%, traders gain 65% and processors 25%. The analysis reveals that the Shea business is financially profitable for all actors belonging to the supply chain. The study also pointed out that introduction of new processing equipment contributes to reduce the work load and increase the frequency of processing by reducing the duration of processing from 4 to 2 days. The simulation of the model with new equipment shows a high impact on processors' income which increased almost for 50%.

Empirical literature on the constraints of smallholder participation in agricultural value chain show that the following are the major determinants that have a negative effect on smallholder decision and benefit in value chain market participation. Poor asset endowment and access (Abafita et al. 2016; Tegegne et al. 2013), low quantity and poor quality of products outputs (Hambloch et al. 2014; Bardhan et al. 2012; Tegegne et al. 2013); poor market infrastructures,

high transaction costs, asymmetry or poor access to market information (Alwang et al. 2012; Leonardo et al. 2015; Gebremedhin & Jaleta 2010; Holloway et al. 1999), poor access to credit and other rural services (Abafita et al. 2016; Ahmed et al. 2004), barrier to entry (Plahe 2005), high regulatory barrier, technological barrier and (Jaffee et al. 2011) .

In his study of household food marketing behavior, Goetz (1992) used a range of factors to reflect the effect of transaction cost factors on the market participation in coarse grain, both for buying and selling. The factors included proxy variables for fixed transaction costs, which included ownership of carts for transportation of grain to the market, physical distance from the market, and regional dummy variables. Ownership of assets is considered important in reflecting market access. The study found a significant relationship between the grain price and the probability of buying, and the quantities bought and sold. The results further showed that apart from these there are other factors, unrelated to the relative changes in output price, which stimulate market participation. Better information, for example, significantly raises the probability of market participation for potential selling households, while access to coarse grain processing technology raises quantities sold by sellers that are provided they participate in the market.

Key et al (2000) extended Goetz's analysis by focusing on participation in maize markets in Mexico. Their study found that both fixed and proportional transaction costs play a significant role in explaining household behavior. With respect to this the proportional transaction costs played a more significant role in the selling rather than the buying decisions. Specifically, selling to official sources tended to significantly increase the production and selling threshold for the sellers. At the same time, the ownership of a pick-up truck, for example, is associated with a lower production-selling threshold. This implies that ownership of assets tends to reduce entry barriers into the market.

A similar study was conducted by Holloway et al. (1999). Their study sought to identify alternative techniques for effecting participation among peri-urban milk producers in the Ethiopian highlands. The study concludes that institutional innovations to promote entry into the market should be accompanied by a mix of other factors such as improvements in infrastructure, knowledge, and asset accumulation in the household. Furthermore they found that by locating producers, the time required to market milk could be minimized. This increased the number of participating producers and the level of marketable surplus.

Jagwe and his collogues' study on transaction costs and smallholder farmers' participation in banana markets in the great lakes region, has analyzed the determinants of the discrete decision of a household on whether to participate in banana markets using the FIML bivariate probit method. The study shows transaction cost related factors such as geographical location of households, market information sources and travel time to the nearest urban center do influence participation. Other factors such as labour availability, farming experience, gender of household head, off-farm income and the asset base of the household also affect the likelihood and intensity of participation (Jagwe et al. 2010).

A study by Senyolo et al. (2009) addresses the choice of marketing channels for smallholder farmers producing bananas and mangoes in some areas of the Limpopo Province and found that not all farmers sell their product. Different factors affect the choice of the market channel, but the study found that problems of transport, searching for markets and education tend to influence participation.

Gebremedhin et. al. (2008) addressed another side of the output markets by focusing on the transaction costs in the choice of market institutions such as grain brokers in Ethiopia. In this case traders first choose where to trade and then choose whether to use a broker to search on their behalf. The study found that high transaction costs shown by traders' individual rationality in selecting brokerage is linked to increased broker use, while high social capital reduces the use of brokers.

Barrett (2008) study shows factors related to household asset in terms of endowments of productive assets are positively associated with the degree of commercialization. Access to land is important for agricultural production; it is an essential for producing surplus that allows for a first entry into the market (Barrett, 2008). Similarly, empirical study shows that access to markets is determined by a variety of factors, such as resource endowments, capital, knowledge, and services, as well as intra-household patterns of resource allocation. Increasingly complex vertical relationships require different combinations of tangible and intangible assets (Ferris et al. 2014).

In addition, many studies (Kaganzi et al. 2009; Gómez et. al. 2013; Kherallah et al. 2015; World bank 2015; Jaffee et al. 2011; Mungandi et. al 2012) on the impact of the growth of high value food chains shows that smallholder lost market access in this high value food global value chain because of three factors. First, transaction costs favor larger farms in supply chains, since it is easier for companies to contract with a few large farms than with many small ones.

Second, when some amount of investment is needed in order to contract with companies or to supply high value produce, small farms are often more constrained in their financial means for making necessary investments. Third, small farms typically require more assistance from the company per unit of output.

Empirical studies postulate that opportunities of linking and increasing benefits of smallholder in the value chains can happens through developing effective coordination mechanisms. Increasing evidence shows that horizontal coordination or producer organizations offer opportunities for smallholders to participate in the market more effectively (Gereffi et al. 2001; Holste 2015). Collective action amongst smallholders in the form of producer groups (formal or informal) is important to lower transaction costs, enable economies of scale, increase the effectiveness of capacity building activities and increase the bargaining power of smallholders (Fischer & Qaim 2014; Francesconi et. al. 2007; Kaganzi et al. 2009)

In Uganda, for example, potato farmers are pooling resources as a group to finance operations (Kaganzi et al. 2009) (Kaganzi et al., 2009). Groups marketing minor millet in India, have set up an internal taskforce groups to acquire inputs and credit for production (Gruere et al., 2009).

In Burkina Faso women had access to a collective irrigated field and a pump for horticulture production via membership of a group. These groups provided few additional services such as for inputs, storage or means of transport and thus limiting enhancing return on investments made in irrigation infrastructure and equipment (Bernard et al., 2008).

Organization in producer groups would make sense for smallholders where there are market opportunities to be seized, provided that the associated transaction costs can be overcome (Markelova et al., 2009). One example is the Papa Andina initiative from Peru. While products were produced in remote areas, transport costs in the overall value of the product were reduced significantly (Devaux et al., 2009).

In Kenya, collective action was used in grain markets to benefit from seasonal price differentiations. By working together, farmers could store the product and sell at a time when prices were higher than just after the harvest. A better price was also obtained by smallholders' collective action by organizing the bulking, storage, grading, sorting and selling to wholesalers (Bekele et al., 2006).

Collective action can also assist individual producers to access special equipment (such as cold chains, for processing), technical expertise and market knowledge, which is essential for

accessing markets for high-value but perishable products (horticulture, livestock). Groups may even work together to set up a brand and invest in this, such as was done for minor millet in India (Gruere et al., 2009).

Vertical coordination is also important opportunity when examining ways to reduce transaction costs. According to Alemu et al. (2012) and Dries et al. (2009), state that reduction in transaction costs through vertical coordination is beneficial to the firm and the farmers mutually. The firm receives an assured and timely supply of the desired raw material. On the other side, the farmers acquire an assured market for their produce. Moreover, farmers gain more reliable access to production inputs, capital, technology, and market information. The increasing of capabilities of smallholder through different upgrading strategies, therefore, is the way to link and increase their benefit in the chain (Saenger et al. 2013).

Studies of the welfare effect of value chain shows that it has a significant positive effect in improving welfare status of smallholder household through increasing their income and employment opportunity (Ahmed et al. 2003; Anon n.d.; Miyata et al. 2009) as well as on a positive effect on food and nutritional status of producers who have participated in the value chain market (Ahmed et al. 2003; Bellemare & Novak 2015; Miyata et al. 2009; Chege et al. 2015).

2.2.7. An overview dairy sub-sector in Ethiopia

1. Dairy production and marketing and consumption in Ethiopia

Ethiopia has huge untapped potential for market-oriented smallholder dairy development; with 30 million genetically diverse cattle population, suitable agro-climate for dairying (Ahmed et al, 2004), and potentially large and growing market for dairy products. Commercial smallholder dairy development in the country can be an effective pathway out of rural poverty. However, the potential has not been fully exploited.

Milk production in Ethiopia is largely from the smallholder farmers in the highlands areas of the country. However, the production is not market oriented and a minor portion of the locally produced milk enters the commercial sector owing to the marketing constraints, and lack of processing techniques suitable for smallholder dairying (Dayanandan 2011).

I. Milk Production System:

Livestock are raised in all of the production systems of Ethiopia by pastoralists, agro-pastoralists, and sedentary farmers (Ahmed et al., 2003). Milk production system can be broadly categorized in to three systems, based on marketing situations, such as urban, peri-urban and rural milk production system (Tsehay, 2002). The main source of milk production in Ethiopia is from the cow, but small quantities of milk is obtained from goat and camel and also used in some regions particularly in pastoralist areas (Dayanandan 2011; Tegegne et al. 2013; Zewdie 2012; Steen et.al. 2014).

Rural milk production system is part of the subsistence farming system. According to Ahmed et al. (2003), it is the predominant production system accounting for over 97% of national milk production. This system includes pastoralists, agro-pastoralists, and crop-livestock producers. Largely, the system is based on low producing indigenous breeds of zebu cattle. The livestock are kept under traditional management conditions and generally obtain most of their feed from native vegetation, aftermath grazing and crop residues (Yilma et al. 2011)

The Ethiopian highlands possess a high potential for dairy development. These areas are occupying the central part of Ethiopia, over about 40% of the country (Ahmed et al. 2004). In the highland areas agricultural production system is predominantly substance smallholder mixed farming, with crop and livestock husbandry. About 63% of the annual total national milk production is produced by rural smallholders in mixed farming system of the highlands; with small urban/peri-urban producers contributing about 22% of the total national production. More than three-fourth of the milk produced by rural households is consumed at home (Ahmed et al. 2004; Yilma et al. 2011).

In this system feed for livestock consists of forages, crop residues and stub grazing and hay native pastures. The majority of milking cows in the smallholders milk production are indigenous breeds which have low production performance with the average age at first calving is 53 months and average calving intervals is 25 months. The average cow lactation yield is 524 liters for 239 days, of which 238 liters is off-take for human use while 286 liters is suckled by the calf. But also a very small number of crossbred animals are milked to provide the family with fresh milk butter and cheese. Surpluses are sold, usually by women, who use the regular cash income to buy household necessities or to save for festival occasions. Both the pastoralist and smallholder farmers produce 98% of the country milk production (Ahmed et al. 2002; Kumar et al. 2014; Yilma et al. 2011).

II. Milk Marketing

In Ethiopia, fresh milk and its products is distributed through both the informal and formal marketing systems. Formal milk markets, predominated by government enterprise and a few private businesses, are particularly limited to peri-urban areas and to Addis Ababa (Tegegne et al. 2013; Muriuki et. al 2001).

The informal market involves direct delivery of fresh milk by producers to consumer in the immediate neighborhood and sale to collectors or traders nearby towns. In the informal market, milk may pass from producers to consumers directly or it may pass through two or more market agents. The informal system is characterized by no licensing requirement to operate, low cost of operations, high producer price compared to formal market and no regulation of operations. The informal (traditional) market has remained dominant in Ethiopia. The traditional processing and trade of dairy products, especially traditional soured butter, dominate the Ethiopian dairy sector (Tegegne et al. 2013; Ahmed et al. 2004).

II. Milk consumption

The consumption of milk and milk products varies geographically between the highlands and the lowlands and the level of urbanization. In the lowlands, all segment of the population consumes dairy products while in the highlands the major consumers primarily include children and some vulnerable groups such as the elderly and women (Yilma et al. 2011a; Land O'Lakes 2010).

Earlier reports indicate that in most parts of Ethiopia the milk produced on farm is used for calves, consumed by the family members and sold to local markets (Ahmed et al. 2004). In some households, only the husband has the privilege to drink milk though it depends on the number of milking cows they have. Usually it is the husband and rarely babies of less than one year age that have access to fresh milk. Milk and milk product form part of the diet of many Ethiopians. At the household level, the consumption pattern is defined as the combination of the types, quantities and frequencies of dairy product consumed (Yilma et al. 2011).

Consumption of processed dairy products was observed even less frequently among the rural low-income households, indicating that the majority of the populations do not consume processed products (butter) to any substantial degree (Ahmed et al. 2004; Yilma et al. 2011). The limited consumption of butter may be due to the higher price associated with it and the need for cash income to buy some necessities. Butter is often consumed on holydays and

special occasions in rural low-income households because it fetches routine cash income. Butter fetches a higher price compared to other milk products (Ahmed et al. 2004; Yilma et al. 2011).

2. Dairy marketing constraints

Enhancing the development of stallholder farmers to reach markets and engage them in marketing activities poses a pressing development challenge. Difficulty in market access restricts opportunities for income generation. Remoteness results in reduced farm gate prices increased input costs and lower returns to labor and capital. This in turn, reduces incentives to participate in economic transaction and results in subsistent rather than market oriented production systems (Ahmed et al. 2003).

In Ethiopia milk marketing system is not well developed (Ahmed et al., 2003) especially, market access in rural area is a critical factor. This has resulted in difficulties of marketing fresh milk where infrastructures are extremely limited and market channel has not been developed. In the absence of organization rural fresh milk market, marketing in any volume is restricted to peri-urban areas. Milk being perishable and demand being high for urban consumption, efficiency in collection and transportation of this bulk from widely scattered rural sources, requires a well-defined method of preservation and distribution. This would have impact on the amount that would be available for consumption through losses in quality (Ahmed et al. 2003; Yilma et al. 2011; Tegegne et al. 2013).

The dairy production and marketing is limited by ineffectiveness and inadequate infrastructural and institutional set-ups, lack of market-oriented production, prevalence of diseases, seasonal variation in the volume of milk production which leads to seasonal fluctuation in prices. The scattered nature of the production units and the poor communication system are generally mentioned as some of the major reasons for the poor performance of this sector (Haile 2009; Yilma et al. 2011; Seifu et. al. 2014).

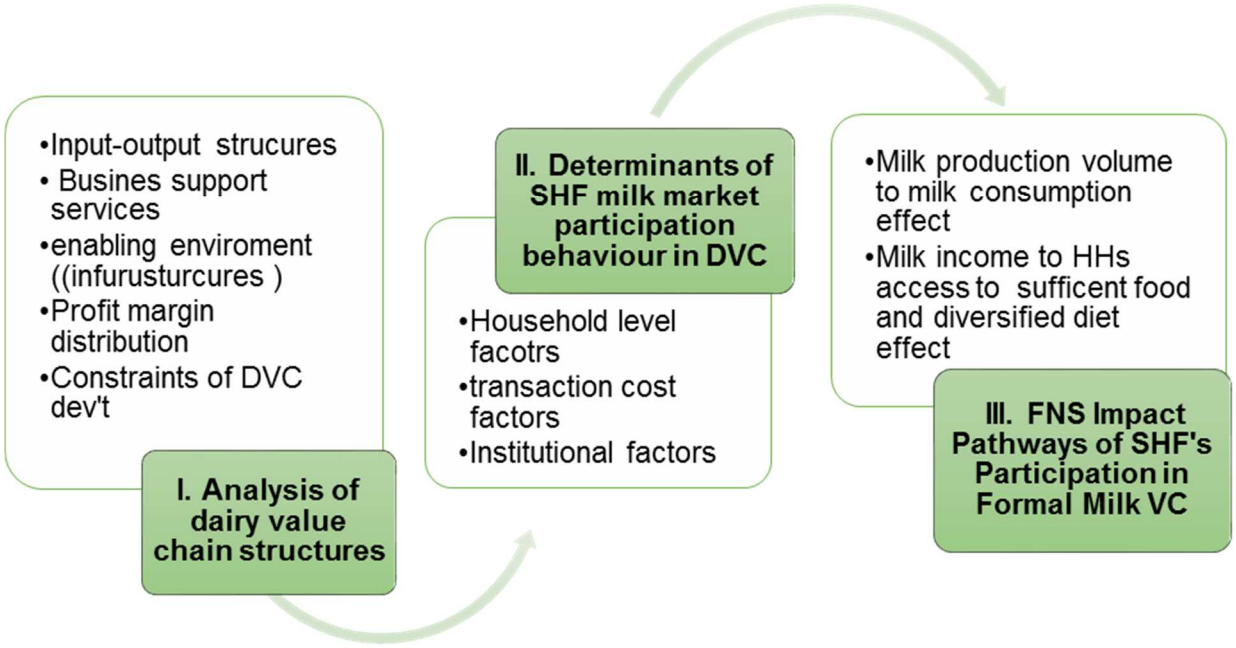
In short, dairy sub-sector has untapped potential to address food insecurity and poverty in rural Ethiopia (Ahmed et al. 2003). The largest (98%) of national milk source supply comes from smallholder production system. Linking smallholder farmer to formal dairy value chain has been thus identified as a key pathways to get rural households out of food insecurity and poverty traps in Ethiopia. Because it contributes to several rural livelihoods indicators, including (but not limited to) better income, nutrition, food security, employment opportunity, savings, insurance

and gender equality (Dayanandan 2011; Hoddinott & Headey 2013; Steen et.al. 2014). However, dairy value chain particularly smallholder dairy constrained by low productivity and inconsistent supply, limited access to input and output market, poor resources and rural infrastructures, high transactions costs and poor business support services, poor institutional setup and, loosely coordinated to modern value chain (Tegegne et al. 2013; Tefera et al. 2008; Steen et.al. 2014; Ahmed et al. 2004; Melesse et.al. 2013). Promoting smallholders' access to a formal dairy market access has thus become a central objective of market-oriented development policies of the country. Because smallholder may indeed have the possibility to considerably improve their dairy production and productivity and, incomes by connecting to a formal dairy value chain. Understanding structure and dynamics of the dairy value chain has a paramount important for policy uptakes that promote smallholder participation and benefits in a formal dairy value chain. Empirical studies are limited, however, on the structure of dairy value chain industry and dynamics of smallholder marketing behaviors in the dairy value chain industry. Much also less known on livelihoods effects of smallholders' marketing behaviors in the dairy value chain industry. The purpose of this study was thus to add values to these empirical research gaps through analyzed the structure of dairy value chain, dynamics of smallholders' dairy marketing behaviors in the dairy value chain and, food and nutritional security impacts of smallholders participation in the formal dairy value chain in a mixed farming systems of Ethiopia.

2.3. Analytical Framework of the Study: Pro-poor Domestic Dairy Value Chain

The analytical framework of the study was built up on a combination of theoretical, conceptual, empirical and contextual literatures discussed above. It has been constructed based on the Global Value Chain (GVC) analysis framework (Gereffi et.al. 2016) and Kaplinsky et. al. (2002) value chain framework. However, it has been extended based on (UNIDO 2011 ; Mitchell et al. 2002; Generic et. al. 2002; CARE 2008; Haggblade et.al. 2012) pro-poor GAFVC frameworks. As discussed above Kaplinsky et.al. (2002) identified that there is a need to identify the point of entry to identify which chain is subject of inquiry that depends on the research objectives for the value chain analysis and; they identified ten possible points of entry inclusive of smallholder farmers. In our case smallholders were the subject of enquiry that mainstreamed smallholder to analyze the structure, dynamics and impact of dairy value chain in two selected districts in highland mixed farming system of Ethiopia. The framework is largely based on the pro-poor

GAFVC approach that shaped to fit into national context of DDVC. The absence of export dairy market in Ethiopia, framed our analytical framework to be limited on domestic dairy value analysis. The reason why we used pro-poor GAFVC approach is because as discussed above, linking smallholder to modern global/national agri-food value chain is key pathways to get out of food insecurity and poverty trap in developing countries. However, GVC analysis often overlooks this dimension of understanding (inclusion of smallholder in GVC) and lacks insights into the impacts of value chain integration on poverty. However, different international development organizations such as



DVC*: Dairy Value Chain: SHHs*: Smallholder Households; FNS*: Food and Nutrition Security

Figure 1: Analytical framework of the study

Source: Author's own diagram

UNDIO, USAID, IFAD, FAO, World Bank and so forth developed Pro-poor GAFVC development approach that aimed to understand how to promote smallholders' participation and benefits in agricultural GVC to address poverty and food insecurity in developing countries (UNIDO 2011; Mitchell et al. 2002; CARE 2008; Kherallah et al. 2015; Haggblade et.al. 2012; World Bank 2015). Hence, we discussed above that linking smallholders to a formal dairy value chain is a promising avenue to get smallholder households out of the recurrent food insecurity and poverty

trap in rural Ethiopia. Pro-poor DDVC framework is thus the right approach that we used in this study to analyze the structure, dynamics and impact of dairy value chain. In the formulation of the analytical framework, research questions have paramount significance to determine a guideline for an effective analysis (Creswell 2003). Taking a similar stance, my analytical framework revolves around the main research question of this study, which inquires the following:

How the dairy value chain is structured? What factors affect milk sales decision and formal milk value chain participation choice of smallholder farmers? What is the food and nutrition security impact pathways of smallholders' participation in the formal milk value chain?

The framework is structured into three steps of analyses i.e., structure of dairy value chain, dynamics of smallholders' marketing behaviors in the dairy value chain and food and nutrition security impact pathways of smallholders' participation in a formal milk value chain.

The first step of the analysis was an exploration of how the dairy value chain is structured. It was a combination of qualitative and quantitative mapping analysis to understand three main issues of the dairy value chain structure and character (UNIDO 2011; Gereffi et.al. 2016; Kaplinsky et.al. 2000; Mitchell et al. 2002). First, it looks at input-output structure analysis of formal and informal dairy value chain structures. It tried to understand the vertical structure of the value chain through addressing the following issues: what are main different processes or functions in dairy value chain? Who are key actors involved in these processes and what are activities they do and their relationship along the value chain participants? What are the flows of dairy products and information and, milk volume? What type of business services are supporting the chain? How does the value changes through the chain? It also tried to understand the character of horizontal structure of the dairy value chain in particular the character of farmers' milk output marketing cooperatives and its role in liking smallholder to formal dairy value chain (Gereffi et.al.2016; Mitchell et al. 2002). In the inputs-outputs dairy structure analysis, particular emphasis was given to understand smallholders' dairy production, marketing and processing (value adding) activities of dairy value chain. Second, gross margins distributions along the value chain actors. It tried to understand the cost structures of smallholder dairy production, what gross margins of each actors and how the gross margin distributed along actors in the value chain? And how gross margin share of smallholders' between formal and informal value chain? (Kaplinsky et.al. 2000; Mitchell et al. 2002; UNIDO 2011) Third, understanding of

constraints for pro-poor dairy value chain development in particular for smallholders' participation and benefits in the modern dairy value chain (UNIDO 2011; Mitchell et al. 2002).

The second step of analysis was to understand determinants of smallholders' market participation behaviors in the dairy value chain. We discussed above that pro-poor dairy value chain approach largely focus on understanding of how to promote smallholder participation in a formal dairy chain and, thus in this study we tried to understand factors that determine smallholders' participation in the formal dairy value chain (UNIDO 2011; Mitchell et al. 2002; Haggblade et.al. 2012). In imperfect market environment like Ethiopia, asset poor smallholders faced two challenges in relation to their market participation decisions in the dairy value chain. The first challenge they are facing is participation decision in milk output market- whether to sell their surplus milk output or not. The second challenge is milk market channel choices between formal and informal channels- where to sell their milk, selling milk either to a formal channel or selling to informal channel (Burke 2009; Staal et al. 2006; Boughton et al. 2007). It tried to understand why some smallholder do participate and why other don't participate in milk output market of the dairy value chain? More importantly, smallholders traded their milk either to the informal milk market channel, or traded to the formal milk market channel through farmers' group milk marketing cooperatives. In this study thus tried to understand how the following four major factors influence milk sales decision and formal milk value chain participation choice of smallholder farmers: (1) smallholder households' head demographic characteristic includes age, gender, educational status and dairy business experience; (2) smallholder household asset factors includes number of cross-breed cows owned and costs for oil seeds cakes and wheat barn;(3) transaction costs factors includes distance to milk collection centers, nearest town and asphalt roads as well as collective action through milk marketing cooperatives; (4) access to business support institutional services such as access to credits, distance to veterinary services and numbers of agricultural extension worker work visit to smallholders' dairying (Gebremedhin et.al. 2010; Gebremedhin et.al. 2012) Tegegne et al. 2013; Fischer et. al 2012; Fischer et. al. 2014; Poole et al. 2013; Burke 2009; Barrett et. al. 2010).

The last step of analysis was to understand impact pathways linkages of smallholders' participation in the formal milk value chain and, food and nutritional security. As we discussed above linking smallholders to the formal dairy value chain is a key avenue in improving smallholders' food and nutrition security in Ethiopia through three impact pathways (Hawkes et. al. 2011; Turner et al. 2013; Simons et al. 2005; UNIDO 2011; Mitchell et al. 2002; Miyata et al. 2009; Chege et al. 2015). The first impact pathway is dairy production and productivity

improvement to consumption. Smallholder participation in the formal dairy value food chain provides opportunity for their dairy production and productivity improvement through enhancing their access to dairy production factors and business support services. Smallholder dairy production and productivity improvement has therefore a positive effect on availability sufficient nutritious dairy products food (FAO 2013) and this in turn, it has positive effect on smallholders' household milk self-consumption (Stifel et. al. 2015; Hoddinott et.al. 2013). The second impact pathway is income to food and health care purchasing power (Chege et al. 2015; Miyata et al. 2009; Hawkes et.al. 2011; UNIDO 2011b. Smallholders' participation in the formal milk value chain provides an opportunity of better returns incomes and consequently positive effect on their food and health care purchasing power to improve their food and nutrition status. The third impact pathway is women's empowerment opportunity to improve food utilization (Bolwig et al. 2008; Hawkes et.al. 2011). The participation provides women's economic empowerment opportunity through improving access to women's controlled dairy income. Hence, in rural Ethiopia, women have a leading role in household food allocation and utilization decisions and, women's controlled dairy income largely spends on the household food and health expenditures (Ahmed et al. 2004). Women's dairy income enables that to expedite it on food and health care, thus affecting smallholders' household food utilization diet and health improvement status (Ahmed et al. 2003). However, in our impact pathways study, we were limited to understand the two food and nutritional security impact pathways of smallholders' participation in the formal milk value chain that involves milk production and productivity improvement to milk consumption and dairy income to food purchasing power impact pathways. The milk production and productivity improvement to milk consumption impact pathway thus attempts to understand how smallholders' participation in the formal milk value chain is affecting sufficient milk availability at smallholder's household from their own milk production and productivity improvement and, in turn how it is affecting their household milk consumption. The dairy income to food purchasing power impact pathway also tried to understand how the participation is affecting smallholder' income and, in turn, how it is affecting their food purchasing power to access sufficient and diversified food.

2.4. Hypothesis of the study

Based on the research questions stated above the following three hypotheses were formulated and tested:

• Hypothesis 1 - Dairy value chain is predominately traditional and loosely coordinated in the study areas.

• Hypothesis 2 - High transaction costs relates to distance to milk collection center and nearest town are significantly influencing milk sales decisions and formal milk value chain participation choice of smallholder farmers in negative way. Whereas, collective action through milk cooperative is high likely to be a key pathway in linking smallholders to a formal milk value chain.

• Hypothesis 3 - Smallholder's participation in the formal milk value chain is high likely to improve food security and nutritional status of smallholder households.

CHAPTER THREE
METHODOLOGY OF THE STUDY

3. Data and Methods

3.1. Geographic Focus of the Study

This research focus on two districts Bahi-Dar Zuriya and Kimbit from a mixed crop-livestock farming system of Ahmara and Oromia regional states of Ethiopia, respectively. These two learning sites encompass a wide diversity of crops (cereals, and legumes) and livestock holdings (cattle and small ruminants). Crop farming is a dominant agricultural activity in a mixed crop-farming agro ecological zones of the study areas. There are large variations in existing levels of livestock and crop diversification and intensification, as well as level of crop-livestock integration underpinned by factors driving intensification such as agricultural potential, access to available technologies, farmer typologies, demand for livestock products, and integration with markets across the two study areas. Livestock represent the most important livelihood resources in the study area in a number of ways; as a source of draught power, as a means to accumulate capital, as sources of food, as sources of income (through rental), as a buffer in times of stress and as a sign of social status(CSA 2007). Therefore, the following two districts that are situated in different agro ecological zones were areas of learning sites for this empirical study.

I. Kimbibit:

Kimibit district is found in the northwest part of Oromia Regional State of Ethiopia and is located geographically about 80 KMs northwest of Addis Ababa, the capital city of Ethiopia. The total population of the district by the year 2005 is about 74,276; of which (50.1%) are males and (49.9%) are females (CSA 2006). About 86.6% of the population is living in rural areas while 13.4% in towns. The district is administratively divided into 29 rural *kebeles* and two urban *kebeles.* The total size of the district is 752km^2 and has an altitude within the range of 2000-3200masl and agro-ecologically it is generally classified as a highly most (highland). Agriculture in the district is predominantly rain-fed and is largely meher (long-rain) dependent with only one harvest in a year (CSA, 2006).

According to data from Kimbibit District Agricultural Office (2014), livestock sources are cattle (1.51million), sheep (1.06 million), goats (223,245), donkey, horses and mules are 254,553; 107,368 and 3,739, respectively.

FGD discussants reported that smallholder dairying is the second important livelihood activity, next to fattening, in livestock system of the district. The dairy activity is largely depend on local zebu cattle and, is predominately traditional. The district is well known by production of nature (organic) Sheno butter. Sheno is the name of district town and butter produced in this area was named within the name of town.

II. Bahir-Dar Zuria

A mixed farming crop dependent livestock keepers of Bahir-dar Zuria district, is located in west Gojam zone of the Amhara Regional State in northwestern Ethiopia. The total area of Bahir-dar Zuria is 117,414 ha out of which 54,471.76 ha is crop land, 9602.36 ha grazing, 2190 ha forest land, 251 ha is covered with perennials, 23,354 ha water bodies (Lake Tana), 7075 ha is used for constructions, 4375 ha wasteland ha and the rest 1698.24 ha swampy areas. The district characterized agro-ecologically as moist and semi-humid; the annual rainfall is mono-modal and, ranging from 1103 mm to 1336 mm, and the temperature ranges from 19-200C. Topographically, the flat area account for 76 %, mountain and hills 11 % and the valley bottom is 13 %. The district has 40,958 households in which 40,630 are in rural areas and 328 households are found in the urban areas. The district has 32 rural sub-districts (*kebeles*) with population of 182,730 with 93,642 men and 89,088 women (CSA 2009; MoARD 2009).

Agriculture is a predominant livelihood activity in the district. The major farming activity in the district is crop production followed by cattle rearing. Cattle are the most important component of the mixed-farming system in the district (MORAD, 2009). According to the FGD discussant, livestock rearing is lucrative employment for smallholder farmers in the district because demand of livestock is increasing in urban areas for meat and milk with improvement in income and changing dietary behavior for animal protein. The major livestock species kept by farmers in the study area was cattle and the predominant breeds include indigenous Zebu cattle and crossbred (Zebu x Holstein-Friesian) animals. In addition, farmers also own sheep, goats, donkeys and mules.

Smallholder daring is the first important livelihood activity in livestock system of the district. Majority of cow belong to indigenous species were herded for milk purpose. Cows provide the only source of milk whereas milk from small ruminants is not consumed in the area because of cultural taboo. In smallholder dairying, women perform most tasks including milking, barn cleaning, feeding and marketing. Grazing is, however, usually supervised by boys (Tasew et. al. 2009).

The dairy sub-sector in both districts, however, is faced multiple level of constraints such as underdeveloped inputs and services system, traditional production and processing systems, a loosely coordinated informal marketing system and poor infrastructures (Tasew et. al. 2009).

3.2. Research Paradigms Debate: Positivism vs. Constructivism

The research paradigm refers to sets of ideological and philosophical assumptions that provide a conceptual framework for world view that enable us to understand the world or the phenomena around us through conducting an organized study (Creswell 2003). There have been many debates regarding the two research paradigms: positivism vs. constructivism. Positivism is the proponent of quantitative research method approach whereas constructivism is the proponent of qualitative research method. Quantitative research tries to understand the world or subject of enquiry through quantification by generating numerical data and then using statistical model to explain the data. It uses measurable data of defined variables like attitudes and behaviors from sample population to formulate facts through generalization (Tolossa 2006). By contrast, qualitative methods tries to understand the world through interpreting social reality and understanding underlying reasons, opinion and motivation of existing reality. The research question to be investigated and data collection methods to be used in these two methods different as well. Qualitative method focuses on the process of social reality and seeks to answer the why and how questions (Tolossa 2006; Creswell, 2002). Whereas quantitative methods focuses on not process of the reality rather what is happing or what regulate in existing reality and seeks to answer the what, how much/many questions. Survey using structured questionnaire, laboratory experiments and field experiments are data collection tools for quantitative method. Using open-ended and semi-structured questionnaire, by contrast individual interview, focus group discussion and observation are data collection tools for qualitative methods (Tolossa 2006).

For several decades, the debate was so intense between the 'positivist paradigm' and 'constructivist paradigm' (Creswell 2003). Positivism argue that the world phenomena is measurable from the outside by an objective observer. They assume that the researcher views reality as objective and that both researcher and reality are separated. Therefore, they argue that quantitative methods are regarded as the only means of investigation to understand the world phenomena and then disseminate the results. Exclusion of non-measurable world data is thus the major critique and limitation of positivism paradigm (Tolossa 2006; Creswell 2003).

On the other hand, 'constructionists' believe that it is impossible to objectively measure and classify the world. They argue that interpretation of social reality is a dominant means to understand the world phenomena. They argue that qualitative method is the only means to interpret the social world. They assume researcher and reality are inseparable, and therefore researcher perception, relation and interaction with the subject of study is critical for the interpretation. With respect to the logic of inference, positivists base at deduction reason from theory to proof or disproof reality, while constructionist base at induction reason from reality observation to construct theory (Creswell 2003; 2009).

These two extreme philosophical stand of research paradigms limit roles of social and behavioral science research in identifying and solving societal problem by influencing researchers' own philosophical stands. Hence, this gap or limitation leads to the development of new research paradigm, mixed methods and commonly referred to as pragmatism as well. Mixed methods places the research problem as the central focus and use multiple methods in order to understand the problem (Creswell, 2009).

3.3. Mixed method research design

A mixed method approach can refers to "the collection or analysis of both quantitative and qualitative data in a single study in which the data are collected concurrently or sequentially, are given a priority, and involve the integration of the data at one or more stages in the process of research" (Creswell et al, 2003). Literature shows that mixed method has become increasingly popular in social and behavioural science research (Creswell 2003; Tolossa 2006). It place the fundamental research question as the central focus to provide the research design framework for better understanding of how to connect the research question to sampling, data collection, data analysis and interpreting findings.

The general advantage of mixed method is to overcome the limitations of a single design. Creswell (2003) identified four advantages of employing mixed method research: Frist, complementing to strengthen a single method using the result of one method to explain or elaborate the result of another method; Second, offset the weaknesses of a single design by using combining both methods and using the strengths of the other; third, provides opportunity to address multiple research questions and different theoretical perspectives using both methods in a single study; fourth, broadening the potential range of inquiry to be best

understood on complex social phenomena with multi-dimensions and have linkages with a range of variables by using multiple inquiry components.

Creswell (2009) identified five typologies of mixed method but in broad term the typology is divided as sequential and concurrent. The relative emphasis and mix of methods varies from study to study and appears to be grounded in the particular context and purpose of each study. The typologies are:

1. Sequential Explanatory: It is the collection and analysis of quantitative data followed by the collection and analysis of qualitative data. The purpose is to use qualitative results to assist in explaining and interpreting the findings of a quantitative study. Equal priority is given to the two phases and data is integrated during interpretations phase.

2. Sequential Exploratory: It is the collection and analysis of qualitative data followed by the collection and analysis of quantitative data. Equal priority is given to the two phases but priority can be given to either and, data are integrated during interpretation. It used primarily to explore a phenomenon by: testing elements of a theory, generalizing qualitative findings to different samples, development of instrumentation (e.g., using qualitative result develop questionnaire for quantitative survey).

3. Sequential Transformative: Collection and analysis of either quantitative or qualitative data first. The results are integrated in the interpretation phase. The purpose is to employ the methods that best serve a theoretical perspective.

4. Concurrent Triangulation: In this method both qualitative and quantitative data collection and analysis conducted parallel and then integrate results during interpretation phase. Priority should be equal but can be given to either approach. It's primarily use for confirmation, corroboration or cross-validation within a single study.

5. Concurrent Nested: In this method the two data collection methods use concurrently, but one is embedded (i.e., nested) within the other. Priority is given to the primary data collection approach with less emphasis placed on the nested approach. Data are mixed during the analysis phase. It uses to broaden the potential range of inquiry for the research by using multiple inquiry components.

6. Concurrent Transformative: In this method both data type collect in parallel and followed by parallel data analysis of the two data and then integrate the result during interpretation

phase. The primary purpose is to evaluate a theoretical perspective at different levels of analysis.

3.4. The Researcher's Philosophical Stand in Application of Mixed Method in this Study

Creswell identified that the research questions guided us what research design and approach we should use in our research process. (Creswell, 2009). Taking a similar stance, formulation of my research design revolves around the central research question complexity nature of this study, which enquires:

The central research question is how dairy value chain is structured? What factors affect milk sales decision and formal milk value chain participation choice of smallholder households? What is food and nutritional security impact pathways linkages of smallholders' participation in a formal milk value chain?

Dairy VCs operate under the complex and uncertain environment of agriculture and involve actors from different parts of the chain that ranged from pre-production to delivery to the final consumer. The central research question of the research is multiple that dealt with the linkage between dairy value chain and food security, and it that has three different and interlinked questions: how the dairy value chain is structured? What determines smallholder participation in the dairy value chain? And what is FNS effect of participation in the formal value chain? The research focus on a complex topic that needs multidisciplinary and multiple levels analysis approach. Hence the central research questions of the study is multiple that involves both type of questions, qualitative and quantitative. The qualitative type question of the research is how the dairy value chain is structured and; while quantitative type of questions are what determine smallholders' participation in the dairy value chain and what is FNS effects of participation in the formal milk value chain. Addressing these research questions thus required a combination of qualitative and quantitative methods. Studies also shows value chain analysis a complex process that required both qualitative and quantitative analysis to understand structure and dynamics of the value chain. The first two the research question are dealt with the structure and dynamic of dairy value chain emphasizing on smallholder farmers. The first research question enquire to understand how the dairy value chain is structured that involves enquiry to understand the following questions: what are the major process in the value chain? Who are key actors and what are their activities in the chain? How dairy products transacted from pre-production to final end product and then delivery to final consumer? How is the linkage and the

relationship along and between value chain participants, what are profit margins distribution across the chain, what are constraints and opportunities for smallholder participation in the dairy value chain? The second, research question, is dealt with the dynamics of smallholders' market participation behaviour that enquire to understand what determines smallholder' to participate in dairy value chain. It therefore addressing these research questions to understand the dairy value chain structure and dynamics, requires both qualitative and quantitative data from multiple sources. It also requires multiple data analysis that use both qualitative and quantitative data analysis. Using a single method to address these multiple and complex research question leads to incompleteness in understanding of how to promote pro-poor dairy value chain development and on consequence erroneous conclusion/recommendation for policy takeaways. Food security has a multidisciplinary nature and moreover hence, the third central research question of the study focus on food and nutrition security impact evaluation of smallholders' participation in modern milk value chain. It is thus a theory based impact evaluation that required to combine mixed methods of qualitative and quantitative analysis. In the context of the investigation of the complex topic of dairy value chain and food and nutrition security with multilevel analysis, mixed methods was deemed of critical importance for better and comprehensive understandings. Thus, this study adopts a sequential exploratory mixed method design as defined by (Creswell 2003; 2013) was identified as being the most appropriate approach to adopt in this research. Based on case studies of existing dairy chains, the research employed a VC methodology and; it used a sequential exploratory mixed methods that can be represented using the following notation: Qual $\rightarrow$ Quan (Creswell 2009; 2013) to gather and analyses both qualitative and quantitative data. Accordingly, the first step was qualitative data collection and analysis and followed by quantitative data collection and analysis and then result interpretation by mixing the two results (qualitative and quantitative). In this research, priority is given to quantitative method because the research largely based on testing the literatures reviewed above particularly inclusive agri-food value chain theory. In addition, the central research questions are dominated by quantitative questions. The bases for data generation content development differ across the data type. The qualitative data collection was guided by drawing on the literature reviewed above, in particular, on inclusive agri-food value chain theory. Purpose of qualitative analysis were: first, to understand the subject of enquiry phenomena reality in the context of small number of individual in the study areas, i.e. The linkage between smallholders, dairy value chain and food and nutritional security in the two districts; second, to select the study learning sites, and then select the sub-sector food products from livestock sector; third, to formulate hypothesis of the study and; fourth develop questionnaire for survey research. Quantitative

data collection was guided by drawing on both the theory/literatures reviewed and on the qualitative result to proof or disproof the hypothesis through generalizing on sampled population of the study.

3.5. The study process and methodical framework.

The Aim of this study was to understand how dairy value chain is structured, what determines smallholders' participation in the dairy value chain and, what is the food and nutritional security effects of smallholders' participation in modern value milk chain in a case of two selected districts in mixed farming system of Ethiopia. To this end, using VC analysis approach the study applied sequential exploratory mixed methods that can be represented using the following notation: Qual → Quan (Creswell 2013; 2009) to gather and analyses both qualitative and quantitative data. As depicted in fig.2 below, the process of the study has ten sequential stages:

Stage one, literature review analysis: In this phase, a literature review was conducted to provide the context for the research through which the research problem, objectives, research questions, and associated research propositions were developed. The literature review also identified relevant theories such as GVC theory in general and Inclusive agri-food value chain approach in particular that were then used for developing the research design and approach.

Stage two, determining the research design and approach: Based on the central research questions, a sequential exploratory mixed methods that can be represented using the following notation: Qual → Quan (Creswell 2013; Creswell 2009) to gather and analyses both qualitative and quantitative data. However, priority is given to quantitative methods to be used dominantly in this study.

Stage three, a preliminary qualitative analysis using Participatory Rural Appraisal (PRA) survey: It involved a two-step qualitative preliminary assessments. First, a documentary analysis and four key informant individual face to face interviews were conducted with key informants in two selected districts. The first two interviews were with *woerda* agricultural officials and the latter two interviews were with farmers' cooperative leaders in the two districts. The purposes of the assessment were: to select sub sector for the value chain analysis from livestock sector in the two districts and then selected dairy sub-sector, to be an informative pilot study into the overall structure of the selected sub-sector, dairy value chain in the two districts; to select samples of study learning sites from two districts and then purposefully selected rural *kebelles* from two

districts, three from Kimbibit and four from Bahir-dar Zuria; to provide suggestions for potential interviewees for the second phase of interviews and, where appropriate, to support the detailed analysis of the dairy value chain. Dairy subsector importance for the livelihoods of smallholder farmers in the two districts in terms of sources of income, employment opportunity and effects on food and nutritional improvement were the major selection criteria of dairy subsector for the value chain analysis in the study area. Participants for this phase of interviews were selected based on a purposive sampling strategy. Second step of the preliminary qualitative assessment involved four focus group discussions (FGDs), 6 semi-structured interviews and observations in seven selected *kebelles*. Similarly the objectives of this assessments were: to select samples of the study population; to get highlight on the dairy value chain structure, dynamics and its effects on the dairy producers livelihoods and; to formulate hypothesis and then to develop questionnaire for the next survey research (quantitative method). Qualitative data analyzed using content methods.

Stage four, questionnaire development stage: Based on the reviewed literatures and qualitative analysis results, two type of structured questioners one for smallholder household survey and the other one is for milk traders were developed.

Stage five, administration of quantitative surveys: Using structured face to face interview two cross-sectional surveys was conducted to collect primary quantitative data from April 20 to June 30, 2014. A trader's survey was conducted with 60 milk traders along the milk value chain actors that involved milk marketing cooperatives, individual traders, processors and retailers. In addition, smallholders' household survey was also conducted with 333 randomly selected smallholder farmers from learning sites.

Stage six, quantitative data analysis: It involved both a descriptive statistical and regression analyses of the survey data.

Stage seven, analysis of dairy value chain structure: Mixing both qualitative and quantitative result, analyzed how the dairy value chain is structured, and then try to understand: the input-output structure of milk value chain, profit margin distribution along the milk value chain and constraints for pro-poor dairy value chain development.

Stage eight, analysis dynamics of smallholder's market participation behaviors: Using quantitative descriptive and binary logit regression results with qualitative result

supplementation, analyzed determinants of milk sales decision and formal milk value chain choice of smallholder households (see appendix 4).

Stage nine, Analysis of food and nutritional security impact pathways of smallholders' participation in the formal milk value chain: As described in appendix 4 using quantitative descriptive and PSM regression results with qualitative result supplementation, analyzed food and nutritional impact pathways of smallholders' participation in the formal milk value chain. Last stage, summarizing the study, identifying general conclusion and recommendation of the study and finally pointed out how the study makes constitution to theory or knowledge development, methods and practice.

3.6. Sampling Strategies and procedures

Multiple and multistage sampling strategies used to collect qualitative and quantitative primary data. As this study had two components that were sequentially performed, qualitative and quantitative data were collected separately.

I. Sampling strategy for qualitative data: A three stages non-probability purposive sampling used to select participants (sample population of the study) for qualitative analysis. First, two districts and next seven rural *kebelles* selected purposefully as a learning sites. Then, using purposive and snowball sampling techniques, diversified participants purposefully selected for preliminary qualitative analysis. The participants' compromised smallholder dairy producers, official and stuff of district agricultural office, development agents, and milk traders, leaders of milk marketing cooperatives and cooperative unions and experts form NGOs.

II. Sampling strategy for quantitative data: Two formal surveys such as smallholder household and rapid milk market appraisal surveys were conducted to collect quantitative primary data. To select the representative sample of smallholder households and rapid milk market appraisal milk surveys, a multi-stage probability sampling procedure was used for quantitative analysis.

- **Sampling strategies for quantitative data**

A. Sampling strategies for smallholder household survey

A three stage sampling techniques used for household dairy farm household survey (see Table 1 below). First, based on scholar interviews and literatures review, the two districts –Kimbibit from Oromia and Bahirdar-zuria from Amhara Regional State were purposefully selected respectively. Then, consulting with the district agricultural office and extension worker, seven rural *kebelles* (PAs) again were purposefully selected from the two districts as a leaning sites for this empirical study. A list of farm households with at least one milking cow was prepared with the help of Development Agent from each of selected rural *kebelles.* Finally 333 farm sample smallholder households were randomly drawn from a complete list of respective selected *kebelles* in conformity to proportionate to size random sampling procedure. Accordingly 163 smallholder farm households were drawn from Kimbibit districts and the rest, 170 smallholder farm households were drawn from Bahir-dar Zuira district.

Table 1: Sample size and sampling strategy for smallholder household survey

Name of selected districts	Name of selected PAs	Sampling Method for PAs selection	Total No of HHs in each PAs(N)	HHs Sample size in each PAs	Method of HHs sample size selection
Kimbibit	zengo	Purposive	301	55 (16. 5%)	Proportional simple random sampling
	Laye Kombolcha		406	74 (22. 2%)	
	Adadi -Mato		194	34 (10. 2%)	
Bhairdar Zuria	Yigoma Andasa		1693	51(15. 3%)	
	Sebat- Amit		1234	35(10.5%)	
	Robit		1983	59(17. 7%)	
	Wondata		802	25(7. 5%)	
Total			**6618**	**333 (5.04%)**	

B. Sampling strategy for Rapid Milk Market Appraisal (MMRA) survey

Similarly, a two stage sampling techniques used for rapid market appraisal milk traders' survey. First was purposive section of the two districts. In order to select samples of milk value chain actors for the appraisal survey, sample frame was developed using lists from tax and revenue collection and administration offices as well as based on the help of district agricultural offices.

The value chain actors that comprised in the frame were traders, collectors/cooperatives, processors and retailers (involves supermarket, milk bars/shops, hotels and restaurants, cafes, and kiosks). A total of 6 milk traders, 2 from Sheno town and 4 from Bahir-dar city randomly were selected. Milk traders are mobile traders who largely function in the informal milk value chain and they are not registered. From the total of 3 milk collectors/milk marketing cooperatives in the two districts, all the three cooperatives were selected; the two cooperatives are found in Bahir-dar Zuria district and only one cooperative is found in Kimbibit district. From the total of three milk processors who are linked to the study areas milk value chain, all the three processors were selected. Of these three processors, two processors are small-scale processors that found in Bahir-dar city and the other one is large scale processor that found in Addis Ababa. Using random sampling method a total of 48 registered milk retailers were selected from the two districts. The selected samples of milk retailers comprised 12 hotels and restaurants, 12 cafes, 6 supermarkets, 6 Milk bars/shops and 12 kiosks. A total of 60 samples of milk value chain actors were selected using systematic random sampling method from three cities such as Bahir-dar, Sheno and Addis Ababa.

Table 2: Sample size and sampling strategies for rapid milk market appraisal survey

Type of milk traders	**Samples size of each group**		**Total sample size**	**Sampling Method**
	Bahirdar-zuria	Kimbibit		
Local Traders	4	2	6	Random
Retailers	28	20	48	Random
Farmers' milk cooperative	2	1	3	All
Private processors	2	1	3	All
Total	31	29	60	

Table 2. Sampling strategies and samples size for MMRA survey

3.7. Data type and data sources

Hence, the research is based on sequential exploratory mixed method design, both quantitative and qualitative data types were used in the study. To this end, both secondary and primary data sources were used. The secondary data on smallholders' dairy production and marketing activities, the role of smallholder dairying in food and nutritional security, dairy value chain

development, dairy value chain actors, dairy business support services, dairy related policies and programs, milk prices, list of rural *kebelles* and traders, legal requirement to enter milk trading business and population distribution reports used from journals, books, working papers as well as from Central Statistical Authority (CSA), district and zonal planning and agricultural offices, offices of Ministry of Agriculture and LIVES/ILRI project, SNV EDGET projects. Primary data sources largely included milk value chain actors' that comprised smallholder farmers, milk traders, milk cooperatives, milk processors and milk retailers. Dairy business support services providers such as agricultural office and micro credit at district and rural *kebelle* levels were also source of primary data to this study.

3.8. Methods of Data collection

Up on the completion of secondary data collection and analysis, both qualitative and quantitative primary data collected using multiple data collection methods. The data collection methods that used in this study includes Participatory Rural Appraisal (PRA) survey, observation, smallholder household survey and Rapid Milk Market Appraisal (RMMA) survey. The PRA and observation methods were used to collect qualitative data, while smallholder household and RMMA surveys used to collect quantitative data.

I. Participatory Rural Appraisal (PRA) survey: A two sequential PRA surveys were conducted in the sample districts for preliminary qualitative analysis purpose from September, 2013 to November, 2013. The PRA surveys had multiple functions involves: to the select sub-sector for the value chain analysis from livestock sector in the two districts and then selected dairy subsector; to select samples of the study population; to get base line information for the next quantitative analysis on dairy value chain structure, dynamics and its effects on the dairy producers livelihoods; to formulate hypothesis and then to develop questionnaire for the next quantitative surveys. Data collection tool such as individual and group discussion interviews were used in this PRA survey. Using semi-structured face to face key informant interview(see Appendix 6) , 10 individual and 4 group discussions (FGDs) interviews were conducted to elicit qualitative data from the PRA precipitants. The key informant participants involves smallholder dairy producers, official and stuff of district agricultural office, development agents, and milk traders, leaders of milk marketing cooperatives and cooperative unions and experts form NGOs.

II. Observation: both participant and nonparticipant observation methods were used. The researcher acted as a participant observer during the PRA surveys. However, when the two quantitative survey questionnaires administered, the researcher was a nonparticipant observer and therefore was not an active part of the setting in which the behaviors or interactions were observed. The observational method of data collection was used throughout the field work in combination with the other methods of data collection.

III. Smallholder household survey: Using structured face to face interview(see Appendix 8), from April 20 to May 30, 2014 a cross sectional farm household survey was conducted with 333 randomly selected smallholder farm households from the selected samples villages of the two districts (Kimbibit and Bahir-Dar Zuria). Household head or de-facto head of the household of sampled dairy producer households were source of information for the survey. The objective of this survey was to collect quantitative primary data to address the major research questions in relation to smallholder access to dairy value chain marketing activities, and its contribution to the producer food and nutritional security. Information collected in this survey therefore included: general socio-economic conditions, demographic features, the livelihood activities, sources of income and their diversity, ownership and access to different assets, access to public assets and services, access to market and infrastructures, dairy farm productivity, cattle milk output market participation pattern, system and, constraints for market-led smallholder dairy farm development and; food security and nutritional status of the households and their perception on the economics contribution of dairy activities . Before data collection, the questionnaires were pre tested. This led to further revision of these lists to make sure that important issues had not been left out. Enumerators, who were trained on the technique of interviewing for five consecutive days, collected the primary data. Enumerators were with a minimum of 12^{th} grade complete, who had experienced in data collection, and worked with, National statistical offices.

IV. Rapid Milk Market Appraisal (RMMA) Survey: Using structured face to face interview (see Appendix 7), from 20 March to April 15/2015 RMMA survey was conducted with samples of 60 randomly selected milk value chain actors. Sample population for RMMA survey compromised 6 milk traders, 3 milk cooperatives, 3 milk processors and 48 milk retailers. Quantitative data in relation to dairy value chain structures such as major processes, actors and their activities and their relations along the value chain, end market, milk market channels, and mode of transactions, profit margin distributions, constraints and opportunities of value chain development were elicited in this RMMA survey. Similar to smallholder

household survey, before data collection, the questionnaires were pre tested for RMMA survey as well.

3.9. Methods of Data Analysis

A mixed method of data analysis that combined both qualitative and quantitative data analysis methods were used to this study. A multiple data analysis strategies includes contents analysis, descriptive statistical analysis and econometric analysis were used to address the research questions. Frist qualitative data analyzed and followed by quantitative analysis and then interpreted quantitative results with qualitative result supplementation. Data analysis and presentation were accomplished in such a way that they allowed me to properly address the research questions posed in connection with smallholder farmers' access to dairy value chain and food and nutritional security.

I. Qualitative Analysis

Content analysis used to analyze qualitative data. The information gathered from the two PRA surveys, and the review of documents compiled, organized, summarized and interpreted in relation to the contents or thematic areas.

II. Quantitative analysis

In this study, both descriptive statistical and econometric data analyses used to analyze the quantitative data. The primary data collected from the two surveys such as smallholder household and RMMA surveys analyzed and tested using SPSS 20 and STATA13.

A. Descriptive Statistics:

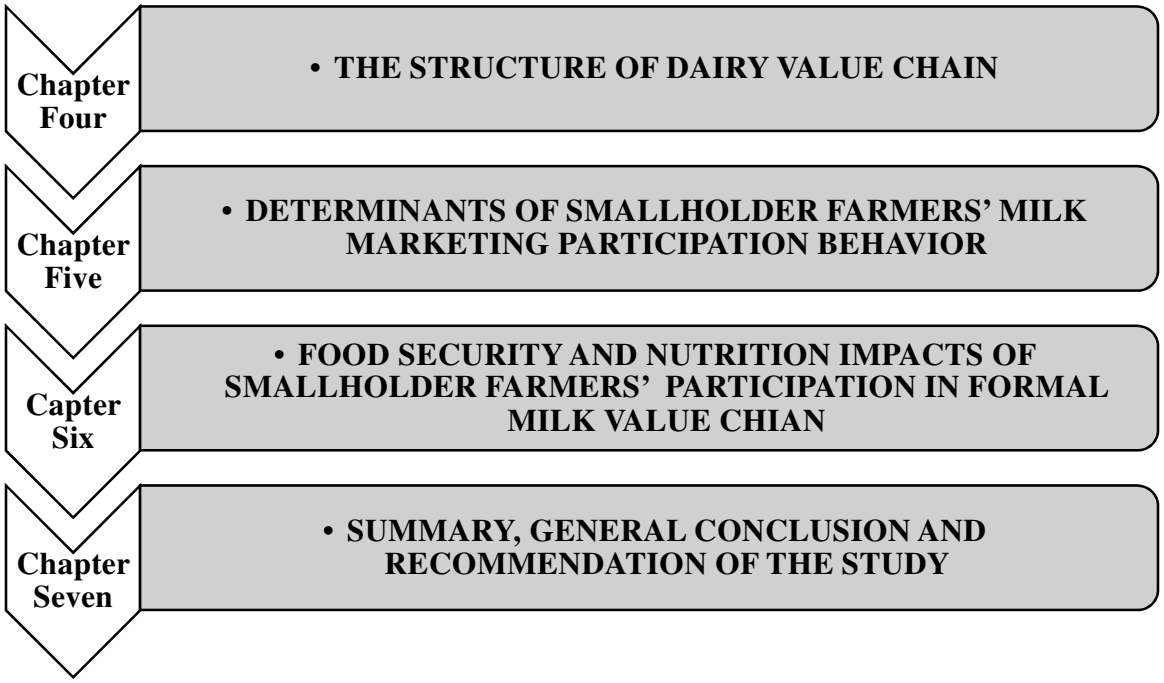
The descriptive statistical tools that employed to this study were means, percentage, frequencies, and standard deviations cross tabulation, as well as T-test and Chi-square test were employed. The degrees of association or correlation between the variables were tested by the use of correlation analysis. In addition because precise costs are frequently difficult to determine in many agricultural marketing chains for the reasons that costs are often cash and imputed, the Total Gross Marketing Margin (TGMM) was calculated (Scott, 1995). It is expressed as a percentage of the difference between end buyer and first seller prices (Mendoza, 1991).

B. Econometric analysis:

Econometrics analysis, using two stage model (Sebatta et al. 2014; Heckman et al. 1998), used to analyze the determinants of smallholder households' decision in milk output market participation and to access alternative milk market channels choices in the fluid milk value chain. Using Propensity Score Matching (PSM) model (Gebrehiwot & Veen 2015), econometric analysis also used to analyze food and nutritional impact pathways of smallholders' participation in a formal milk value chain (see model specifications detail in chapter five and six).

PART TWO

FINDINGS AND DISCUSSION AND, SUMMARY, GENERAL CONCLUSION AND RECOMMENDATION, CONTRIBUTION OF THE STUDY



CHAPTER FOUR
THE STRUCTURE OF DAIRY VALUE CHAIN

4. THE STRUCTURE OF DAIRY VALUE CHAIN

Geday A. Elias[1], Tolossa Degefa[2], Padilla Martine[3], Montaigne Etienne [4]

[1] MOISA, Sup-Agro Montpellier, France; [2]CDS, Addis Ababa University, Ethiopia

[3]CIHEAM Montpellier, France;

[4]MOISA, Sup-Agro Montpellier, France

Abstract

The purpose of this paper was to analyze the structure of dairy value chain in mixed farming system of Ethiopia. Using individual interviews and focus group discussions, qualitative data collected from purposely selected key informants. Using face to face structured interview, quantitative data collected from 60 and 333 randomly selected dairy traders and smallholder households respectively. The sample of dairy traders includes 6 milk collectors, 3 milk cooperatives, 3 milk processors and 48 milk retailers. The result shows that the largest (70%) of sampled smallholders participated in the informal dairy value chain, while 30% of smallholder participated in a formal fluid milk value chain. Butter reached to consumers through informal market channel, while fluid milk predominately channeled to consumer through formal market channel. Collective action through milk cooperative found to be dominant smallholders' milk market strategy in the formal milk value chain. The average annual milk production costs and gross profit of formal fluid milk value chain participated smallholder households were significantly higher by 78.8% and 91% than informal fluid milk participated households respectively. In a formal milk value chain, processors got the highest gross market margin share (54.5%) whereas in the informal milk value chain, producers got the highest (60%) share of gross market margin. Shortage and high cost of feeds, shortage of AI supply, low productivity, insufficient extensions and business support services and high transaction were major constraints of dairy value chains. Generally, the dairy value chain is predominately traditional and loosely coordinated.

Key Words: Actors, smallholders, dairy, value chain, performance, constraints

Résumé

Le but de cette étude est d'analyser la structure de la chaîne de valeur des produits laitiers dans le système d'exploitation mixte en Ethiopie. Des données qualitatives ont été obtenues auprès de répondants de convenance par des entretiens individuels et des discussions de groupes. Les données quantitatives ont été recueillies par des interviews structurées en face à face auprès de 60 commerçants de produits laitiers choisis aléatoirement et 333 ménages parmi les petits exploitants. L'échantillon de commerçants laitiers comprend 6 collecteurs de lait, 3 coopératives laitières, 3 transformateurs de lait et 48 détaillants. Les résultats montrent que la plus grande partie (70%) des petits exploitants de l'échantillon participe à la chaîne de valeur laitière informelle, alors que 30% des petits exploitants sont intégrés à la chaîne de valeur

formelle du lait liquide. Le beurre est vendu aux consommateurs essentiellement par le biais du marché informel, tandis que le lait liquide est principalement acheminé par le circuit formel. L'action collective par le biais de coopératives laitières est dominante dans la stratégie de marché des petits exploitants dans la chaîne de valeur formel. Les coûts de production annuels moyens et la marge brute des ménages de petits exploitants participant à la chaîne de valeur formelle du lait liquide sont significativement plus élevés de 78,8% et 91% que ceux des ménages intégrés à la filière informelle. Dans la chaîne de valeur formelle, les transformateurs ont la plus grande part de la marge brute du marché (54,5%), alors que dans la chaîne de valeur du lait informel, c'est le producteur qui obtient la part la plus élevée (60%) de la marge brute du marché. La pénurie et le coût élevé des aliments pour animaux, la pénurie de l'offre des autres intrants, la faible productivité, l'insuffisance des services de vulgarisation et des services de soutien aux entreprises et des coûts de transaction élevés sont les principales contraintes des chaînes de valeur des produits laitiers. En général, la chaîne de valeur des produits laitiers essentiellement traditionnelle et peu coordonnée.

Mots clés: acteurs, petits exploitants, produits laitiers, chaîne de valeur, performance, contraintes

4.1 Introduction

A vibrant dairy sub-sector is important for the economic development of Ethiopia. Dairy offers a pathway out of poverty for a large number of households keeping livestock. Ethiopia has huge untapped potential for market-oriented smallholder dairy development; with 30 million genetically diverse cattle population, suitable agro-climate for dairying (Ahmed et al. 2004), and potentially large and growing market for dairy products. Commercial smallholder dairy development in the country can be an effective pathway out of rural poverty. However, the potential has not been fully exploited (Ahmed et al. 2003).

Dairy production system can be categorized into traditional (dominant in the rural area) and modern production systems. The traditional smallholder dairy makes up the largest (98%) part of the dairy production system, includes subsistence mixed crop-livestock, pastoralist and agro-pastoralist systems. The modern production system includes small scale production systems, and commercial private urban and peri-urban production (Ahmed et al. 2004; Yilma et al. 2011).

The traditional butter processing at smallholder household level is dominated dairy processing system that processed 95% of milk that producing in traditional production system. (Gebiremedhen et. al.2014). On the other hand, modern processing system processed only 5% of milk that supplying from both formal and informal milk market channels. It includes both small and large scale modern processing industries and, producing dairy products such as

pasteurized milk, cheese, flavored yoghurt, table butter and creams (Tegegne et al. 2013; Dayanandan 2011; Tefera et al. 2008; Seifu et. al 2014; Ahmed et al. 2004).

The dairy marketing is also predominately traditional and poorly coordinated. It involves direct sales from producers to final consumers or indirect sales through market intermediaries. The formal marketing system, which usually serves the urban/peri-urban consumers, involves organized milk collection, processing and distribution (Ahmed et al. 2004; Yilma et al. 2011). 95% of the national milk is marketed through informal channels and is unprocessed. The traditional processing and marketing of dairy products, especially traditional soured butter, dominate the Ethiopian dairy sector. Only 5% of the milk produced is marketed as liquid milk due to underdevelopment of infrastructures in rural areas. The rural smallholder farmers provides the largest bulk of milk (98% of the total liquid) both to the formal and informal marketing system. The rest 2% of liquid milk supplies from small and large scale commercial producer in pre-urban and urban areas. Collective action, through smallholder farmers' marketing cooperative, is dominant vertical integration mechanism of smallholder farmers in to formal dairy value chain. (Francesconi 2009; Debele et. al. 2014).

Women play an important role in dairy activities dealing with production management, transformation and marketing. Identifying and supporting the roles, decision-making and capabilities of women as cattle owners, processors and users of dairy products are key aspects to promote women's economic and social empowerment and consequently a rural women's ability to break the cycle of poverty and food insecurity (Yilma et al. 2011).

The dairy value chain in Ethiopia is constraints by poor input supply, subsistence production with low productivity; traditional marketing system; limited access of smallholder farmers to formal value chain due to factors relates to high transaction costs and poor infrastructures and; poor business support services, traditional processing with poor value addition and shortage of large modern processing industries, quality problems and adulterations and; poorly coordinated. On the other hand, growing demand of dairy products due to urban population and middle income growths and; favorable agro climate zone and government policies and programs are the major favorable enabling business environment that provides opportunities for the dairy value chain development in the country (Kuma 2012).

Vale chain analysis has a paramount important for policy uptakes that promote pro-poor value chain development (UNIDO 2011).Value chain encompasses the full range of activities and services required to bring a product or service from its conception to sale in its final markets—

whether local, national, regional or global (Generic et. al. 2002). The Global value chain approach analyze the structure and dynamics of the global industry (Gereffi et. al. 2016; Kaplinsky et. al. 2000). The structural analysis examines core functions/processes and activities, added values, actors, information flows, business support and enabling environments, and resource allocation from the inception of a product/service to the final delivery and final disposal of after use stages of the value chain industry. It also involves the examination of economic gain or profit distributions along the value chain actors and, identification of the vertical and horizontal structure of the value chain (Kaplinsky et. al. 2000; Gereffi et. al. 2016).

The core processes or functions of dairy value chain includes input supply, production, processing, marketing/distribution and consumption. Actors who perform these core functions of the dairy value chain includes input suppliers, producers, processors, collectors and retailers, and consumers. Power relationship along these key actors are critical for sustainable dairy value development (Kaplinsky et. al. 2000). The dairy value chain also includes business support services such as technical support (extension) and financial services (credit). The role of these business support providers is also important for the value chain development.

To enhance the contribution of dairy subsector for rural development and food security in Ethiopia, it is important to understand how to promote inclusive dairy value chain development that involves smallholder farmers' participation. To this end, pro-poor dairy value chain analysis is important in better understanding of constraints of smallholder framers' participation and benefits in a formal dairy value chain. Empirical evidence shows GAFVC approach is provides a framework for better understanding on how the value chain is structured (Mitchell et al. 2002; UNIDO 2011; Generic et. al 2002). Because, the approach using smallholder farmer as an entry point/focal point, gives better understanding on the input-output structures of the value chain, economic gain distribution along the value chain and constraints of the value chain to develop upgrading strategies for pro-poor dairy value chain development (Mitchell et al. 2002; Generic et. al. 2002; CARE 2008; Kherallah et al. 2015).

However, there is a dearth of information on how the dairy value chain structured (Seifu et. al. 2014). Most of previous empirical studies are predominately limited to smallholder dairy production and market participation issues (Yilma et al. 2011a; Kumar et al. 2014; Zuria et al. 2009; Ahmed et al. 2002; Tefera et al. 2008) The purpose of this study was thus to add values to these empirical research gaps through analyzed the structure of dairy value chain.

4.2. Methodology

4.2.1. Samples, Method of data collection and source of data

Both primary and secondary data were used in this study. A combination of different techniques was applied to collect the data required to analyze the dairy value chain in the two districts (Kimbibit and Bahirdar-zuria). Frist, Desk review was conducted to collect secondary data, Next PRA was administered with purposefully selected participants. Using semi-structured face to face key informant interview, 10 individual and 4 group discussions (FGDs) interviews were conducted and qualitative data collected from the PRA precipitants. The key informant participants involved smallholder dairy producers, official and stuff of district agricultural office, development agents, and milk traders, leaders of milk marketing cooperatives and cooperative unions and experts form NGOs.

Next, using structured face to face interview, smallholder household survey was conducted with 333 randomly selected smallholder farmer households from the two districts. The collected quantitative household survey data includes: general socio-economic conditions, demographic features, the livelihood activities, sources of income and their diversity, ownership and access to different assets, access to public assets and services, access to market and infrastructures, dairy farm productivity, cattle milk output market participation pattern, system and, constraints for market-led smallholder dairy farm development.

Then using structured face to face interview, RMMA survey was conducted with 60 randomly selected dairy traders in the two districts. Sample population for RMMA survey compromised 6 milk traders, 3 milk cooperatives, 3 milk processors and 48 milk retailers. Quantitative data in relation to dairy value chain structures such as major processes, actors and their activities and their relations along the value chain, end market, milk market channels, and mode of transactions, profit margin distributions and constraints of value chain development were elicited in this RMMA survey.

4.2.2. Method of data analysis

The data which were collected during the PRA survey, RMMA and farm household surveys were analyzed using both qualitative and quantitative methods. The qualitative data collected from PRA survey were analyzed using a thematic analysis approach. Quantitative data were analyzed using the descriptive statistical analysis, and accounting method was also used to

calculate the distribution of costs and margins along fluid milk value chain. Throughout interpretation of the results, both qualitative and quantitative results were complemented each other.

4.2.3. Analytical framework

The study focuses on was an exploration of how the dairy value chain is structured. Value chain approach was employed to assess the dairy value chain structures in the two districts (Kimbibit and Bahirdar Zuria). It was a combination of qualitative and quantitative mapping analysis to understand three main issues of the dairy value chain structure and character includes input-outputs structures, performance of the dairy value chain and constrains of dairy value chain (UNIDO 2011; Gereffi et.al. 2016; Kaplinsky et.al. 2000; Mitchell et al. 2002).

The framework is structured in to three steps of analyses: The first step was mapping the input-output structure of formal and informal dairy value chain structures. It tried to understand the vertical structure of the value chain through addressing the following issues: what are core functions in dairy value chain? Who are key actors involved in these functions and what are activities they do and their relationship along the value chain participants? What are the flows of dairy products and information and, milk volume? What type of business services are supporting the chain? How does the value changes through the chain? It also tried to understand the character of horizontal structure of the dairy value chain, in particular, the character of farmers' milk output marketing cooperatives and its role in liking smallholder to formal dairy value chain (Gereffi et.al.2016; Mitchell et al. 2002). In the inputs-outputs dairy structure analysis, particular emphasis was given to understand smallholders' dairy production, marketing and processing (value adding) activities of dairy value chain. The second step was fluid milk value chain performance analysis. Using simple accounting method, it was calculated the milk production costs, gross profit and the share of gross market margin along the value chain actors. It tried to understand what gross profit margins of each actors and the share of gross market margin distribution along actors in the value chain? And how gross profit margin and gross market margin share of smallholders' between the formal and informal value chains? (Kaplinsky et.al. 2000; Mitchell et al. 2002; UNIDO 2011). The third step was understanding of constraints for pro-poor dairy value chain development (UNIDO 2011; Mitchell et al. 2002).

4.2.4. Model for Milk Value Chain Performance Analysis

Accounting method was used to analyze the performance of fluid milk value chain. Two step process was conducted to analyze the marketing performance of dairy value chain includes gross profit analysis through milk production cost analysis at smallholder level and marketing margin analysis at each node of the fluid milk in the area studied.

1. Smallholders' Gross Profit Margin Analysis

Smallholders' gross profit margin is the difference between annual revenues which calculated as milk quantities sold X selling price per litter and the sum of annual production cost incurred in milk production.

Annual milk revenue calculated by multiplying the quantity milk sold by price per litter sold as shown in the following formula (Garoma et al. 2013; Kuma 2012):

$TR_i = QMS_i \times SPL_i$ ..... (i)

Where;

TRi= Total annual revenue of smallholders earned from milk sales
QMS_i = Annual Quantity milk sold
PSU_i = Sold Price per Liter

Total milk production costs is the sum of costs incurred in one year includes cost for fodder, concentrate feeds, veterinary and transport as shown in the following formula:

$TPC_i = FFC_i + CFC_i + VC_i + TC_i + CPRC_i$ ..... (2)

Where,

TPC_i = Total milk production costs of smallholders
FC_i = Fodder Feed costs
CC_i = Concentrate Feed costs
VC_i = Veterinary Costs
TC_i= Transport Costs
$CPRC_i$ = Crop reside costs

Smallholders' gross profit margin in their milk marketing was calculated by subtracting the estimated total milk production costs from total milk revenue as shown in the following formula:

$SGPM = TR_i - TPC_i$ ..... (3)

Where,

SGPM = Smallholders' Gross Profit Margin
TR_i = Total Revenue of smallholder
TPC_i = Total production of smallholder
i= 1–nth smallholder dairy producers

2. Marketing Margin Analysis

Estimates of the marketing margins are the tools to analyze performance of market. Marketing margin was calculated by taking the difference between producers and retail prices. The producers' share is the commonly employed ratio calculated mathematically as, the ratio of producers' price to consumers' price. Mathematically, producers' share can be expressed as (Kuma 2012):

PS = PP/RP ..... (1)

Where:

PS= producer's share

PP = producer's price

RP= retail price

Calculating the total marketing margin was done by using the following formula. Computing the Total Gross Marketing Margin (TGMM) is always related to the final price paid by the end buyer and is expressed as a percentage (Kuma 2012):

TGMM = EP-PP/EP X 100 ..... (2)

Whereby:

TGMM = Total gross marketing margin

EP = End market price

PP = producer's price

To find the benefit share of each actor the same concept was applied with some adjustments. In analyzing margins, first the Total Gross Marketing Margin (TGMM) was calculated. This is the difference between producer's (farmer's) price and end market price (price paid by final consumer) i.e.

TGMM = End market price – Farmer's price ……. (3)

Then, marketing margin at a given producer/processor/traders/retailers stage 'i' (GMMi) was computed as:

GMM_i = SP-PP/TGMM X 1000 …….. ……. (4)

Whereby: SP_i is selling price at i^{th} link and PP_i is purchase price at i^{th} link.

4.3. Results and Discussion

4.3.1. Mapping input and output structures of dairy Value chain

4.3.1.1. Mapping core functions, actors and activities of the dairy value chain

A systemic diagram representing the dairy value chain at Kimbibit and Bahir-Dar Zuria sites and charted based on information gathered in the course of the field study is presented in Figure 3. At both sites, there are five segments/core functions in dairy value chain includes: input supply, production, marketing (Distribution), processing and consumption in the formal dairy value chain. However, there are four core functions in the informal dairy value chain includes input supply, production, marketing and consumption. The key actors along the chain include input suppliers, producers, milk cooperatives, milk processors, collectors, retailers and consumers.

1. Input supply /business support services/ segment

Input supply and preparation is one of the core functions in dairy value chain of the two districts. Inputs supply is a business support function that provide all necessary inputs and services for dairy production functionality. The inputs supply considered here include feed supply, breeding services, veterinary services, and credit and extension services.

I. Feeds supply service

The availability of feed resources and the nutritional quality of the available feeds are the most important factors that determine the productivity of dairy production. Both type of feeds,

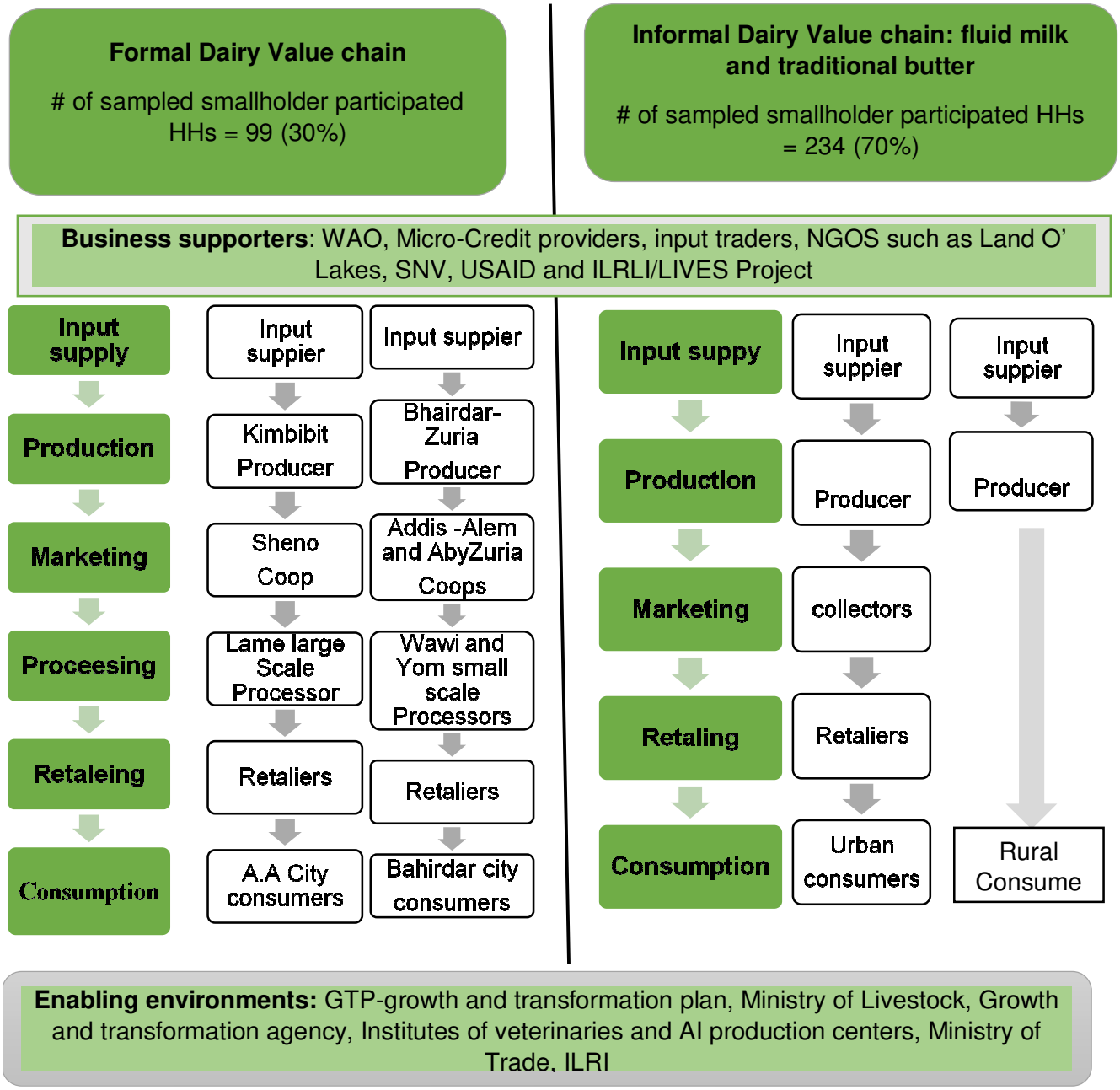


Figure 2: Mapping the dairy value chain structure of the study areas

Source: The study survey

conventional and non- conventional feeds are provided and supplied in the two districts. The conventional feeds that are provided and supplied in the study areas includes open grazing,

hay, crop-residue, improved forage and concentrates. Concentrates feeds are provided by mixing industrial by-products, such as wheat bran and oilseed cakes. According to FGDs findings, *Noug* oil seeds cake is the major concentrate ingredient used as protein supplement in dairy production. However, there is high supply and quality shortage of concentrate feeds.

Cereal based straws such as straw of *teff*, wheat, barely, field pea and chick pea are commonly available crop residue feeds for dairy farmers in the study area. FGDs data shows cowpea, lablab and elephant grass are common improved forage supplied in the study areas. *Attela* is a non-conventional feeds largely available in the study area. It is a by-products of locally produced traditional beer that produced at household level.

The study data showed sources of dairy feeds in the study area are three includes on-farm production, purchased and aid or support in form of seed for forage development. The data shows smallholder farmers themselves, private traders, government agricultural offices at district and *kebelle* levels, private traders, small scale oil and flour processing mills, private traders, farmers' cooperatives and NGOS identified as major feeds suppliers in the study areas. The study data shows smallholder farmers acquired concentrate feeds only through purchasing while self on farm production is their only source of open grazing feeds in the study areas. Table 4.1 shows smallholders' sourced the other feeds such as crop residues, hay, *attella* primarily through self-own on farm production and then through purchasing from other farmers in time of shortage. Forage is sourced from self-own on farm production, however government agricultural office and NGOs provided forage seeds free of charge for smallholders' farmers.

As shown in Table 3, major dairy feeds suppliers to smallholder farmers includes five in the chain actors groups; namely:

1. Individual traders

Individual traders are the largest supplier of concentrate feeds (69%) and they used open market at different local and town level market centers as market outlet for the feed transaction with smallholder farmers.

2. Small scale oil and flour processing mills

They are the second concentrate feeds supplier that account 28% of the total supply. They produced and a supplied oil seeds feed cakes and cereal crops by-products but they are very few. They also used open market at their food processing plant as market outlet for their feeds transaction with smallholder farmers.

Table 3: Sources of dairy inputs percentage distribution for smallholder surveyed households

Inputs type	Sourced of inputs					
	Own on farm production	From other farmers	District agri. office	Individual traders	Food processor and milers	Coops
Open* grazing	100%					
Hay	92%	8%				
Crop residue	95%	5%				
Improved forage	100%					
Concentrates				69%	28%	3%
Attela	76%	24%				
AI			100%			
Bull	30%	70%				
Drugs			31%	69%		

* Open grazing is largely depend on communal grazing land and private grazing land

Source: the study survey

3. Farmers' group milk marketing cooperative

Farmers' group milk marketing cooperative is also the other small suppliers of concentrate feeds that supplies only 3% of the total supply. According to the FGDs, only one cooperative that found in Kimbibit supplies concentrates to its members based on credits. The cooperative buying the feeds from large scale food processing plants found in Addis Ababa capital city and then using its store as market outlet, supplies to its members. However, the supplies face irregularity and shortage problems due to high increment of the feeds price and financial shortage.

	Input Supply	Production	Distributing	Processing	Retailing	Consumption
Actors	-Smallholder dairy farmers -WAO - Individual traders -Food processing plants	- Smallholder farmers	-3Farmers' group milk marketing coops	-Lame processing plant in Addis Ababa -2 small scale processors	-café and restaurants - supermarket -milk kiosk bar -kiosk	-urban consumers at A.A, Bahirdar and Sheno
Activities	Supply of: -AI -Bulls -Feed includes concentrates -Forage seed and -Vet drugs -Credit	-cow rearing -feeding -Milking	-Collecting -Quality control -Bulking - Transporting -Delivery to processors	-Milk chilling - Pasteurization -Packaging -Products making -Quality assessment	-Selling - Transporting	- consumption

Figure 2: Mapping of core functions, actors and activities in the formal milk value chain

Source: study survey

4. Smallholder farmers

The data shows smallholder farmers produced feeds such as hay, crop residue and *attellla* primary for their dairy farming and supply the surplus to the other nearby smallholder farmers who face feeds shortage.

They are thus both buyers and suppliers of these feeds in the study areas. Farm gate is the major market outlet for smallholder feeds supply. The study shows that smallholder accessed improved forage , open grazing,, crop residue, hey and *attella* feeds largely from their own on farm production with the respective percentage of 100%, 95%, 92% 76%.

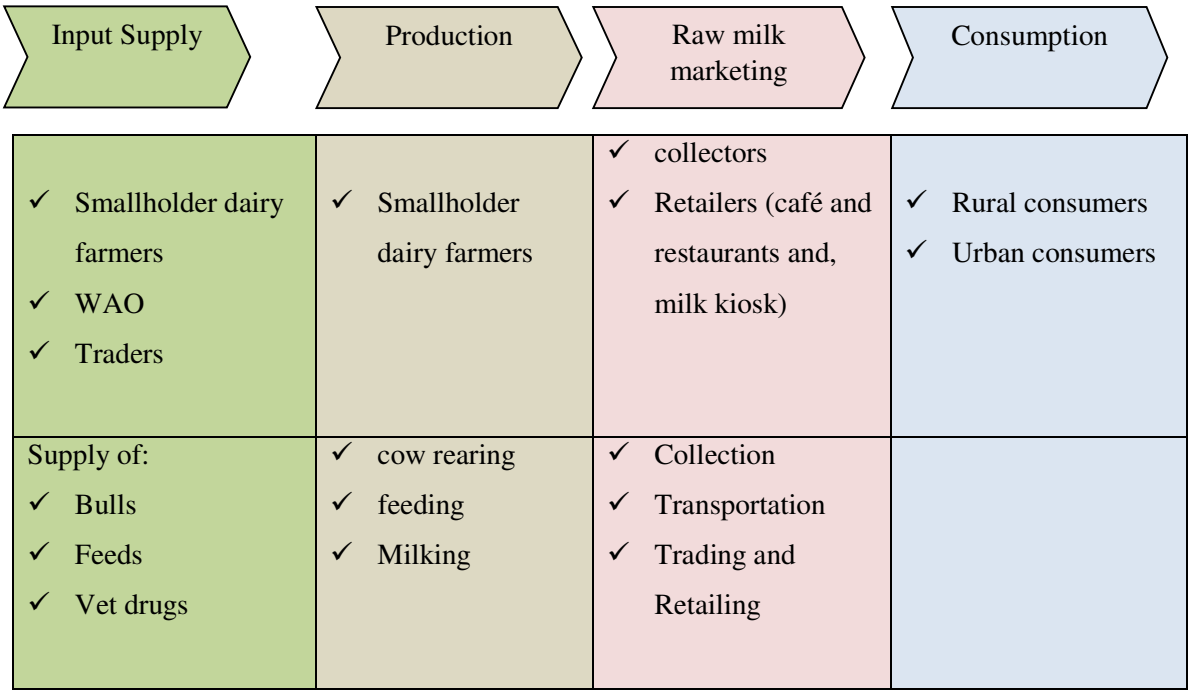


Figure 3: Mapping of core functions, actors and activities in the informal milk value chain

Source: Author's survey

5. Government agricultural offices and NGOs

FGDs result showed that through its agricultural extension program, the agricultural office at district and rural *kebelle* level are irregularly supplies forage seeds to smallholder farmers with free of charge in the study areas. International NGOs such as SNV in kimbibit district and Land O' Lakes in Bahir-dar Zuria also provides an irregular forage seeds support to smallholder farmers.

In short, the study showed that the feeds supply system in the dairy value chain dominated by informal and loosely organized. The feed supply transactions between smallholders and traders totally depend on spot market whereby traders have been setting the price and exercised

opportunistic behaviors. Because, there is no feeds quality controlling institutions and quality standards and supply shortages. It thus the relationship between smallholders and feed traders is very week and competitive, and in turn it may adversely affect for sustainable smallholder participation in the dairy value chain.

II. Breeding services

FGDs data showed that there are two type of breeding services includes bull and Artificial Insemination (AI) services. There is no formal institution/ individual who provides bull services in the study area, rather the services is informal whereby smallholder farmers use their network to find better breed near to their living area and use the bull service with free of charge. Regarding the provision of artificial insemination (AI), first, AI produced at government AI production centers of Amahara and Oromia regions and, distributed to government agricultural office at district level. AI produced by combining semen from exotic, indigenous, as well as, crosses of these breeds, Holstein-Friesian indigenous bulls used and producing improved IA at regional government AI production center. Then through its agricultural extension services, district agricultural offices supply to smallholder dairy producers with free of charge in the two districts. However, FGDs result showed that the AI supply is not regular whereby farmer that could satisfy their demand. On the other hand, there is no any private commercial or development institution who are engaged in AI provision in the study area. Government agricultural offices at both district and rural *kebelle* level thus are the only key player in AI provision services. As table 3 showed, the proportion of farmers' currently using bull and AI services from the total sample households are 71 % and 29% respectively. The data showed very small number of smallholders used AI services. This shows that there is high shortage of AI services in the study area that, in turn, adversely affecting smallholder milk productivity and production and their market orientation in dairy value chain as well.

III. Veterinary Service

Improving dairy animal health services is one of the keys to successful dairy value chain development. FGDs data shows public veterinary services provided by government agricultural offices at district and *kebelle* level are key dominant players in the provision of veterinary services in the study area. The veterinary services outlets are veterinary clinic and animal health post located at district and rural *kebelle* levels respectively. In each district of the study area, there is one veterinary clinic located in the district's town. With regard to animal health post distribution ratio at *kebelle* level, one animal health post served for three *kebeles* in each district.

This means smallholders have to travel long distance such as an average of 1.4 hours and 0.45 hours walking time to get access to veterinary clinic and animal health posts respectively. The distributions of veterinary experts to smallholder dairy farmers is very low. The veterinary clinic in Bahirdar-Zuria district has one veterinarian and three animal health expert, and only one animal health extension worker for each health post in the district. Similarly, the veterinary clinic in Kimbibit has two veterinarians and three animal health expert, and only one animal health extension worker for each health post in the district. This means that 2 veterinarians in Kimbibit and one veterinarian in Bahirdar-Zuria districts serving 10,000 and 8,050 smallholder households respectively.

Reports of the key informant interview showed that the type of veterinary services provided by the government agricultural office includes provision of training and awareness on animal health management, vaccination, treatments, drug supply and consultancy. With regard to private traders' role in veterinary services provision, however, the PRA result showed that private traders' role have limited to drug supplies in the two districts. Using their own drug supply shops as market outlets located in district towns, licensed individual traders supplies drugs for smallholder famers. In addition to licensed individual drug suppliers, however, illegal and unlicensed drug supply and animal health treatments services have been also practicing in kimbibit district, and hence, this adversely affected animal health and dairy value chain development in the study areas. Except in drug supply there is no thus any private commercial and development organizations who provides veterinary services in the study area. The result showed private trader are the largest (61%) drug supplier and followed by public veterinary clinic and animal health post (39%). Of the total sampled smallholder households, largest number of smallholders' households (89%) use drugs in their dairy production.

IV. Agriculture extension services

Agricultural extension services provision is dominated by government agricultural office at district and rural *kebelle* level in the study areas. The livestock department of the agricultural office is the responsible body for animal extension services including dairy extension services provision both at district and rural *kebelle* level. The department led by one head manager and three experts includes veterinary, feed and business development experts. At rural *kebelle* level, there is one animal extension worker for each *kebelle* and one animal health extension worker for the three *kebelles*. The major animal extension services provided by government agricultural office at district and rural kebelle level includes services of veterinary, feeds and forage seeds supply, AI supply, training and awareness creation on animal production managements and

small business development and managements. However, the study data showed that government animal extension services provision coverage has limited to small proportion of smallholder farmers. Of the total sampled households, 31%, 5%, 29%, 24% and 40 % of smallholders' farmers reported that they have used the government animal extension services of technical advice, market information, AI, forage seeds supply and capacity building trainings respectively (see table 4 below).

The role of developmental organization in dairy value chain development

Developmental organization particularly international NGOs have significant role in dairy value chain development of the study area in addition to government agricultural extension services roles. The PRA survey result showed that international NGOs such as ACDI/VOCA-USAID, SNV and Land O' Lakes provides technical training and material support to smallholder farmers' group milk marketing cooperatives in the two districts. ACDI/VOCA-USIAD donated the following equipment to Abay-Zuria and Addis-Alem milk cooperatives: deep freezers, electric cream separator machine with capacity of 125 liters per hours, Bajaja taxi cars, lactometers and milk shop containers. In addition, ACDI/VOCA provided milk handling training to the cooperatives leaders'. Similarly, Land O' lakes and SNV NGOS material and technical supports that provided to the two cooperatives in Bahirdar-Zuria and one in Kimbibit districts includes: milk shop containers, lactometers and forage seeds we well as training on dairy animal husbandry managements, milking and milk handling and elementary financial managements. The PRA survey result shows that these NGOs supports is one of the key driver for smallholders' transformation into market-oriented dairy production through attracting smallholders to join milk marketing cooperatives in Bahir-Dar Zuria district. In short, there is a supportive relationship between developmental organizations and milk cooperatives and thus developmental originations has been playing significant role in dairy value chain development of the study areas.

Table 4: Proportion of sampled smallholders who used different government agricultural extension services

Did the extension services of your *District* and kebelle have offered you----? 1=Yes 0= No		
Services	Response: Yes in percent	No response in percept
Technical advice	31%	69%
Market Information (input or/and output)	5%	95%
Credits	0%	100%
Farm equipment	0%	100%
Improved breeds	0%	100%
AI	29%	71%
Forage seeds	24%	74%
Capacity building training	40%	60%

V. Credit services:

Financial capital is one of key inputs in dairy value chain development and credit service is major key source of finical capital. The study data showed that the government micro institution at district level is the dominant credit providers for smallholder farmers. However, the household survey result showed that the largest number (86%) of sampled smallholders' households were not used the micro credit services. Respondents of smallholders' sampled households reported that collateral requirements for the credit service was their main reason that impeding smallholder to get access to the credit services. In addition to the government micro credit services, Sheno milk marketing cooperative provides credit services in Kimbibit district.

2. Production segment

Milk production is the second segment or function in dairy value chain process (CARE 2008). The milk production system in the study areas structured in to three includes rural smallholder traditional/subsistence production, rural smallholder market-oriented production, and urban small scale commercial production. Smallholder dairy farmers are the major actors who perform most of the milk production functions in the value chain right from farm inputs preparation on their farms or procurement of the inputs from other sources to post harvest handling and marketing. The major production functions that dairy producers perform include rearing and calving, feeding, milking and supplying.

Feed resources commonly used by smallholder dairy producers in the study area with the respective percentage includes open grazing, crop residue hey, *attella*, improved forage and concentrates 95%, 92%, 88%, 78%, 41% and 34% (see table 5 below).

Table 5: Proportion of sampled smallholder households who used different dairy inputs

Input type	**Proportion of smallholder who used the inputs**
Open grazing	95%
Crop residue	92%
Hay	88%
Attella	78%
Improved forage	41%
Concentrates feeds	34%
Cross breed cows	33%
AI	29%
Bulls	71%
Drug	89%
Credit	14

The herd structure and composition per household in the study area are indicated in table 6. The average cow holding per household in the study area was small, 1.92. The major type of breeds cow kept by farmers in the study area was indigenous Zebu cattle and crossbred (Zebu x Holstein-Friesian) cows. The mean numbers of local and crossbreeds cow owned per family in the study area of sampled households were 1.78 and 1.86 respectively. The average size of local and crossbreed cow ownership across formal and informal milk value chains participated smallholder households were 1.04 and 1.94 and 1.83 and 0.63 respectively. Similarly, in technology adoption behaviors between formal and informal milk value chains participated households were significantly different. That is, almost 100% of households in the formal value chain adopted crossbreed cows, whereas only 5% of households operating in the informal value chain adopted the crossbreed cows in the dairy business. The survey data showed that there was also a significance difference in terms of concentrate feed utilization between the formal and informal milk value chains participated households. Almost all households operating in the formal value chain were used concentrate feeds but only 3% of households with informal value chain participants were used the feeds. As result, the daily average milk yield between formal and informal milk value chain participated is also significantly different. That is, households in the formal milk value chain produced an average of 11 liters per day; whereas households in the

informal chain average daily milk production is 3 liter only. The average milk yield per cow/day across cross and local breeds' cows were 5.5 liters and 1.45 liters respectively. There is, however, seasonal variation in milk production, the lowest being between February and May and the highest between October and December. Smallholder households marketed their milk through both formal and informal channels.

Table 6: The herd structure and composition per surveyed smallholder household.

Type of breed	Formal Milk Value Chain Participated Mean	Informal Milk Value Chain Participated Mean	Total Mean
Local Cows	1.04	1.83	1.78
Crossbreed cows	1.92	0.06	1.86

Source: authors' survey data

Traditional hand milking is the major type of milking practices in the two districts. Milking is usually under the control of women. As key informant of FGD pointed out, cows were milked mostly twice a day. There were no differences among rural *kebeles* and gender of household heads in the frequency of milking of cows during the wet and dry seasons. However, as FGD discussant indicated that milking frequency decreases from twice into only onetime milking/day for local breed cow.

In short, the largest number (70%) of sampled smallholder households were subsistence/traditional dairy producers. These subsistence producers primarily produced milk for their own household consumption and marketed the surplus through informal market channel either in form of fluid milk or after processed into butter. On the other hand, the rest (30%) of smallholders households were market oriented who's primarily milk production purpose was for market. The resource allocated in their dairy production was thus significantly different between smallholders' households with and without formal milk value chain participation. As we discussed above the participated households made higher specific investment on inputs such as invested to buy crossbreed cows and concentrate feeds than non-participated households and hence they were better off in milk production volume than non-participated households.

3. Marketing/Distribution/ segment

Milk and milk products marketing/distribution is the third core function in the dairy value chain process (Dries et al. 2009). It is the process of collecting, bulking, transporting and trading and retailing milk and milk products from smallholder producer and passing through different chains and channels to the end market consumers. Milk and milk products channeled to consumer in the study areas through formal and informal dairy market systems. The milk and milk products marketing/distribution process in the study areas structured in to three major activities includes collection, trading and retailing. Accordingly the key actors' players of these major activities includes milk marketing cooperatives, traders and retailers.

I. Milk marketing cooperatives

Empirical studies shows that smallholder farmers are marginalized in formal agricultural value chain participation because their capacity are limited to meet the entry points of the value chain (Yilma et al. 2011; Dayanandan 2011). Smallholders face economic scale constraints in their input and output marketing activities and, this in turn, adversely affects the quality and quantity of their production outputs. Hence, due to these economic scale constraints, downstream buyers' preferred to source out from large scale commercial producers and, hence, excluded smallholders from the formal value chain (Francesconi et. al 2007; Fischer et. al. 2012). However, studies show that collective action through smallholder farmers' group cooperative is a key pathway to link smallholder farmers to formal agricultural value chain. Because collective action could provide an enabling environment for smallholders through: reduce transaction costs in their input and output market, create access to market information, increase their barging power (Fischer et. al. 2014) and facilitate other marketing activities (Francesconi et. al 2007). Smallholder farmers' group marketing cooperative is one form of collective action whereby smallholder farmers voluntarily organized for the common purpose of collectively marketing their agricultural products for better profits gain.

There are three smallholder farmers' group milk marketing cooperatives in the study areas of the two districts. The two cooperatives namely Bahir-dar Zuria and Addis-Alem milk marketing cooperatives found in Bahir-dar Zuria district, while Sheno milk marketing cooperative found in Kimbibit district. Sheno milk cooperative, which is located in Sheno town 60 Km from the capital city of Addis Ababa, was established in 2004 by 20 volunteers and currently its members reached 127. Currently, the cooperative collected 1200 liters of milk per day from its members and supplies to Lemme (Sholla) milk processing company.

The two cooperatives in Bahir-Dar Zuria district were established consequently. First, Addis-Alem milk cooperative, which is located 22 km from Bahir Dar town, was established in 2004. It had 27 smallholder farmers founding members with 3000 Birr gross capital of establishment and currently the number of members reached 55. Abay-Zuria milk cooperative, which located 7 km from Bahir-Dar city, was established in 2005. It had 21 founding members with 2500 Birr gross capital of establishment and the currently its members increased to 56. Currently the two cooperatives, Addis-Alem and Bahir-Dar Zuria collected an average of 190 liters and 220 liters volume of milk per day and, then supplies to Yom and Wawi small scale dairy processors respectively.

The cooperatives major activities in the dairy value chain of the study areas includes milk collecting from the cooperatives members (smallholder farmers), controlling the milk quality during collection, bulking, transporting and supplying the collected milk to milk processing firms. In addition to the above collective milk supply provision services, the services provided by the cooperatives to its members includes: market information, consultancy and training facilitates. More importantly, Sheno cooperative provides credit and credit based concentrate feeds supply services to its members.

Milks are collected from the cooperative's milk collection centers located to near to smallholders' living areas. However, it is smallholders' responsibility to supply their milk product to milk collection centers which takes them an average of 33 minutes walking from their farm gate. With regard to the distribution of milk collection centers across the cooperatives, Bahir-Dar Zuria and Addis-Alem cooperatives have 6 and 3 milk collection centers, whereas Sheno has only one milk collection center which is located in Sheno town. Unlike the two cooperatives in Bahir-Dar Zuria district, Sheno milk cooperatives in Kimbibit district has very small number of smallholder farmers (25%) members and the rest members (75%) are urban commercial small scale producers. This is because Sheno cooperatives has not established any rural milk collection centers in Kimbibit district, although it is smallholder based cooperative. According to the key informant interview, good governance constraints at the cooperative and the cooperative union levels is the main reason for failed to established rural milk collection centers in kimbibit district. It is thus in kimbibit district access to formal milk value chain limited to smallholder who are livening near to Sheno town. Of the total formal milk value chain participated sampled households, it is therefore, and very limited (7.6%) smallholders in Kimbibit accessed formal milk value chain. This call for intervention either to establish a new purely smallholder based

cooperatives or support Sheno cooperative to establish rural milk collection centers in the district.

Mode of milk transaction between smallholder and milk cooperatives and, between the cooperatives and dairy processors or downstream actors across the three cooperatives are similar. There is trust based written contractual relationship between smallholder and milk cooperatives whereby smallholders officially registered with registration payment as a regular members of the cooperative, and agreed to supply their milk regularly with expected quality and in return smallholder has the right to get the services of the cooperative. Pricing strategy is largely based on pre-determined price set based on the market assessment collective decision. Mode of payment is credit based whereby smallholders get their milk sells payment in every 15 days. In case of Sheno milk cooperatives, smallholder supplies their milk twice per day, early morning (7:00—7:30 A.M) and late afternoon (4:00-4:30 P.M). Whereas, in case of Bahir-Dar Zuria and Addis-Alem milk cooperatives, smallholder supplied their milk onetime in day, early morning (7:00 – 7:30 A.M). According to FGDs discussants, the main reason for the two later cooperatives in Bahir-Dar Zuria district collected milk from smallholder only onetime in a day is because the processors (buyers) have limited processing.

Similarly, there is also written contractual agreement between milk marketing cooperatives and dairy processors (buyers) whereby cooperatives agreed to supply milk daily with expected quality. In the agreement, price of the milk has been also set based two parties agreed market assessment information. The processors also confirmed in the agreement about on time payment and not to refuse the supply without the contractual agreements. The life span or the duration of the contract however varies across the three cooperatives. In case of between Bhair-Dar Zuria cooperative and Wawi processing firm and, between Sheno cooperative and Leme processing company, the life span of the contract is for one year and, with possibility of renewal that based on mutual agreement of the two parties (suppliers and buyers). Whereas, the contractual agreement between Addis-Alem milk cooperative and Yom processing firm is subject to renewal for every three months. This may be both an opportunity and risk for smallholder farmers. Because, it is risky from market security perspective in which smallholders or the milk cooperative may face challenges to secure market if the buyer is refused to renew the contract. On the other hand, it may bring opportunity for smallholder from price perspective given high price increment of milk and milk products at major regional cities. According to key informant interview, this short term contractual agreement was initiated by the Yom milk processor. Hence, there are very few milk processors, major milk buyers in the study area, milk

processing firms' are the leading firms' who have better market power in the dairy value chain of the study area. It is thus the supply relationship between Addis-Alem cooperative and Yom processor seemed to be competitive whereby Yom dairy processor showed some opportunistic behavior which might adversely affect smallholders' sustainable participation in the formal milk value chain. On the other hand, PRA survey showed that there is collaborative relationship between Bhair-Dar Zuria cooperative and Wawi dairy processing firm and, this in turn, it have a positive effect on smallholders' sustainable participation in the formal milk value chain. The survey result showed that Wawi dairy processor provides financial incentives through covering the cooperative monthly milk transportation costs amounted 3,500 Birr. But there is no any either technical or financial support provided by the other milk processors to the other two cooperatives, Sheno and Addis-Alem. In short, the three smallholder farmers' group milk marketing cooperatives are a key players in linking smallholder farmers to the formal milk value chain in the two districts.

II: Collectors

The survey results showed that collectors are major actor who play a key role in fluid milk and butter products distribution in the informal dairy value chain of the study area. Collectors who involved in fluid milk distribution, they used two channels to distribute the fluid milk: from smallholder farmers directly to urban consumer through door to door selling, and from smallholders to retailers. While collectors who involved in butter value chain distribution, they used 2 channels to distribute butter in the traditional butter value chain: from smallholder to retailer/butter shops at district town, and from smallholder to wholesaler in Addis Ababa. Hence all collectors' in the dairy transaction are based on spot market transaction, it is thus they have very week relationship with their transaction parties. However, there is no any collectors who involved in fluid milk distribution in the formal milk value chain of the study areas.

III. Retailers

Retailers are also the other key players in both formal and informal dairy value chain of the study area. The survey result showed that retailers in the informal fluid milk value chain includes hotels and restaurants, cafes and milk shops. They sourced fluid milk from traders and sell it to the customers after upgrading the fluid milk in to boiled milk, macchiato, yogurt at sheno town, Bahir-Dar and Addis Ababa cities. Retailers in the informal butter value chain are butter shops that they buy butter either from collectors in Sheno and Bahir-Dar city, or from wholesaler in Addis Ababa and, sell it without any upgrading process to the consumer in their retailing shops

at Sheno town, Bahir-Dar and Addis Ababa cities. Retailers in the formal fluid milk value chain includes hotels and restaurant, cafes, super market and mini-supermarket, kiosks and milk shops. Supermarket, mini-supermarket, milk shops and kiosks in Addis Ababa largely sourced pasteurized packed milk from Lame (Sholla) milk processing and sell it to consumers without any upgrading process in their retailing outlet at Addis Ababa. In addition they sourced other dairy product lines such as cream, ice-r-cream, cheeses, table butter and floured yogurt. While, hotels and restaurant in Bhair-Dar, Gonder and Mekelle sourced different forms of cheeses from Wawi milk processor at Bhair-Dar city and used it for their Pizza retails business. Hotel and restaurants, cafes and pastry shops at Bahir-Dar city sourced dairy products such as table butter, cream and cheese from Yom dairy processor. In short, spot market is a dominant transaction mode between dairy retailers and milk processors/wholesaler whereby the processors/wholesalers set the product selling price.

4. Processing segment

Milk processing is the fourth key process of dairy value chain. It is the act of converting milk into milk products such as butter, cottage cheese, ghee, skimmed milk, among others. The survey result showed that dairy processing function structured in to two in the study areas includes traditional dairy processing at smallholder household level and modern dairy processing at firm levels.

I. Traditional milk processing

The survey result showed that traditional milk processing practiced at rural smallholders' household level using naturally fermented soured milk to produce traditional butter. According to FGD results, women mostly the housewives are responsible and key players for traditional dairy processing at rural household level. The traditional dairy processing has three steps. The first step is milk accumulation and soured milk formation: because of smallholders' household daily milk quantity production is low, women accumulated the daily milk produced in a clay pot between 4 to 5 days and allowed to sour naturally. The second step is churning process: after sufficient milk has been collected and soured, manually churned the sourced milk by shaking the pot in backward and forward movement direction to produce traditional butter. The main purpose of churning is to extract the fat from soured milk and then produce the traditional butter. The third step is cottages cheese processing: after extracted the fat milk and produced traditional butter, the liquid that remains, buttermilk, is heated in a clay pot and is allowed to cool down and then produced cottage cheese (locally known as *ayib*).

The survey result showed that the traditional dairy processing has a maximum of 11 litters of milk processing capacity per churning and almost all (95%) of the sampled smallholder's households used from 6 to 11 liters milk per single churning process. Accordingly, the amount of butter produced by smallholder per churner ranged from 200 to 500 grams. The survey data showed that the amount of milk that sampled smallholder households used to produce 1 kg butter is ranged from 17 to 19 liters of milk and they used and average of 17.5 liters of milk to produce 1 kg of traditional butter. Traditional dairy processing is time consuming that takes from 1.5 to 2 hours per churning process.

The survey result showed that almost all (91%) sampled households practiced traditional dairy processing to produce butter and cottage cheese from the milk produced in the house in the study area. Smallholder household who were participated in the traditional milk processing activities across Kimbibit and Bhir-Dar Zura districts were 96 % and 87%, respectively. This show that traditional butter production is a dominant product segment in the dairy value chain of the study area.

II. Modern dairy Processing:

The modern dairy processing activities in the two districts is structured into large scale and small scale processing that include one large scale and two small-scale processors. Lame (Sholla) dairy processing is located in Addis Ababa and it is the second large scale dairy processing industry in Ethiopia. The processor has a maximum of 60, 000 liters of milk processing capacity per day, however because of supply constraints currently the processor is operating at less than 50% of its capacity. Pasteurized half liter milk packed by plastic packets is a dominant product line that the industry distributed to costumers in Addis Ababa through retailers. The processor is producing and distributing additional dairy product lines to customers in Addis Ababa such as ice-cream, table butter, flavored yogurt and different forms of cheeses. Sheno milk marketing cooperative from Kimbibit district, 80 KM from Addis Ababa, is one of raw milk supply source of Lame processor. Based on their contractual agreement, currently the processor receiving an average of 1, 200 liters of milk per day from the cooperative. The other two small-scale dairy processors are Wawi and Yom dairy processors and they are located in Bahir-Dar city, 650 Km from Addis Ababa. Bahir-Dar Zuria milk marketing cooperative is the only milk supply source for Wawi processor with an average supply of 220 liters of milk per day. While Addis-Alem and Bahir-Dar city milk marketing cooperatives are the only sources of milk supply for Yom dairy processors with an average supply 190 and 100 liters of milk per day respectively. Wawi processor primarily engaging in dairy processing business to produce

different forms of cheeses for own pizza business and to distributed different forms of cheeses to other pizza retailers at Bahir-Dar, Gondor and Mekelle cities. On the other hand, Yom processor produced table butter, cream and cheese dairy product lines and distribute to the retailers such as hotel and restaurants, cafes and pastry shops at Bahir-Dar city. Spot marketing is a typical form of dairy transaction between dairy processors and dairy products retailers in the study area.

6. Consumption segment

Milk and milk products consumption is the last segment in the dairy value chain process. Hence the study is focused on domestic value chain, there are two types of end market or consumer in the dairy value chain of the study area: Rural and urban consumers.

I. Rural Consumers

Rural smallholder farmer households are the largest rural consumer of dairy products in the study area. Rural dairy products consumptions are limited to raw milk, natural fermented milk (ergo), traditional butter, cottage cheese *(Ayib)* and whey (*arrera*). Rural consumer have no access to modern dairy products such as pasteurized milk, yogurts, cheese and creams. According to the FGD with key informants, in the mixed production system of the study area milk was the primary dairy products for formal milk value chain participant households. While, butter was the primary product for non-participant households, and next to butter. Cheese is also the second primary dairy product. According to key informants of the FGD, the priority to milk consumption is given to children, wife's, husband and then for guests, sequentially. Survey showed that of the total daily milk produced by informal dairy value chain participated sampled households, small portion (19 %) of fluid milk used for household consumption. Similarly, of the total processed butter by smallholder in the informal value chain, 38% used for household consumption. On the other hand, of the total milk produced by formal milk value chain participated households, very small portion (1 %) milk is used for household consumption. Of the total processed butter by formal milk value chain participated sampled households, the largest (80%) used for household consumption. The survey showed that of the total supplied milk by informal value chain participated sampled households, the amount of fresh milk and traditional butter supplied to the local rural end market were only 2 % and 38% respectively. It is because rural households' dairy products consumptions are largely depend on from their own on farm production and, moreover, dairy demand is much lower in rural area than urban areas. This shows smallholder households with participation in the formal milk value chain are

significantly lower in their fresh milk and butter consumption than smallholder households with participation in the informal dairy value chain.

II. Urban Consumers

Milk and milk products channeled to urban consumers at Sheno town, Bair-Dar and Addis Aababa cities through formal and informal marketing system. Dairy product consumption in urban areas classified in to two: direct consumption without adding to other food stuffs and indirect consumption as supplementary food by adding the dairy products in to other food stuffs. Dairy products such as raw milk, fermented milk (ergo), and pasteurized milk are directly consumed without adding into other food stuffs. Whereas, traditional butter and cottage cheese (*Ayib*) dairy products are indirectly consumed by adding in to other food stuffs as supplementary and flavored ingredients. It is therefore, urban people in Sheno twon, Bahir-Dar and Addis Ababa are major end market urban consumers of dairy products. However, due to absence of large scale processors, pasteurized milk distribution is limited only to Addis Ababa consumers and hence, consumers at Bahir-Dar city and Sheno town have no access to pasteurized milk. The survey result showed that 33% sampled smallholder households supplied their milk to urban consumer. Of the total daily milk produced by the formal milk value chain participated households, the largest portion of milk (93 %) supplied to urban consumers. Whereas, of the total dairy milk produced by the informal milk value chain participated households, very small portion (3%) supplied to urban consumers. Similarly, of the total traditional butter supplied by informal butter value chain participated households, the largest (65%) supplied to urban consumers in the areas studied. This shows that dairy products consumption is higher in urban consumer than rural consumers in the study areas. This may be associated to factors such as urban consumers have better income and knowledge on nutritious value of dairy products than rural consumer do have. In addition, the sampled household end market segmentation strategies across urban and rural consumers, there is difference between smallholders households operating in the formal and formal milk value chains. Smallholders operating in the formal milk value chain supply strategy is fully targeted to urban consumers, whereas, smallholders operating in the informal milk value chain supply strategy is targeted largely to rural consumers and then urban consumers. This is because, due to its better quality and with more value added, milk and milk products channeled through the formal value chain are expensive that cannot afford by rural consumers.

4.3.1.2. Smallholders' market participation in dairy value chain

The survey result showed that of the total sampled households (n=333), 65%, 5% and 30% smallholder households were participated in informal butter value chain, informal fluid milk value chain and formal fluid milk value chain respectively. This shows that the largest (70%) sampled smallholder's households were depend on informal marketing system whereby these smallholders' farmers participated in informal dairy value chains. Whereas, small portion (30%) of sampled smallholders have access to formal milk value chain. Of the total fluid milk output participated smallholder households, the largest (86.1%) smallholders participated in the formal fluid milk value chain, while the rest (13.9%) participated in the informal fluid milk value chain in the study areas.

4.3.1.3. The Proportion of Milk Production, Processing and Consumption of Smallholder Households

The survey results showed that informal milk value chain participated smallholder households produced an average of 3 liters milk per day, out of which the largest (76 %) processed in to traditional butter, while only 19 % of fluid milk used for own household consumption and the small amount (5%) marketed. Of the total processed butter by smallholder in the informal value chain, the largest (62%) marketed and the rest (38%) is used for household consumption. On the other hand, formal milk value chain participated households produced an average of 11 liters of milk per day, of which the largest (93%) of fluid milk marketed to urban consumers, 1 % of milk used for household consumption and 6 % of milk processed in to traditional butter. Of the total processed butter by formal milk value chain participated sampled households, the largest (80%) used for household consumption and small amount (20%) marketed. Of the total supplied milk by the informal value chain participated sampled households, the amount of fresh milk and traditional butter supplied to the local rural end market were only 2 % and 38%, respectively.

4.3.1.4. Structure of Dairy Value Chain Marketing Channels

The dairy value chain of the study area structured in to informal and formal dairy value chain:

1. Informal dairy value chain marketing channels:

Informal dairy value chain refers to a dairy marketing system whereby milk and milk products channeled to consumer either directly from smallholder producers to both urban and rural consumers or indirectly through one more intermediaries. The survey result showed smallholders in the informal value chain are subsistence farmers in which they supplied the

surplus of their dairy production to both rural local and urban end market. In this system, the core value chain processes such as input supply, production, processing and distribution dominated by traditional system. This system is characterized by low quality and quantity of milk production, no license to operate and low cost of operation as compared with formal dairy value chain. Based on the dairy product lines, the informal dairy value chain structured in to fluid milk and butter informal value chains.

I. Fluid milk informal value chain marketing channels:

The survey result showed that fluid milk supplied to both rural local and urban end market consumers using two the following informal milk market channels:

Table 7: Informal market channels for fluid milk in the study areas.

Channels	Actors	% milk supplied
Channel 1	Smallholders → local rural consumers	2 %
Channel 2	Smallholders → local collectors → retailers(Hotel and res→ urban consumers	3 %

Source: Author's survey data

As shown in above table 7, the first channel is direct supply whereby fluid milk supplied directly from smallholder to local rural consumers. In this channel, smallholder directly supplies to the neighbor smallholders. The volume of fluid milk supplied by sampled smallholder to the local rural consumer was very low (2%). The second fluid milk channel in the study area is indirect whereby fluid milk supplied to urban consumer through two intermediaries. First, smallholder supplied the fluid milk to local collectors, and local collectors to retailers such as hotel and restaurants and cafes; and then retailers to consumers. The volume of fluid milk supplied from sampled smallholders households to urban consumers was very low = 3%.

II. Informal value chain marketing channel for traditional butter:

The survey result showed that traditional butter supplied to both rural local consumer and urban consumer using the following four informal market channels:

As shown in table 8, of the total butter supplied by the sampled households, the direct supply from smallholder to rural consumer was small (15%), while the largest butter supply (50.9%) channeled to urban consumers in Addis Ababa passed through three intermediaries. That is, from smallholder in Kimbibit district to butter collectors at district level, and from collectors to wholesalers in Addis Ababa, next from the wholesalers to butter retailers shop in Addis Ababa, then from retailers to Addis Ababa consumers. The sampled smallholder households butter supplied to urban consumers higher by 20% than butter supplied to rural local consumers. That is, of the total butter supplied, 70 % supplied to urban consumers while 30% supplied to rural local consumers. This is associated with the factors that rural consumers dairy product supply largely depend on from their own on farm production and, moreover, the demand of dairy products in rural areas much lower than the demands in urban areas.

Table 8: Informal market channels for traditional butter

Channels	Actors	% butter supplied
Channel 1	Smallholders → local rural consumers	15.1%
Channel 2	Smallholders → local collectors → local rural consumers	14.4%
Channel 3	Smallholders → local collectors → retailers/dairy shops→ urban consumers	22.6 %
Channel 4	Smallholders → collectors → wholesaler→ retailers/dairy shops→ urban consumers	50.9 %

As shown in table 8, of the total butter supplied by the sampled households, the direct supply from smallholder to rural consumer was small (15%), while the largest butter supply (50.9%) channeled to urban consumers in Addis Ababa passed through three intermediaries. That is, from smallholder in Kimbibit district to butter collectors at district level, and from collector to wholesalers in Addis Ababa, next from the wholesalers to butter retailers shop in Addis Ababa, then from retailers to Addis Ababa consumers. The sampled smallholder households butter supplied to urban consumers higher by 20% than butter supplied to rural local consumers. That is, of the total butter supplied, 70 % supplied to urban consumers while 30% supplied to rural local consumers. This is associated with the factors that rural consumers dairy product supply largely depend on from their own on farm production and, more over the demand of dairy products in rural areas much lower than the demands in urban areas.

The survey result so far thus showed that in the informal dairy value chain of the study area, the volume of butter supplied by smallholder farmers significantly higher compared to the volume of fluid milk supplied. This is associated with the perishability risk of fluid milk and traditional butter. Hence fluid milk is highly perishable product, it needs modern market system whereby there is secured market for supply with modern, on time and safe distribution. However, most (70%) of the sampled smallholder farmers have no access to this modern marketing system. But, traditional butter have longer shelf life than fluid milk that can stay up to two months without any freezing material. The largest (65 %) smallholders thus preferred to process the milk in to traditional butter to get better shelf life so that they could marketed in the informal market.

2. Fluid milk formal value chain marketing channels:

Formal milk value chain channel in this study refers to a formal dairy marketing system whereby distribution of milk and milk products involved market oriented smallholder producers, licensed actors, and quality standards, horizontal and vertical integration and, formal controlling system (Yilma et al. 2011). The survey result showed that of the total sampled households, the small numbers (30%) of smallholders were participated in the formal milk value chain. Urban traditional and modern dairy retails market consumers are the end market of the formal value chain of the study area. Milk and milk products channeled to urban consumers through the following channels (table 9):

Table 9: Fluid milk formal market channels

Channels	Actors	% butter supplied
Channel 1	Smallholders →1 cooperative → Lame L. S. processor → traditional retailers (kiosk, hotel and restaurants, cafes) → urban consumer in A.A	8%
Channel 2	Smallholders →1 cooperative → Lame L. S. processor → modern retailers (upper market, supermarket and min-supermarket) → urban consumer in A.A	
Channel 3	Smallholders → 1 cooperative → Wawi S. S. processor → traditional retailers (hotel and restaurants, pizza house) → urban consumer in Bahirdar, Gonder,	45. %
Channel 4	Smallholders → 1 cooperative → Yom S. S. processor → traditional retailers (hotel and restaurants, pizza house) → urban consumer in Bahirdar,	39%

Source: Author's' survey

The survey result showed that of the milk supplied to the formal milk value chain by smallholders, only 8% supplied to Addis Ababa consumer through two formal market channel:

the first channel is from Kimbibit district smallholders to Sheno milk marketing cooperative, next from the cooperative to Lame large scale dairy processors, next from the processor dairy products such as pasteurized milk, flavored yogurts, table butter, creams channeled to urban consumers in Addis Ababa either through traditional retailers (involves hotel and restaurants, cafes and pastry shops) or through modern retailers such as hypermarket, supermarket and mini-super market. While, of the total milk supplied by sampled smallholders, the largest (92%) milk supplied to Bahir-Dar, Gonder and Mekelle urban consumers from smallholder in Bahir-Dar Zuria distrect through two channels: channel 3 is from smallholder at district level to Abay-Zuria milk cooperative, from the cooperative to Wawi small scale processor, from the processor to traditional retailer and then to urban consumers in Bahir-Dar, Gonder and Mekelle cities. Channel 4 is from smallholder to Addis-Alem cooperative, from the cooperative to Yom small scale processor, and then to traditional retailers and finally to consumers. The survey result presented above table 7 showed that smallholders' participation in the formal milk value chain varies across the two districts whereby the participation of smallholders' famers in kimbibit district was much lowered by 800% compared to the smallholders' participation in Bahirdar-zuria district.

4.3.1.5. Dairy Products Market Outlets

The survey result showed that market outlets for smallholders' dairy product supply in dairy value chain of the study areas includes milk collection centers, farm-gate and local market centers.

I. Milk Collection Centers

Milk collection centers are the major fluid milk market outlet for formal milk value chain participated smallholder households. All smallholders who are participated in the formal milk value chain supplied their milk to milk marketing cooperative at milk collection centers. Milk marketing cooperatives established milk collection centers near to the vicinity areas of rural smallholder farmers, and collect milk from the smallholder farmers at the milk collection centers. Of the total fluid milk output market participated sampled households (115), the proportion of direct sales to cooperative using milk collection centers as market outlet was highest (86.1%) in the study areas. The milk collection point average walking distance from farm gate is 33 minutes. This result thus show that a milk collection point is a predominant milk market outlet for smallholder farmers' fluid milk supply in the formal milk value chain in the study area. Hence, this predominant market outlet is provided by dairy cooperative, it is, therefore, possible to

argue that smallholder farmers' milk marketing cooperatives hold a key position in prompting market-oriented milk production system and pro-poor dairy value chain development in the study area.

II. Farm-gate

The survey result showed that farm-gate is the predominant fluid milk market for informal milk value chain participated smallholder farm households. Of the total smallholders households participated in milk output market (115), very small proportion (13%) of sampled smallholders used farm-gate market outlet for their fluid milk supply.

III. Local Market Centers

Local market centers are the major traditional butter market outlets for all informal butter value chain participated sampled smallholder farmer households. Local market centers are an open weekly market in most rural areas of informal marketing system of Ethiopia. The local market centers that used for smallholder farmers' traditional butter supply outlets with their respective distance from Bahir-Dar city were Tiss-abay, Zegae, Qimbaba and Feres-Waga and *30***,** 28, 14 and 35 km respectively. On the other hand, local market centers such as Hamus-Gebiya, Qidame-Gebiya, Keto/Segno-Gebiya, Chacha/Makisegno-Gebiya and Ginager with their respective distance of 7, 0, 17, 25 and 40 km from Sheno town are the major weekly local market centers that used for traditional butter market outlets in Kimbibit district.

4.3.1.6. Quality Standards and Quality Controlling System of the Dairy Value Chain

I. Quality standards

The PRA survey result showed that there is no any formal standards sets for the dairy products in the dairy value chain of the study area. However, there is informal standards for traditional butter product in the informal dairy value chain of the study area. This informal quality standards set predominately based on the geographical origin of the butter. The PRS survey result showed that informal brand name has been given to the traditional butter product based on the origin of the butter and graded accordingly. Accordingly traditional butter such as Ginager, Kotu and Sheno have been graded as first, second and third rank of butter in the traditional butter value chain respectively and; their price sets based on their grades. Sheno butter is an informal national first rank brand for the traditional butter in Ethiopia. According to FGD descants, the reason behind this origin/geographical based quality standards of traditional butter is

associated with factors of agro-climatic zone of dairy production area that determine dairy feeding system and quality. Hence, subsistence smallholder dairy production is largely depend on natural pasture and crop residue feeding system, agro-climate is a key factor to get quality and sufficient feeds and, in turn, it determines the milk quality. It is, thus, these particular areas such as Ginager, Kotu and Sheno may have more favorable agro-climatic zone for dairy cattle rearing and feedings. However, this informal quality standards needs further research that focus on historical development, nature, characters, patters, determinants and effects.

II. Dairy products quality controlling system

The survey result showed that only in the formal milk value chain that formal milk quality control is practicing in the study area. The formal milk quality control predominately is practicing at upstream stage of the formal milk value chain. Smallholder farmers' group milk marketing cooperatives control the milk quality when they are collected from smallholder farmers at milk collection centers. During the collection, milk cooperative conducted instantaneous milk quality tests using of lactometer and lacto-scan. Chemical composition (fat and water) content were the major milk quality criteria to accept or reject the milk, if the density and fat content of milk as found below the standard, raw milk is subject to rejection. However, Key informant interviews with milk cooperatives reported that the rejection rate is very low in all sampled milk marketing cooperatives.

On the other hand, the survey result showed that there is no any formal quality control or assessment in the informal value chain for butter and fluid milk products in the study areas. Simple mechanical observation and smell test are the only quality measurement mechanisms in all stags ranged from upstream supply to retailing in the informal value chain. It is thus according to PRA survey result adulteration is a critical problem in both informal fluid milk and butter value chains. It is common to happen that smallholders' farmers and local traders added waters to the milk they are supplying. The PRA survey result showed that adulteration is more serious problem in traditional butter market whereby adding banana to the butter is commonly happened and, sometime materials which are dangerous for health also added to the butter. However, these quality issue in the informal dairy value chain needs further research investigations.

4.3.2. Performance of Fluid Milk Value Chain

4.3.2.1. Cost Structures and Gross Profit Margin of Smallholder Farmers

Production cost is one of the important components in any production system that helps in the evaluation of the performance of the value chain (Kuma 2012; Sonam et. al. 2011). Findings on annual milk production costs of smallholder farmers across formal and informal fluid milk value chains presented in below Table 10. The survey results presented in the table shows that total milk production costs and detail costs such as fodder costs, concentrates feeds costs and crop residue costs between formal and informal fluid milk value chain participated sampled households were 8,352.89, 1,019.89, 5,965, 985 and 2,249 389, 1,459, 300 birrs respectively. These results show that the average annual milk production costs, detail costs such as fodder costs, concentrates feeds costs and crop residue costs for the formal fluid milk value chain participated smallholder sampled households were significantly higher by 78.8%, 72%, 80.3% ,76.6% respectively, as compared to households participated in the informal fluid milk value chain. These result thus shows that in market-oriented resource allocation for dairy production, formal fluid milk value chain participated households are significantly much better as compared to informal milk value chain participated households in the study area. This confirms the hypothesis that there is high likely to participate in the formal value chain for smallholders with market-oriented resource allocation behavior. On the other hand, the result shows milk production cost for informal fluid milk participated smallholder households are very low. This is because they are subsistence farmer as a result the resource they allotted for dairy production was low and, they were largely depend on their own on farm production for dairying feeds. This confirms with the hypothesis/ literatures that production costs in subsistence traditional production system is low (Ahmed et al. 2003).

The milk production cost structure result also showed that concentrate feeds costs accounted the largest cost (71%) and (64%) of the total milk production costs incurred by both formal and informal fluid milk value chain participated households respectively. This result associate with the production constrains of high price of concentrate feeds in the study area. The PRA survey showed that smallholders' frustrated to continue in their milk marketing business because of high price increment rate for concentrate feeds while their milk selling price is not increased.

The survey results presented in table 10 shows that gross profit earned annual income from milk sales between formal and informal fluid milk value chain participated sampled households were 22,307.11 and 2,131 birr respectively. These results show that the average annual milk

income or gross profit from milk sales for formal fluid milk value chain participated smallholder sampled households were significantly higher by 91%, as compared to households participated in the informal fluid milk value in the study areas. This is because there is production orientation difference between formal and informal milk value chain participated households. Hence, formal milk value chain participated households' are market-oriented in which their dairy production is primarily for market whereas, households operating in the informal milk value chain are not market-oriented. Consequently, the milk quantity sold by formal milk value chain participated households' was significantly higher by 84% as compared to informal milk value chain participated households in the study areas. It is thus production orientation for dairy production of smallholder farmers determined the quantity milk sold and, in turn, is determined income earned from milk sales.

Table 10: Production costs and gross profit structures of dairy production between formal and informal milk value chain participants of smallholder surveyed households

Description		**Smallholder fluid milk market channel choice**	
		Formal milk value Chain	**Informal milk value Chain**
Costs	Cost type	Amount in Birr	Amount Birr
	Fodder	1019.89	389
	Crop residue	985	300
	Concentrates feeds	5965	1459
	Veterinary	252	50
	Transport	131	51
	Labour	0	0
Total cost		**8,352.89**	**2,249**
Revenue	Total milk sold	3,832.5	730
	Price per liter	8	6
Total Revenue		**30,660**	**4,380**
Gross profit margin		**22,307.11**	**2, 131**
Profit margin / liter		**5.82**	**2.919**

Source: Author's survey data

On the other hand, table 10 result shows profit margin per liter sold between formal and informal milk value chain participated sampled households' were 5.82 an 2.919 birr respectively. These result shows that the gross profit earned per liter by formal milk value chain participated households higher by 66% as compared to gross profit earned per liter by informal participated

households' in the study areas. This is because per liter price that smallholder sold in the formal milk value chain through cooperative was higher by 57% as compared to the per liter price in the informal milk value chain.

4.3.2.2. Profit Margin Distribution along the milk Value Chain Actors

The performance of fluid milk value chain was evaluated by considering associated returns or profit and the share of gross marketing margins. The methods employed for analysis of performance were channel comparison and marketing margin.

Gross profit margin used to measure the amount of returns or profits that actors of the milk value chain in each node gained from participation in milk marketing activities (Kumar et al. 2011). Gross marketing margin can be used to measure the share of the final selling price that is captured by actors includes producers, collectors, processors, retailers and consumers in the value chain. The relative size of the actors' gross margins share can indicate where in the marketing chain value is added and/or profits are made (Garoma et al. 2013). In order to calculate the profit margin and the share of gross marketing margin of the actors in the value chain, the average purchased and sold price of fluid milk for actor at each node was taken. In order to measure profit margin and the market margin share of actors in each node, the marketing channel where all actors have participated was selected (Kumar et al. 2011; Garoma et al. 2013; Tefera 2014). The gross profit margin and the share of gross marketing margins of fluid milk value chain in the two channels (formal and informal) for each group of direct market players or actors are given below in figure 5:

Where:

GPM= Gross profit margin, it is the gross profit actors gain from transaction in milk value chain and it is estimated subtracting purchased price of milk per liter from the sold price of milk per liter .

GMM = Gross marketing margin; it is actors' gross marketing margin share gained from milk marketing activities in the fluid milk value chain and it calculated by divided the GPM by end market price (EMP).

GTMM = Gross total marketing margin; it is the gross marketing share paid by the consumer.

The result shows the total gross marketing margin (TGMM) is higher in the formal milk market channel which accounts 64% than the informal milk market channel accounts only 40%. It means consumers in the formal milk value chain market pays more prices for the milk product

than the consumer in the informal milk value chain because more value added in the formal milk market channel.

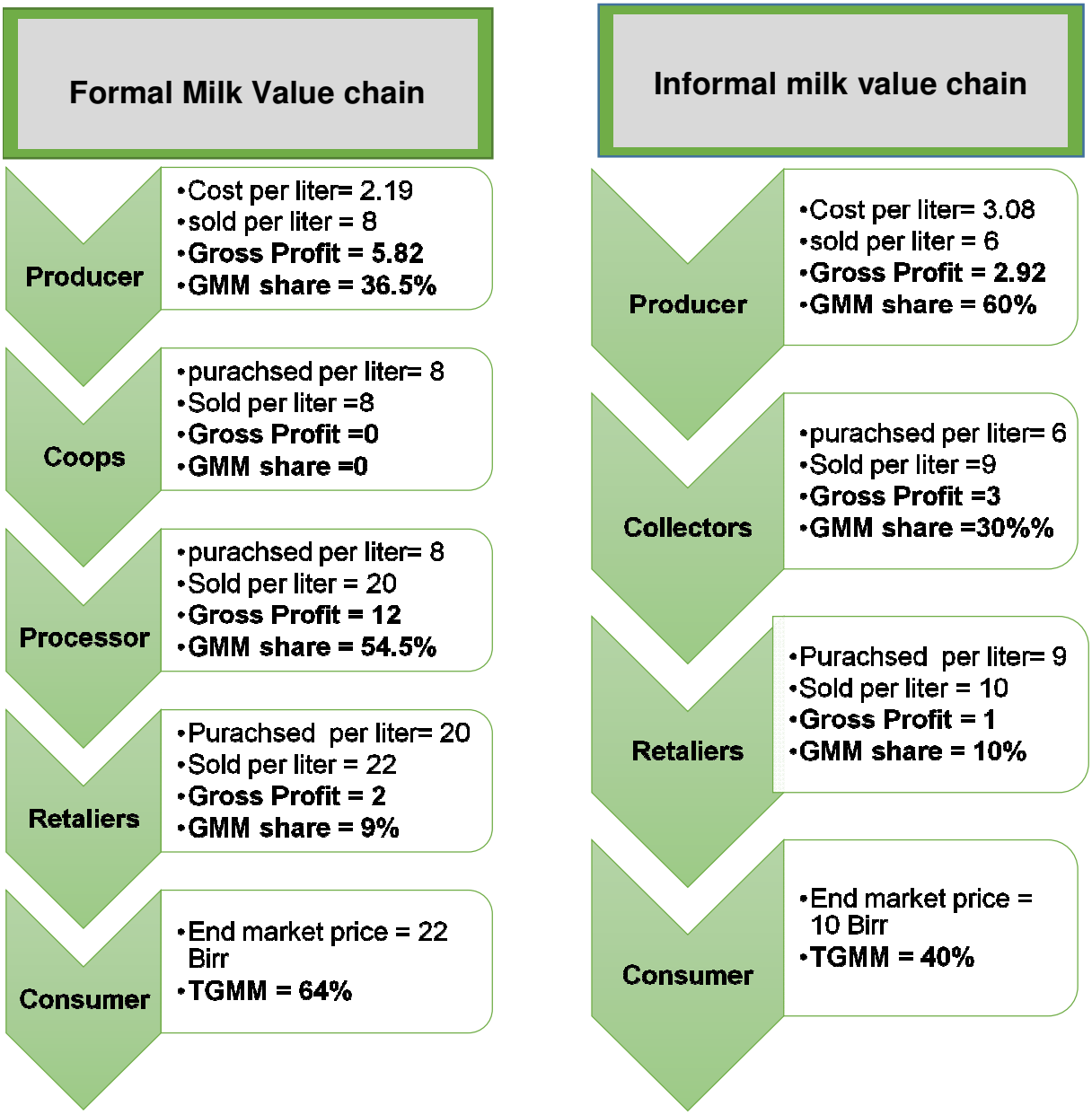


Figure 5: Profit and marketing margin distributions along the formal and informal fluid milk value chain actors

Source: Author's own survey

With regard to gross profit margin across actors in the milk value chain, processor got the highest (12 birr /liter) and next smallholders got the higher (5.82 birr /liter) in the formal milk value chain, whereas in the informal milk value chain, collector got the highest (3 birr/liter) and next producers got the higher (2.92 birr/liter). Retailers got the lowest gross profit in both formal (2 birr/liter) and informal milk value chain (1 birr).

The result show the gross market margin share distribution along actors is similar also with the gross profit distribution in both value chains. Gross market margin share across actors in the formal milk value chain, processors got the highest (54.5%) and next smallholders got the higher (36.5%) in the formal milk value chain, whereas in the informal milk value chain, producers got the highest GMM share (60%) and next collector got the higher GMM share (30%). Retailers got the lowest GMM share in both formal (9%) and informal milk value chain (10%). Over all, the data show processors gained the highest gross profit and gross market margin share. This happens because; processors are leading actors of the value chain who performed the lion share in the value-added process from milk collection and pasteurization to packaging in the formal milk value chain.

The figure show that smallholder producer's GMM share between the formal and informal milk value chain as different. Smallholder producers in the informal milk chain gained higher profit share (60%) than producers in the formal milk chain (36.5%). This is because, the informal milk value chain is relatively short whereby producer channeled their milk to the consumer only after passing one or two intermediaries due to absence of processing node, and there is little value added to the fluid milk in the informal milk value chain. Whereas, formal milk value chain is relatively long and there is processing activities that added one node in the value chain to reach end market.

4.3.3. Constraints of Dairy Value Chain

In pro-poor value chain analysis, identification and chain prioritization of constraints for pro-poo value chain development is critical factor to develop upgrading strategies of the value development. To this end, in upcoming section we discussed the major constraints for pro-poor dairy value chain development in the study area. The survey results showed that dairy value chain of the study areas constrained by multiple factors at all stages ranged from input supply to consumption.

I. Inputs supply constraints

A. Supply Shortages and High prices of feeds

The survey result showed that high supply shortage, poor quality as well as high price of feeds were the major constraints of pro-poor dairy value chain development in the study area. Large proportions (90%) of sampled household dairy producers in the study area ranked shortage and high costs of feeds as the first constraint for their milk production and marketing business. The producer highly stressed that the problem of high price increment on concentrate feeds has become beyond their control to stay in the milk marketing business. As the key informants stated that on farm forage development was limited in the study area due to land and water shortage. These constraints result in low milk yields and low animal weights. The energy deficit resulting from poor quality or low quantity feed, especially during the dry season, could result in losses in body weight and body condition, thus, affecting the production and reproduction efficiency of the cows. A high price of feeds was thus among the major problem for the cause of high production cost of milk that has made dairy producer could not cope with, in the market-oriented production system, explained by the key informants. Thus as the key informants pointed out that the key constraint to development pro-poor dairy value chain was low profitability stemming from relatively low productivity and high cost of production in the study area. Establishment of smallholder farmers' group feed marketing cooperative was suggested by the respondents to fill feeds supply gap in the study areas.

B. Supply shortages of cross breed/improved heifers and AI

Inadequate supply of improved breed cows and less availability of AI services found to be important production problems in the districts, as the endogenous cattle breeds are characterized by low productivity. Out of the total respondents about 85% farmers identified that shortage of improved breed supply as their major milk production and marketing problem. Introducing government and dairy cooperative cross breed cow supply service with faire price at district level is the suggested solutions by the sampled household producers and key informants to increase milk yield for marketing. The majority of sampled dairy farmers (75%) of the study area were indicated problems related to unavailability of AI services as the third constraints for their milk production and marketing dairy activity.

C. Animal health and veterinary services constraints

The PRA result showed that problems associated to prevalent of dairy cows diseases such as trypanosomiasis, mastitis and dermatophilosis affected the dairy cows' productivity and productivity in the study areas. According to key informant interviews, low standard and expired drug supply by both licensed and unlicensed private drug suppliers are also affecting dairy cows' production and productivity in the study areas. Hence most smallholder farmers illiterate and less educated, they are highly exposed to the risk of using this contraband and illegal private veterinary services supply. This need call for innervation to establish controlling mechanisms.

D. Constraints related to credit and financial services

According to the key informants, most of the farmers of the study area were self-financing and keep their operational costs low. The majority sampled household farmers identified that due to complex collateral requirements of micro-credit providers, luck of access to soft loans for their dairy business is a major constraints.

II. Production Constraints

High production particularly very high feeds costs, high investment costs, poor input supply, subsistence production, low productivity of the local dairy cattle and the problem of accessing AI services and poor dairy management skill of smallholder dairy farmers, were found to be the most important constraints for low volume and poor quality milk production, these low economic scale production in turn hindering smallholders' participation in modern milk value chain.

III. Processing constraints

The survey result showed that dairy processing constraints in the study area vary across the three level of dairy processors includes micro (traditional household processor), small scale and large scale processors. Luck of modern processing technology in traditional smallholder household processor is a major constraints that adversely affected time opportunity costs due long time processing, quality and efficiency.

Luck of land and financial capitals to expand and upgrade their business and shortage of technical skills to process value added products such as cheese and butter were major constraints of small-scale processors. On the other hand shortage of raw milk supply, milk supply quality problems and high packing costs were identified constraints of large scale processor, Lame.

IV. Marketing constraints

The survey result showed that low volume of milk yield, high transaction costs related poor rural infrastructures and long distance to milk collection centers, low milk price and luck of cooling equipment's were found to be important constraints in marketing liquid milk in the study areas. Luck of formal quality controlling system is also the other constraints of dairy value chain in particular in traditional dairy value chain. It is thus dairy products' quality problem associated with adulteration was found to be critical constraints in the informal dairy value chain of the study areas.

V. Consumption constraints

The survey result showed due to orthodox Christian 7 long fasting seasons per year (200 days per year), demand and price fluctuations is a major constrains for major actors particularly smallholders, collectors and small scale processors. Hence, the majority of the study area population are orthodox Christian followers, both the demand and price of dairy products decreased significantly in both rural and urban study areas. However, the problem in Addis Ababa is not serious due to its high and diversified populations. In addition, the prevailing assumption of rural people that milk is meant only for kids, the high milk price that prohibits the low income group of the society from consuming milk, and the lack of law enforcement for milk quality standards are some of the constraints identified at the consumption stage.

4.4. **Conclusion**

Value chain analysis is important approach to understand the structures and dynamics of the dairy industry. The dairy value chain analysis on the two districts shows that the dairy value of the two districts is structured in to formal and informal value chain. The dairy sub-sector in the study areas dominated by traditional production, processing and marketing system, and hence the sub-sector is dominated by informal value chain. Traditional butter is largely produced, consumed and marketed dairy products in the value dairy chain of study areas. However, the traditional butter processing is time consuming that affects time opportunity costs of rural women who are responsible in butter processing. Significant actors of the dairy value chain in study areas are smallholder, collectors, processors and retailers. However, processors are leading actors who holds the largest value added share in the value chain. Business support providers such as government agricultural offices and international NOGS also play important role for dairy value chain development in the study areas. Collective action through milk marketing cooperative is a key pathway to link rural smallholders' to formal milk value chain. We

found that private participation in inputs supply services is very low. The dairy value chain constrained by poor input supplies, low production, traditional processing and marketing, high transaction costs and high seasonal based demands fluctuation of dairy products. The relationship along actors of the value chain is very poor. Generally, the dairy value chain predominately traditional and loosely coordinated.

CHAPTER FIVE

DETERMINANTS OF SMALLHOLDERS' MILK MARKETING PARTICIPATION BEHAVIOR

5. DETERMINANTS OF SMALLHOLDERS' MILK MARKETING PARTICIPATION BEHAVIOR

Geday A. Elias[1], Tolossa Degefa[2], Padilla Martine[3], Montaigne Etienne [4]

[1] MOISA, Sup-Agro Montpellier, France; [2]CDS, Addis Ababa University, Ethiopia

[3]CIHEAM Montpellier, France;

[4]MOISA, Sup-Agro Montpellier, France

Abstract

Linking smallholders to formal dairy value chains is a key pathway to escaping the poverty trap and food insecurity in Ethiopia. The purpose of this study is, therefore, to analyze the determinants of milk sales decisions and the choice of smallholders in the mixed farming system of Ethiopia to participate in a formal milk value chain. Using individual interviews and focus group discussions, qualitative data were collected from purposely selected key informants while quantitative data were collected from 333 randomly selected smallholder households using face-to-face structured interviews. The data was analyzed using content analysis, descriptive statistics and a two-step binary logit model. The result shows that a majority (65%) of the smallholders sample did not participate in fluid milk sales. Of the total smallholders' active on the fluid milk market, 86.1% participated in a formal milk value chain, while, 13.9% participated in informal milk value chain. The two-step binary logit results shows that transaction cost factors such as distance to milk collection centers, nearest town and cooperative membership; resource factors such as the cost of fodder, cross-breed cow sizes and milk yield per day; and access to veterinary services significantly determine smallholders' milk sales decisions and access to a formal milk value chain. Collective action through milk marketing cooperatives is a key pathway linking smallholders to formal milk value chain.

Key words: smallholder, milk, value chain, formal, informal, sales, determinants, participation

Résumé

Relier les petits exploitants agricoles éthiopiens à la chaîne de valeur laitière formel est un moyen clé de les faire sortir du piège de la pauvreté et de l'insécurité alimentaire. Le but de cette étude est donc d'analyser les déterminants des décisions de vente de lait et de participation aux chaînes de valeur formelelle du lait des petits exploitants agricoles éthiopiens

développant des systèmes d'exploitation mixtes. L'étude est basée sur des données qualitatives recueillies via la conduite d'entretiens individuels et de groupes de discussion auprès de personnes-ressources clés. Elle est aussi basée sur des données quantitatives obtenues à partir d'entretiens structurés menés auprès de 333 ménages de petits exploitants sélectionnés de manière aléatoire. Les données ont été traitées en utilisant l'analyse de contenu, les statistiques descriptives et un modèle logit binaire à deux étapes. Les résultats montrent que la plus grande partie (65%) de l'échantillon de petits exploitants a participé à la vente de lait liquide. Sur l'ensemble des petits exploitants qui sont connectés au marché du lait, 86.1% participe à une chaîne de valeur laitière formel ; alors que 13.9% participe à une chaîne de valeur informel de lait liquide. Le modèle logit montre que les facteurs influençant les coûts de transaction, tels que la distance au centre de collecte de lait, à la ville la plus proche, et l'adhésion à une coopérative; les facteurs relatifs aux ressources tels que le coût des aliments pour les animaux, la taille des races de vache, la production journalière de lait et; l'accès aux services vétérinaires influencent de manière significative les décisions de mise en marché du lait des petits exploitants et leur accès aux chaînes de valeur du lait formel. L'action collective par le biais de la création de coopératives laitières est un moyen clé pour relier les petits exploitants aux chaînes de valeur du lait formel.

Mots clés: petits exploitants, lait, chaîne de valeur, formel, informel, ventes, déterminants, participation

5.1. Introduction

Dairy production is an important part of the livestock production systems in Ethiopia. Cattle, camels and goats are the main livestock species that supply milk, with cows contributing 81.2% of the total milk output. In the highlands where subsistence smallholders are predominant, crop and livestock production are an integral part of their livelihood. In the lowlands, the nomadic pastoral farmers subsist almost entirely on milk and livestock for their food supply while trading livestock and livestock products to purchase cereals and other necessities (Ahmed et al. 2004; Yilma et al. 2011b).

Smallholder participation in market-led dairy development has not been widespread in Ethiopia (Ahmed et al. 2003). Milk produced by smallholders is primarily used for household consumption purposes. The surplus is processed to make butter, ghee, cheese and sour milk

and is sold through informal markets (Ahmed et al. 2004; Yilma et al. 2011b; Dayanandan 2011). The main reason for this seems to be inefficient dairy and dairy product marketing characterized by high margins and poor marketing facilities and services (Redda, 2001). However, the country, and in particular the highland mixed crop-livestock area, has huge untapped potential for the market-oriented development of smallholder dairy production (Ahmed et al. 2004; Dayanandan 2011; Steen et. al. Maijers 2014; Tassew et. al. 2009).

Dairy marketing is predominately traditional and milk and milk products are marketed through both formal and informal systems (Ahmed et al. 2004; Yilma et al. 2011a). The informal marketing system involves direct sales from producers to end consumers or indirect sales through market intermediaries. The formal marketing system, which usually serves the urban/peri-urban clients, involves organized milk collection, processing and distribution (Ahmed et al. 2004; Yilma et al. 2011b; Ahmed et al. 2003).

In Ethiopia, 95% of all milk produced within the country is marketed through informal market channels and is unprocessed. The traditional processing and marketing of dairy products, especially traditional sour butter, dominate the Ethiopian dairy sector. Only 5% of the milk produced is marketed as liquid milk due to underdevelopment of infrastructures in rural areas (Ahmed et al. 2004; Yilma et al. 2011a). Smallholders supply the bulk of milk both to the formal and informal marketing system. Hence, the informal market has remained dominant in Ethiopia. Production is non-market-oriented and most of the milk produced is processed to make traditional butter, sold on informal markets and used for home consumption (Ahmed et al. 2004; Yilma et al. 2011a; Dayanandan 2011; Haile 2009).

The empirical studies and development programs report (Land O'Lakes 2010) shows that linking smallholders to formal dairy value chains is a promising means of improving the food security and livelihood of rural households in Ethiopia (Tegegne et al. 2013; Ahmed et al. 2003). This is because it makes a potentially significant contribution to multiple welfare gains for the rural community for example by providing a source of income and employment opportunities, improving household food security and nutrition and enhancing the links between the input and output sides of agricultural markets (Ahmed et al. 2004; Tefera et al. 2008; Steen et. al. 2014; Dayanandan 2011; Ahmed et al. 2003).

Aware of these facts, the Ethiopian Ministry of Agriculture has formulated a strategy to improve milk marketing and processing in villages (Berhanu et.al. 2014). The strategy is to develop an environment for smallholder dairy farmers, which enables farmers to respond immediately to

market demand (Kuma 2012; Asfaw et al. 2012). Moreover, the country's previous and current national development strategies, known as the Plan for Accelerated and Sustainable Development to Eradicate Poverty (PASDEP) and the Growth and Transformation Plan (GTP) respectively, emphasize the pro-poor, gender-responsive and sustainable commercialization of smallholder agriculture (Degu 2012; Berhanu et. al. 2014). The development of high-value commodities, value chain development and export-oriented investments have been identified as key tools for achieving smallholder agricultural commercialization (World Bank, 2015). The development of a smallholder dairy value chain is thus consistent with the national agenda and aspirations.

While it has long been recognized that the potential role of pro smallholder dairy value chain development would affect poverty alleviation and the country's rural development process, the sector is nevertheless still dominated by a subsistence-oriented production system. The traditional smallholder dairy system makes up the largest part (98%) of the dairy production system (Yilma et al. 2011; Steen et. al. 2014; Geleti et al. 2014).

There are as yet few empirical studies on smallholder participation in the dairy market in Ethiopia. These studies are, however, limited to analysis of market participation determinants (Dayanandan 2011; Geleti et al. 2014; Zewdie 2012; Tassew et. al. 2009) and there is therefore scant of empirical evidence concerning the determinists of smallholder participation in formal milk value chains. This is particularly true in study areas where there are few empirical studies on the determinants of smallholders' milk sales decisions and their choice to participate in a formal milk value chains. Mitigating the market access problem of poor smallholder dairy farmers and linking smallholders to formal dairy value chains is therefore one of the most pressing rural development challenges in Ethiopia. Research questions such as how to expand smallholder participation in dairy value chains, how to link the smallholders to the formal dairy value chain and how to promote the competences and benefits of smallholder farmers in dairy value chains have been, and still are, critical issues that need to be addressed in pro-poor dairy value chain development process (Yilma et al. 2011b; Land O'Lakes 2010; Steen et. al. 2014). Against such a backdrop, this study thus analyzed the determinants of milk sales decisions and the choice of smallholders to participate in a formal milk value chain in two districts, Kimbibit and Bahirdar-Zura .

5.2 The research methodology

5.2.1. Introduction

This research was essentially a micro-level enquiry that was mainly carried out at rural household level to analyze the determinants of smallholder milk output participation and their choice to participate in a formal milk value chain in the fluid milk sector in the highlands of Ethiopia. To this end, a sequential exploratory mixed method was adopted, that can be represented using the following notation: Qual → Quan (Creswell 2013, 2009), to gather and analyse both qualitative and quantitative data. Priority was nevertheless given to quantitative methods to be used dominantly in this study.

To conduct the study, a cross-sectional design was used in which data were collected at a single point and time. The population of study comprised smallholder dairy farmers who owned dairy cattle at the time of study in 7 rural kebelles (pesant associations-PA) in the Kimbibit and Bahir-Dar-Zuria districts from Oromia and Amhara regions, respectively. This section addresses the following points: samples and sampling techniques, data sources and acquisition methods, methods of data analysis and model specification of the study.

5.2.2..Data type and sources and methods of data collection

The study used both primary and secondary data. The secondary data on milk prices, the list of PAs and traders' legal requirements to enter the milk trading business, population distribution and research and project reports on smallholder dairy projects were collected from the Central Statistical Authority (CSA), district (woreda) and zonal planning offices, district branch offices of the Ministry of Agriculture and SNV/EDGET and USAID projects. Two data collection methods, namely participatory rural appraisal (PRA) tools for base line information and household survey, were used to generate qualitative and quantitative primary data, respectively for this study.

I. PRA survey

PRA surveys using key informant interviews, FGDs and direct observation were conducted to collect qualitative data from different segments of the population in both districts. The PRAs were used to identify resources, available services and common livelihood issues at district level. Moreover, information on the livestock sector was elicited and analyzed on the spot using value chain approaches concerning smallholder access to the dairy value chain market. The information focused on the following areas: dairy productivity; access to dairy-related services;

market information/participation; household income sources; important dairy activities; and opportunities and constraints for pro-smallholder dairy value chain development. The PRA participants included smallholder dairy producers, officials and staff of district agricultural offices, development agents and milk traders, leaders of milk marketing cooperatives and cooperative unions and experts from NGOs

II. Household survey

This was a structured questionnaire designed to collect primary data from smallholder households. During the PRA phase, the questionnaire was tailored to all milk market and smallholders' conditions of the study site. The structured formal interview guidelines were written up in the form of a formal questionnaire. The questionnaire was administered to 333 sample households and generated information on households' general socio-economic conditions, demographic features, livelihood activities, sources of income and their diversity, ownership and access to different assets, access to public assets and services, access to the market and infrastructures, dairy farm productivity, cattle milk output market participation pattern and the system and constraints relating to market-led smallholder dairy farm development. Before data collection, the questionnaires were pre-tested. This led to further revision of these lists to ensure that important issues had not been left out

5.2.3. Samples and sampling strategies

A three stage sampling technique was employed for this study. First, because of the two districts have strong potential for dairy production development, Kimbibit district in the Oromia region and Bahirdar-zuria districts in the Amhara region were purposefully selected. Then, consulting with the staff of the district agricultural offices, 7 peasant associations or rural kebelles were again purposefully selected from the two districts as learning sites for this empirical study, based on based on their quantity of milk produced, dairy technoloy adoption level and their market orientation. Finally, using a proportional simple random sampling technique, 333 sampled smallholder dairy farmers households were chosen at random from the rural kebelles selected.

5.2.4. Data analysis methods

The research strategy employed in this study was thus a sequential exploratory mixed method combining qualitative and quantitative methods and both qualitative and quantitative data analysis was used to analyze the primary data.

I. Qualitative analysis

The primary qualitative data collected using the PRA survey were compiled, organized, summarized and interpreted based on major thematic topics.

II. Quantitative analysis

The primary quantitative data collected from sample households were analyzed and tested using SPSS 20 and STATA13. In this study, descriptive statistical tools were used to analyze the quantitative data. The descriptive statistical tools adopted were mean, percentage, frequency and standard deviation cross tabulation, while T-tests and Chi-square tests were also employed. The degrees of association or correlation between the variables were tested by correlation analysis. More importantly, econometric analysis using binary logit model was used to analyze the determinants of milk sales decisions and smallholder choices to participte in a formal milk value chain.

5.2.5. Econometric model specification

In the imperfect market environment setup of the study areas, asset-poor smallholders face two challenges in relation to milk market participation decisions in the dairy value chain. The first challenge facing them is the participation decision in the milk output market – whether to sell their surplus milk output or not. Then, once they have decided to sell or to participate in the milk sales market, the next challenge is the milk market channel choice between formal and informal milk value chains. The study analysis was therefore carried out on two levels. First, the determinants of the decision to sell fluid milk and second, the determinants of the smallholders' decision to participate in a formal milk value chain in the study areas. The model specification of the study was built on the basis of the following theoretical frameworks and empirical studies on smallholders' agri-food marketing behavior in developing countries (Gebremedhin et.al. 2010; Abafita et al. 2016; Barrett 2008; Barrett et. al. 2010; Barrett et al. 2006; Jaleta et al. 2009; Chirwa 2009). The key features of the models in this study are that smallholder' milk sales decisions and the choice to participate in a formal milk value chain are not uniform because smallholders have different demographic characteristics and resource endowments, face differential transaction costs and have different access to institutional business support services. Hence, the core issues in the models concern what are factors relating to demographic characteristics, resources, transaction costs they face and their access to institutional business

support services affected smallholders' milk sales decisions and their choice to participate in the formal milk value chain.

According to the literature (Barrett et al. 2006; Barrett et.al. 2010; Tegegne et al. 2013; Abafita et al. 2016; Ahmed et al. 2003; Kuma 2012; Luoga et al. 2014; Hambloch et al. 2014), the endogenous and exogenous variables that affected smallholders' milk sales decisions and their choice to participate in a formal milk value chain includes: (1) household demographic factors such as age, gender, education and dairy business experience; (2) household level resource endowments such as the number of cross-breed cows owned, investment in fodder and the average daily milk yield; (3) transaction cost factors such as the distance to a milk collection center, the distance to asphalt roads and the distance to the nearest town; and (4) institutional business support service factors including access to credit, the number of visits by agricultral extension worker and the distance to veterinary services.

A two-step smallholder market participation behavior model was used to analyze factors that influenced smallholders' milk sales decision and their choice to participate in a formal milk value chain in the study areas. First, the determinants of the smallholders' decsions to sell fluid milk were analyzed using a binary logit model. Second, based on their milk sales decision, we separated the participating household data and analyzed the determinants of smallholders' choices to participate in a formal milk value chain using a binary logit model. These models consider the following five major endogenous and exogenous variables stated above that affected the two-step milk marketing decisions of smallholder dairy farm households. The endogenous factors includes demographic characteristics and resource endowment status of smallholder households. Whereas, the exogenous factors includes transaction costs that smallholders facing in their milk marketing and their access to institutional business support services. Binary choice models assume that an individual is faced with a choice between two alternatives and that their choice depends on their characteristics. It was assumed that smallholders who produce milk for various reasons may or may not be participate in the milk market as a net seller or may sell or otherwise not sell milk. This dependent variable consists of two outcomes, yes or no, therefore a logit model is appropriate for dichotomous dependent variables. Then, once they have decided to sell their milk product, smallholder households have to choose where to sell the milk, between the available alternatives of formal and informal milk value chains. A binary loigit model is therefore once again used to analyze the determinants of the choice made by smallholder dairy farm households to participate in a formal milk value chain.

Model: An application of a binary logit model in analyzing milk output market participation decisions and milk marketing channel choices

Binary logit or logistic regression (BLR) is most useful when you want to model event probability for a categorical response variable with two outcomes. It was thus used to analyze the probability of the smallholders' milk sales decision and their choice to participate in a formal milk value chain . For the individual smallholder, the decision to sell or not to sell milk and the decision to choose between a formal and informal milk value chain can be formulated as a binary choice model that can be analyzed using the logistic equation below.

The logistic distribution function is specified as:

$$P_i = \frac{1}{1+e^{-zi}}$$

Where: P_i is the probability of the milk sales decision and the probability of the choice to participate in a formal milk market for the i^{th} the respondent, ranging from 0 -1.

e^{zi} : stands for the irrational number e raised to the power of Zi

Z_i : is a function of N-explanatory variables and expressed as:

$Z_i = \beta 1 + \beta 2X2i + \text{------}\beta nXni$

β1 is the intercept

β2 ------βn are the parameters

The parameters indicate how the log-odds is in favor of milk sales decision and in favor of marketing to a formal milk value chains as the independent variable changes. The unobservable stimulus index Z_i assumes any value and is actually a linear function of factors influencing the decision to sell milk and to market the product through a formal milk value chain. As Z_i ranges from -∞ to +∞, P_i ranges between 0 and 1 and P_i is non-linearly related to the explanatory variables. In order to simplify the expression, we need to rewrite the equation in the form of an odds ratio. Accordingly, if P_i is the probability of milk sales and the probability of choosing to market through a formal milk value chain, then 1- P_i is the probability of not selling milk and the probability of not marketing through a informal milk value chain. This means that the probability of selling milk and the probability of choosing to market through a formal milk value chain should be between 0 and 1 whereas if the probability of selling milk and of choosing to market through a formal milk value chain is 1, then the probability of not selling and of choosing to market

through an informal milk value chain will be 0. In other words, since the probability of an event must lie between 0 and 1, it is impractical to model probabilities using linear regression techniques because the linear regression model allows the dependent variable to take values greater than 1 or less than 0.

The odds ratio is written as:

$$\frac{Pi}{1-Pi} = \frac{1+e^{-Zi}}{1-e^{-Zi}} = e^{Zi}$$

$\frac{Pi}{1-Pi}$: is thus simply the odds ratio in favor of milk sales and in favor of a marketing decision via a formal milk value chain.

In this study, the independent variables affecting a smallholder's decision to sell milk and their choice to participate in a formal milk value chain were derived from participatory research and empirical studies. The independent variables, their definitions, symbol, nature and hypothesized sign are shown in table 11.

Table 11: Variable category, symbol, definition and hypothesized sign of explanatory variables used for the analysis of determinants of smallholders' milk sales decisions and their choice to participate in a formal milk value chain.

Hypothesis	Proxy indicators Variables	Type of Variable	Hypothesized sign
Smallholders' household demographic characteristics Matters?	Age (years)	Continuous	(-)
	Gender 1=Male ; 0 =female	Dummy	(+)
	Education status of the household head: 0= illiterate 1= literate; 2= elementary; 3= secondary 4= college	Dummy	(+)
Smallholders Households' resource constraints Matters?	Number of cross breed cow smallholder owned (Numbers)	Continuous	(+)
	Annual costs for seeds oil cakes used (amount in Birr)	Continuous	(+)
	Annual costs for wheat barn used (amount in Birr)	Continuous	(+)
	Quantity milk Yield per day(liters)	Continuous	(+)
	Distance to milk collection center from the smallholder's home(in mints)	Continuous	(-)
Transaction costs Matters?	Distance to Asphalt roads from the smallholder's home(in mints)	Continuous	(-)
	Distance to nearest town from the smallholder's home (in mints)	Continuous	(-)
	Farmer's milk cooperative membership status of the household: 1= members and 0= none members	Dummy	(+)
	If smallholder's make sure about the availability of buyer's' for their milk to be marketed: 1=yes ; 0= no	Dummy	(+)
Access to business support Institution services Matters?	Smallholder's access to credit : 1= yes ; 0=no	Dummy	(+)
	Distance to veterinary services from the smallholder's home	Continuous	(-)
	Number of extension worker visiting smallholder's dairy	Continuous	(+)

5.3 Results and discussions

5.3.1. Introduction

The aim of this section is to look at demographic characteristics, resource endowment status, transaction costs and access to institutional business support services factors that affected smallholders' decisions concerning milk sales and their choice to participate in a formal milk value chain. Some households may prefer to participate in one particular market over another, while others may be excluded by market conditions. Based on the data collected in the survey year (2013) and a sample of 333 milk smallholder dairy farm households, 35% (115) of them participated in fluid milk sales while the majority of farming households (65% representing a total of 218) did not participate in milk sales. Similarly, out of 115 smallholder households present on the milk sales market, the majority (86%) marketed their milk product via a formal milk value chains, while 14% of smallholder households marketed their milk product through the informal milk value chain. Thus, a two-stage procedure was used to overcome the problem of sample selection bias.

Accordingly, a binary logit regression model was run first to identify factors that influenced smallholders' milk sales decisions on milk output markets. Second, based on the participation response, we separated hosuehold data relating to milk output and milk sales participation and ran a binary logit regression to analyze the determinants of smallholder households' formal milk value chain participation choices . Before running the two-step marketing decision models, data normality and multicollinearity tests were carried out. No significant problems of normality or multicollinearity were observed.

5.3.2. Determinants smallholder households' milk sales decisions

I. Descriptive characteristics of surveyed households

T-test results concerning key characteristics of the smallholder households sampled participating or not in milk sales are presented in table 12. The total number of sample smallholder households interviewed during the survey was 333. The survey results show that of the total sample households, 73% were male-headed and 27% were female-headed households. Of the total sampled households, 35% were present on the fluid milk market while the majority (65%) were not. Similarly, the survey results show that the percentage of households participant and non-participant in milk sales across Kimbibit and Bhir-Dar Zuria

districts were 7.6% and 92.4% and 60% and 40%, respectively. These result show that smallholders participation in milk sales in Bahir-Dar Zuria district was 85% higher than smallholder milk sales participation in Kimbibit district. This can be explained by the fact that smallholders have limited access to the fluid milk market in Kimbibit district compared to smallholders in Bahir-Dar Zuira district. There are no rural milk collection centers in Kimbibit district. Consquently, smallholders in Kimbibit district have to travel long distances to sell their fluid milk in Sheno town, either supplying to the Sheno milk marketing cooperative or supplying to retailers/consumers directly. Smallholders in Kimbibit district therefore prefer to process their milk to make traditional butter which is sold on local markets.

The survey results presented in table 12 show that there was no statistically significant difference between smallholder households selling milk and those not selling milk with regard to the mean age of the household head. The mean age of head of households participating and not participating in milk sales was 46 and 74 respectively. The level of education of the head of households selling millk was significantly higher (by 21%) than in households not selling milk. The survey results show that the distribution of household heads with an illiterate, literate, elementary and high school educational status between households participating and not participating in milk sales was 15.32% and 35.74%, 22.52% and 11.11%, 6.6% and 5.41% and 2.10% and 1.20%, respectively.

Table 12: T-test results of key characteristics of smallholder households sampled participating or not in milk sales.

Explanatory Variables	Proxy measurements	Mean values of Smallholders' milk sales participate and non-participated Households		
		Participated Mean	Non-participated	Mean Difference
H1: Smallholders' households' demographic specificity matters?	Age of the household head	46	47	1.027
	Sex of the household head (male)	.81	.69	.112**
	Education	.815	.602	.213**
H2: Smallholders' household resource constraints matters?	Annual costs of oil cakes feeds	2854	107	2746***
	Annual costs of concentrate feeds	3242	7	3236***
	Cross breed cows ownership status	1	0.08	0.92***
	Number of cross breed cows owned	1.82	.08	1.7***
	Quantity milk yield per day	11	3	8***
H1: Transaction costs matters?	Distance to milk collection centres	32	110.	-79***
	Distance to nearest town	49	113	-64***
	Distance to asphalt roads	39	107	-68***
	Milk cooperative membership(yes)	.850	.009	.841***
H1: Business support services Institutions matters?	Distance to veterinary services	32	110.	-79***
	Frequency of extension worker visits	.3493	.271	.077
	Access to credit services (yes)	0.10	0.088	0.12

The mean annual costs of oil seed cakes and wheat barn feed for smallholder households selling milk were significantly higher (by 2,746 and 3,236 birr respectively) than for householdsnot selling milk. This indicates that households selling milk enjoyed better market-oriented resource allocation in their dairy production compared to households not selling milk. Similarly, there is a significant difference in mean crossbreed cow size between households selling milk and those not selling milk. The former have an average of 1.82 crossbreed cows while the latter have an average of 0.08 crossbreed cows. This result also shows that the former are relatively better off in terms of adopting technology in dairy production compared to the latter. The average quantity of milk produced per day by households selling milk is significantly higher (by 8 liters per day) than in households not selling milk. The average milk yield in the former is 11 liters per day whereas average milk yield in the latter is 3 liters per day. This result

indicates that households selling milk were better off relatively in adopted modern dairy production system compared to household who were not seeling milk. The average distance traveled to milk collection centers, the nearest town and asphalt roads for households selling milk is significantly lower (by 79, 64, 68 minutes compared to the households not selling milk. These results imply high transaction costs, such as market information search, and transports costs could be factors preventing certain smallholders from participating in the milk market in the areas studied whereas households selling milk incurred lower transaction costs in the milk market compared to those not selling milk. In terms of collective action in the dairy system, there is a significance difference between households selling milk and those not selling milk. All of the former were members of milk marketing cooperatives whereas the latter were not members of milk marketing cooperatives. The distance traveled to obtain veterinary services is significantly lower (by 79 minutes) for households selling milk than for other households. This shows that households selling milk have better access to agricultral extension services or public veterinary services than households not selling milk. On the other hand, there was no significant difference in the frequency of visits of extension workers to the producer households or in terms of access to credit services between the two groups. The number of extension worker visits to households selling milk and those not selling milk was 0.35 and 0.71 respectiviely in every three months while the percentage of the former with access to credit services was 6.3% with this figure falling to 3.3% for the latter.

II. Econometric results and discussions

The results of a first-stage binary logit model estimation of the determinants of the probabilities that smallholders participate in the fluid milk sales market are presented in Table 13. These results provide an insight into the effects of demographic characteristics, resource endowment status and transaction costs, as well as the effect of access to institutional business support services as a factors in smallholders' decisions to sell milk. That choice is represented by the milk sales decision variable, which takes a value of one if the household sells fluid milk, and zero otherwise. The model of decisions to sell identifies characteristics that push households to sell milk as opposed to those which do not. Eighteen variables relating to demographic and household assets, transaction costs and institutional support factors, which are believed to have an influence on the decision to sell milk, were included in this analysis based on the findings in the literature. After conducting a multicollinearity test, however, only eleven explanatory variables were included in the binary logit regression model to identify factors affecting the decision of farm households to sell milk. These are household head age, gender of the

household head, educational status of the household head, milk yield of the household, distance to milk collection centers, distance to nearest town, membership of a cooperative, annual costs of oil seed cakes and concentrates, cross-breed cow ownership status and the number of cross-breed cows owned . The following variables were excluded from this analysis because it was discovered that they were missing correlations: years of dairy production experience, total land size of the household, access to credits/loans, total number of local breed cows of household, walking distance to veterinary service, walking distance to all weather road in minutes, walking distance to local market, total non-dairy income of the household and access to market information.

The overall model is significant at the 0.01 level as indicated by the log pseudo likelihood value of-8.5721712. Moreover, based on the pseudo R^2 of 0.95, the model appears to be a good fit for the data (Table 13).

Of these 11 explanatory factors that are included and expected to cause a variation in the dependent variable, 9 independent variables were significant in affecting the decision of sampled smallholder households to sell milk, the two exceptions being the gender of the household head and educational status at elementary level. In addition, most of these variables such as age, gender, educational status of the household head, milk yield per day, distance to milk collection centers, distance to nearest town, membership of a cooperative, annual costs of oil seed cakes and wheat barn feeds, cross-breed cow ownership status and number of cross-breed cows owned demonstrated the expected coefficient sign.

Table 13: First-stage binary logit estimation results of determinants of probability of selling milk

Independent Variables	Coef.	Std. Err.	P-Values
Age of the household head	.1062899	.0543658	1.96*
Education			
Literate	3.908384	2.082278	1.88*
Elementary level	.5034551	1.921204	0.26
High School level	6.959531	2.85862	2.43**
Cost for oilseeds cakes	.0003337	.0001916	1.74*
Costs for wheat barn	4.772582	1.782514	2.68**
Number of cross breed owned	5.790794	2.74658	2.11*
Cross breed cow ownership (Yes)	7.839811	2.926953	2.68**
Quantity milk yield per day	1.558531	.4761455	3.27**
Cooperative membership (Yes)	16.56593	5.554501	2.98**
Distance to nearest town	-.0026959	.0009413	-2.86**
Distance to milk collection enter	-.0007399	.0004176	-1.77*
_cons	-7.557411	3.154698	-2.40
Number of obs. =333	Log pseudo likelihood =-8.5721712		
Wald chi2(12) =44.81	Pseudo R2 = 0.9599		
Prob > chi2 =0.0000			

***, **, and * indicate statistical significance at 1%, 5%, and 10%, respectively.

Source: Author's own survey

The gender dummy for the household head is meant to proxy gender-based differentiation of participation in milk sales. Unexpectedly the gender of the household head has no significant effect on the farmer's decision to sell milk in the model. As hypothesized, the education coefficient has a positive significant result in the model. Age and education are commonly taken as proxies for human capital and management skills (Boniphace et al. 2015). As hypothesized, the age of the household head is positive and significant at the 5% level in the models. The usual reason offered in the literature by those who postulate a positive association is that older farmers are generally more experienced and have accumulated capital which makes activities attractive to and feasible for them (Dayanandan 2011). With regard to quantity of cow's milk produced, the variable has, as expected, a positive and significant contribution at the 1% level in smallholders' decision to sell milk. A marginal increase in cattle milk production has an obvious and significant effect in encouraging market participation. As hypothesized, the distance to market or distance to milk collection center adversely affected the milk output participation decision of sampled household farmers at the 5% significance level (Gebremedhin et. al. 2010; Sharma 2015). As the distance increased, the probability of selling milk decreased among

smallholder dairy farmers. The assumption that smallholder the more close to milk market has the higher positive effect on smallholder farmer's milk output market participation decision. It is because milk markets distance tend to be important to make milk market risk decision that would entail expectation that milk market participation would decrease when distance to milk marke increases (Tegegne et al. 2013). As hypothesized, collective action through cooperatives (Fischer et. al. 2012; Emana 2012; Francesconi 2009; Tassew et. al. 2009) significantly and positively affected smallholder milk market participation decisions at the 1% significance level. In this empirical study, the probability of accessing or participating in the milk value chain as a milk supplier, was higher among farming households sampled which are members of milk marketing cooperatives than among non-member households. The distance to the nearest town variable (Alwang et al. 2012; Boniphace et al. 2015; Dayanandan 2011) displayed, as hypothesized, the negative coefficient at the 5% significance level. Smallholders located far away from the support-giving institutions usually located in towns may not be frequently served by the extension agent and the service provision by institutions in more remote areas might be of lower quality (e.g., late delivery of information, equipment, and poor supervision in relation to animal health management activities) (Dayanandan 2011; Gebremedhin et. al. 2010; Abera 2009). As a result, the greater the distance from business support institutions, the less likelihood there is to receive technical support from extension services and this in turn adversely affects their milk productivity and thus their decsion to sell milk (Degu 2012).

5.3.3 Determinants of smallholder farmers' decision to participate in the formal milk value chain

I. Descriptive characteristics of surveyed households

Table 14 compares formal and informal milk channels of smallholder farmers with respect to a set of key characteristics. The survey results show that in the total sample households, 115 (35%) smallholder households sell milk. Of these, 86.1% participate in a formal milk value chains while 13.9% opt for informal milk value chains. The t-test results presented in table 14 show that, overall, there is a significant difference in demographic characteristics between households in the formal and informal milk value chains. However, there is no difference in the age of the head of household in formal and informal milk value chains. The average age of the household head in a formal and informal milk value chains is 46 and 46.4 years respectively. There is a significant difference in the educational level of the two household groups. Male heads of household in the formal milk value chain are 25% greater than in the informal milk

value chain. The educational status of household heads in the formal milk value chain is significantly higher (50%) than that of heads of households in the informal milk value chain. Education plays an important role in the adoption of new technologies and market information analysis and therefore plays a positive role in smallholders' decision to favour the formal milk value chain (Gebru 2006; Sharma 2009).

The t-test results presented in the table show that households operating in the formal milk value chain are better off in terms of resource allocation for their dairy business and milk production than households opting for the informal milk value chain. The mean annual cost of oils seed cakes and wheat barn feed in households who supplied their milk to the formal milk channle is significantly higher (by 2,192 and 2, 489 birr respectively) than households who supplied their milk to informal channel . Similarly, there is significant difference in mean cross-breed cow size between households supplied their milk to formal and informal milk market channels. The housheols who are supplied to the formal milk value chain have an average of 1.9 cross-breed cows, while households who are supplied to the informal milk value chain have an average of 0.71 cross-breed cows. This shows that households who are supplied to the formal milk market channels use largely high-yielding cows whereas those households who are supplied to informal milk market channels use low-yielding local breeds. Average milk production of households with supplied to formal channles is significantly higher (by 8 liters/day) than households with supplied to the informal channles. These results thus show that smallholder households who are supplied to the formal milk value chain are market-oriented in their dairy business (Gebremedhin et. al. 2010; Gebremedhin et. al. 2012).

The average distance travelled to milk collection centers, the nearest town and asphalt roads for households who are supplied to formal milk value chain is shown to be significantly lower (by 96, 85, 47 minutes) compared to households who are supplied to the informal milk value chain. These results imply that in accessing formal and/or modern end milk markets, households in the formal milk value chain face significantly lower transaction costs in terms of market information search and transport costs than households who are supplied to the informal milk value chain (Mungandi, Conforte & Shadbolt 2012). All hosueholds operating in the formal milk value chain are members of milk marketing cooperatives, whereas none of households operating in the informal milk value chain are members of such cooperatives. This result implies that in milk marketing activities, households opting for the formal milk value chain are better able to reduce transactions costs, market risk as well as better off in barraging power compared to those households operating in the informal milk value chain (Tassew et. al 2009). Similarly, the survey

results show that households supplied to the formal milk value chain are better at getting pre-transaction information about milk buyers' availability than those households supplied to the informal milk value chain. The distance travelled to obtain veterinary services is significantly lower (by 93 minutes) for households opearting in the formal milk value chain than for households operating in informal milk value chain. This shows that the former have better access to extension or government veterinary services than the latter. On the other hand, there is no significant difference in the frequency of visits of extension workers to producer households or in access to credit services between the two groups. The number of extension worker visits and households with access to credit services for households supplied to formal and informal milk value chains are shown to be 0.29 and 0.27 every three months and 0.09% and 0% respectively.

Table 14: T-test results for key characteristics of surveyed households in the formal and informal milk value chains

Explanatory Variables	Proxy measurements	Mean Values between formal and Informal milk value chain participated households		
		Formal value chain	Informal Value chain	Mean Difference
H1: Smallholders' households' demographic specificity matters?	Age of the household head	46	46.425	-.425
	Sex of the household head (male)	.82	.57	.25
	Education	1.285	.777	.507*
H2: Smallholders' household resource constraints matters?	Annual costs of oil cakes feeds	2642	450	2192***
	Annual costs of concentrate feeds	3160	671	2489***
	Cross breed cows ownership status	1	0.08	0.92***
	Number of cross breed cows owned	1.69	.71	.98**
	Quantity milk yield per day	11	3	8***
H1: Transaction Costs Matters?	Distance to milk collection centres	25	121	-96***
	Distance to nearest town	41	132	-85***
	Distance to asphalt roads	45	92	-47***
	Milk cooperative membership(yes)	.97	.005	.96***
	Buyers' Availability information	.898	.571	.326**
H1: Business support services Institutions matters?	Distance to veterinary services	42	135.	-93**
	Frequency of extension worker visits	.29	. 27	.02
	Access to credit services (yes)	.092	0	.092

Source : Author's survey data

II. Econometric results and discussions

The second-stage binary logistic model was estimated using the maximum likelihood method. The binary logistic model estimations of the determinants of the probabilities that smallholder households participate in the formal milk value chain are given in Table 15.

This study utilized a dichotomous choice framework to determine the factors that influenced producers' decisions to choose a formal milk value chain over a informal milk value chain or vice-versa. The researcher used binary logit to determine the factors that influenced smallholder households' decisions to participate in a formal milk value chain. Two major alternative milk marketing channels commonly used in the areas were considered: formal and informal milk marketing channels constituting the dependent variable. The researcher derived the binary logit model from a random utility function that determines the probability associated with a producer's choice to participate in a formal milk value chain. In this model, smallholder households' participation in a formal milk value chain was assumed to be based on different determinant factors. The dependent variable was the milk market channel chosen by the producers. The independent variables were factors assumed to influence their decisions to favour a formal milk value chain over an informal milk value chain.

The dependent variable of this model is a binary dummy variable for smallholders' choice of milk marketing channel where: 1 = households choose to participate in a formal milk value chain and 0 = households choose to participate in an informal milk value chain. The dependent variable is, therefore, the milk market channel chosen by smallholder households. The following definitions are thus used for the dependent variables in this study.

A formal milk value chain channel refers, in this study, to a formal and contractual milk marketing system whereby smallholders market their raw milk product collectively through a framers' group milk marketing cooperative to modern milk processors and then the processors further processed the raw milk in to pasteurized milk and to other dairy products and finally the processors market it through retailers to urban consumers.

An informal milk value chain refers to a spot milk marketing system whereby smallholders market their raw milk product either directly to neighboring rural consumers or indirectly, and inconsistently, through local collectors to urban consumers without any further value added.

The overall model was significant at the 0.01 significance level indicating a 99% confidence level that the explanatory variables selected assessed the effects on the probability

smallholders opting for a formal milk value rather than an informal milk value chain, as indicated by the log pseudo 87 likelihood value of -198.34. Moreover, based on the pseudo R^2 of 0.314, the model appears to be a good fit for the data (Table 5.5).

The study indicates that the majority of smallholders (86.1%) in the study area participate in a formal milk value chain, whereas only a very small proportion (13.9%) of participate in the informal milk value chain. The formal milk value chain is therefore the predominant fluid milk market channel for smallholder households in the milk value chain of the areas studied (Kimbibit and Bahirdar-zuria districts). The factors that influence the preference of smallholders for the formal milk value chain over the informal milk value chain are discussed below.

Of the 10 explanatory factors that are included and expected to cause variation in the dependent variable, only three factors (gender and age of the household head and buyers' availability) were not significant in affecting the sampled farm households' preference for the formal milk value chain over the informal milk value chain. Moreover, most of these variables such as educational status of the household head, distance to milk collection centers, membership of a cooperative, the annual cost of oil seed cakes and wheat barn feed, cross-breed cow ownership status and the number of cross-breed cows owned display the expected coefficient sign, whereas distance to asphalt roads displays an unexpected positive coefficient sign (see table 15.below).

Table 15: Second-stage binary logit estimation results for the determinants of the probability of smallholders opting for the formal milk value chain

Independent variables	Coef.	z (P>z)
Age of the household head	.3284207	2.21*
Sex of the household head (Male)	-.3511441	-0.20
Educational status of the household head		
Literate	10.93518	2.45*
Elementary level	15.49168	3.12**
High School level	23.18903	3.13**
Costs of oil seeds cakes	.0051416	3.31**
Costs of wheat bran	.0126267	3.49***
Number of cross breed cows owned	6.188003	3.58***
Cooperative membership (yes)	9.423176	3.12**
Distance to milk collection centers	-.016471	-3.56***
Distance to nearest town	-.0024514	-1.90*
Distance to asphalt roads	.0043731	2.20*
Milk buyers' availability information (yes)	2.269386	1.23
_cons	-27.47873	-3.14**
Number of obs. = 115 Pseudo R2 = 0.7585		
Wald chi2(13) = 27.86 Log pseudo likelihood = -6.369248		
Prob > chi2 = 0.0095		

***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels respectively.

Source: Data collected by the authors

As hypothesized, the educational level of smallholder's household head (Geleti et al. 2014; Sharma 2009) is positively and significantly related to the choice of a formal milk value chain rather than an informal milk value chain at less than 5% significance level. The higher the educational level of a smallholder's household head is, the higher the probability the smallholder will choose a formal milk value chain over an informal milk value chain. Education is believed to give individuals the necessary knowledge that can be used to collect market information, interpret the information obtained and make production and marketing decisions. The education level is positively correlated with the choice of a formal milk value chain because as the education level increases, the farmers' ability to adopt market risk activities increases and strengthens the involvement in high-return markets (formal markets) (Gebru 2006; Chege et al. 2015).

As expected, variables relating to smallholders' asset or resource status such as the number of cross-breed cows (Ahmed et al. 2003; Sharma 2015; Hambloch et al. 2014), annual costs of wheat barn and oil seed cakes (Hambloch et al. 2014; Tegegne et al. 2013) positively and significantly affected smallholders' decision to favour a formal milk value chain over an informal milk value chain at 1%, 1% and 5% levels respectively. A formal, high-value food value chains therefore display high barriers to entry requiring higher investment and production costs than informal high-value food value chains (Miguel I Gómez & Ricketts 2013). However, resource constraints are one of the reasons for the exclusion of smallholders' from formal high-value food value chains (Mungandi et. al. 2012). Similarly, access to formal milk value chains requires regular and better milk quality supplies in the areas studied. To this end, smallholders have to adopt a market-oriented dairy production and need to invest in inputs such as cross-breed cows and nutritious, rich dairy feeds. Empirical studies show that the adoption of cross-breed cows and concentrated feed is critical for dairy productivity and in turn access to a formal milk value chains (Ahmed et al. 2002; Dayanandan 2011; Ahmed et al. 2003). However, resource constraints in the study areas negetively affected the market-oriented resource allocation of smallholders in their dairy activity. Smallholders with higher numbers of cross-breed cows and a higher investment in concentrated feed such as oil seed cakes and wheat barn thus display a greater presence in formal milk value chains than smallholders with fewer cross-breed cows and less investment in concentrated feed in the study areas. The more farmers make specific investments in a particular farm business, the higher the probability they will choose a less risky market with higher returns (formal market) (Gebremedhin et. al 2010; Abafita et al. 2016; Gebremedhin et. al. 2012) over a high-risk and low-return market (informal market) .

As hypothesized, variables relating to transaction costs factors such as the distance to milk collection centers (Ahmed et al. 2003) and the distance to the nearest town (Mungandi et. al. 2012; Zivenge 2012) significantly and negatively affect smallholders' choice of the formal milk value chain over the informal milk value chain at 1% and 10% significance levels, respectively. Milk collection centers are major rural milk market outlets for the formal milk value chain and a crucial determinant for linking smallholders' to the formal milk value chain. Hence, the farther distance smallholders are located from formal milk markets, the higher the information and market research costs they incur and the higher the market risk they face. In turn, the higher information or market research costs, the lower the smallholder participation in these distant formal milk markets (Mungandi et. al. 2012; Kaganzi et al. 2009; Zivenge 2012; Abafita et al. 2016). Smallholders located closer to milk collection centers are thus more likely to choose a formal milk value chain over an informal milk value chain than smallholders located farther away

from milk collection centers in the study areas. Similarly, this study confirms that the distance to the nearest town negatively affects smallholders' decision to operate in a formal milk value chain at the 10% significance level in the areas studied. The study found that smallholders living close to the nearest town are more likley to opt for a formal milk vale chain over an informal milk value chain than smallholders located far from the nearest town in the study areas. This result reflects other empirical studies (Abafita et al. 2016; Gebru 2006; Kaganzi et al. 2009; Hambloch et al. 2014) showing that smallholders closer to towns/cities have better access to modern daiiry inputs and end markets than smallholder living far from towns/cities. In turn, the closer smallholders are to towns, the lower the information and market research costs incurred in accessing formal and/or modern, high-return milk markets. This study thus confirms that the distance to the nearest town is the other critical determinant for smallholders to access formal milk value chains in the areas studied.

It is unexpected that the variable concerning the distance to asphalt roads positively influences the choice of smallholders to opt for a formal milk value chain in the study areas. Empirical studies (Alwang et al. 2012; Boniphace et al. 2015; Ahmed et al. 2003) show that smallholder transport costs are largely determined by access to asphalt roads. More importantly, the studies show that transport access is critical in connect smallholders to a formal high-value food markets for high-risk food due to its highly perishable nature (Miguel I. et. al. 2013). Empirical studies therefore show that the probability of participating in a formal high-value food value chains is higher among smallholders who are close to asphalt roads than among smallholders who live far from asphalt roads. In this study, however, the variable concerning the distance to asphalt roads is positive and significant. Smallholders located closer to asphalt roads are, suite unexpectedly, less likely to opt for a formal milk value chain than smallholders located farhter from asphalt roads in the study areas.

As hypothesized, varaiable relating to membership of a cooperative (Hambloch et al. 2014; Francesconi 2009; Bernard et. al. 2009; Tassew et. al 2009; Bernard et al. 2007; Fischer & Qaim 2012) is positively and significantly related to smallholders' choice of a formal milk value chain over an informal milk value chain. This result echoes the empirical evidence in that the probability of participating in a formal milk value chain is higher for smallholder who are members of a milk marketing cooperative in the study areas than among smallholders who are not. This is because collective action through the formation of milk marketing cooperatives is a key pathway for smallholders to access formal milk markets in the study areas. Empirical studies (Fischer et.al. 2012; Francesconi et. al. 2007; Kaganzi et al. 2009) show that producers

engage in cooperative marketing in repsonse to fundamental problems in the market and when they only have small quantities of milk to market. Moreover, milk is highly perishable and thus requires special handling to ensure quality and shelf life. Milk marketing with poor rural infrastructures is costly and risky, as the product requires quick to-market time and a modern marketing system (Miguel I. et.al. 2013; Chege et al. 2015). Thus the rapid delivery of small quantities of milk, ranging from 2 to 11 liters/day to formal milk markets may not be practical or economical; some smallholder producers may market no more than 3 liters/day on any given day in the areas studied. Given the high perishability of milk, marketing the small quantities of milk they produce may cause smallholders to face a high transaction cost risk. Therefore, the practical collection and transportation of milk to modern/formal milk markets usually requires quality controls, bulking, cooling and rapid transportation that requires good organization (CARE, 2008). This is why smallholders in the study areas adopted cooperative milk marketing strategies to supply their milk to the formal milk markets with better returns. A cooperative milk marketing strategy involves collective milk marketing activities by jointly owned smallholder milk marketing enterprises which pool their resources, expertise and finances to market their raw milk products to formal milk markets. Milk marketing cooperatives thus offer member smallholders economies of scale in their milk marketing activities, bargaining power, access to modern markets and a better price for their milk (Fischer & Qaim 2012). This study confirms that the probability of opting for a formal milk value chain is higher for smallholders who are members of milk marketing cooperatives than for smallholders who are not (Francesconi 2009).

5.4. Conclusion

The majority (65%) of smallholder farmers in our sample lack access to a fluid milk market. However, of all smallholders sampled who sell fluid milk, the majority (81.9%) have access to a formal fluid milk value chain. It is possible to argue that collective marketing through cooperatives is the predominant fluid milk marketing strategy of smallholder households in the areas studied. The dairy production systems of households operating within a formal milk value chain are found to be market-oriented, while smallholders who opt for an informal milk value chain focus on subsistence. The binary logit model indicates that transaction cost factors such as the distance to milk collection centers or milk markets, the nearest town and collective action through milk cooperatives exercise a crucial influence on smallholders' decisions to sell milk and their choice of a formal milk value chain. The study found that the distances traveled to milk collection centers and the nearest town (proxies for a formal milk market) by smallholder operating in a formal milk value chain households are significantly lower than among

households in the informal milk value chain as well as for those not selling milk. In addition, all households participating in the formal milk value chain are members of milk cooperatives whereas no households in the informal milk value chain and no non-milk-selling households are members of cooperatives. The study found that the quality and quantity of inputs such as concentrated feed and cross-breed cows used in dairy production by smallholders are significantly higher inhouseholds with a more formal milk market outlook than in those opting for the informal milk value chain and those not selling milk. These results, therefore, show that smallholders' market-oriented dairy production behavior is high likely to be influenced by transaction cost factors such as distance to formal milk markets and cooperative membership. This in turn affects the decision of smallholders to opt for a formal milk value chain. In other words, the likelihood of market-oriented smallholders' to opt for the formal milk value chain is significantly higher than in subsistence households. It can therefore be argued that transaction cost factors such as the distance to milk collection centers and cooperative membership are crucial in determining smallholders' access to the formal milk value chain.

CHAPTER SIX

FOOD SECURITY AND NUTRITION IMPACTS OF SMALLHOLDER FARMERS' PARTICIPATION IN FORMAL MILK VALUE CHAIN.

6. FOOD SECURITY AND NUTRITION IMPACTS OF SMALLHOLDER FARMERS' PARTICIPATION IN FORMAL MILK VALUE CHAIN[1].

Geday A. Elias[1], Tolossa Degefa[2], Padilla Martine[3], Montaigne Etienne[4]

[1] MOISA, Sup-Agro Montpellier, France; [2]CDS, Addis Ababa University, Ethiopia

[3]CIHEAM Montpellier, France;

[4]MOISA, Sup-Agro Montpellier, France

Abstract

Linking smallholder farmers to formal dairy value chain industry has identified as a potential pathway to get out of poverty trap by raising incomes and by increasing the availability of nutrient-dense foods in Ethiopia. However, little known about the poverty implication of smallholder participation in dairy value chain. We assess food security and nutrition impacts of smallholder farmers' participation in the formal milk value chain with cross sectional survey data from Ethiopia. To assess smallholder farmer households' food and nutrition security outcomes, we employed multiple food access measurements such as per capita dietary energy intake, food consumption score, and household income. We use propensity score matching model to analyze impact pathways. The results show that as compared to households without participation, households with participation have higher dietary energy intake, dietary diversity, and household income. However, there is a negative association between participation in the milk value chain and level of milk consumption. We find that smallholder farmers' participation in milk value chain has a positive significant effect on food sufficiency, dietary diversity and income. This study, therefore, confirms the potential role of smallholder farmers' participation in the formal agri-food value chain to get out of poverty trap through improving rural household income, food security and nutrition.

Key words: food security, impacts, milk value chain, nutrition, smallholder farmer.

Résumé

L'intégration des petits exploitants à la chaîne de valeur de formel des produits laitiers est identifiée comme une voie potentielle pour sortir du cercle vicieux de la pauvreté en augmentant les revenus et en augmentant la disponibilité d'aliments nutritionnellement denses en Ethiopie. Cependant, l'implication de la participation des petits exploitants à chaîne de valeur laitière sur de la pauvreté reste peu connue. Nous évaluons les impacts sur la sécurité alimentaire et la nutrition de la participation des petits agriculteurs à la chaîne de valeur formelle du lait à partir

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de données d'enquêtes transversales réalisées en Ethiopie. Pour évaluer la sécurité alimentaire et nutritionnelle des ménages des petits agriculteurs, nous avons utilisé plusieurs mesures d'accès aux aliments telles que l'apport alimentaire énergétique par habitant par jour, le score de la consommation alimentaire et les revenus des ménages. Nous utilisons un modèle de « propensity score matching » pour analyser les impacts. Les résultats montrent que par rapport aux ménages sans participation, les ménages qui participent au marché ont un apport énergétique plus élevé de la ration alimentaire, une plus grande diversité alimentaire et davantage de revenus. Cependant, il existe une association négative entre la participation à la chaîne de valeur du lait et le niveau de consommation de lait. Nous constatons que la participation des petits exploitants agricoles à la chaîne de valeur du lait a un effet positif significatif sur la suffisance alimentaire, la diversité alimentaire et le revenu. Cette étude confirme donc le rôle potentiel de la participation des petits agriculteurs dans la chaîne de valeur agroalimentaire pour sortir du cercle vicieux de la pauvreté piège grâce à l'amélioration des revenus des ménages, de la sécurité alimentaire en milieu rural et de la nutrition.

Mots clés: sécurité alimentaire, les impacts, la chaîne de valeur du lait, la nutrition, petit agriculteur.

6.1 Introduction:

Food insecurity and poverty remain significant problems for many sub-Sahara African smallholder farmers (Issues 2014; Graef et al. 2014.). Due to subsistence production, still smallholder rural farmers are facing with the problems of food insecurity and malnutrition. Addressing the challenges of transforming smallholder farmer in to market oriented production system is therefore an important priority development agenda if the food insecurity issue is needed to be addressed in sub Saharan African countries (Silvia et al. 2015).

Empirical studies and development programs shows that inclusive agri-food value chain[1] approach identifies as a promising pathway to address poverty and hunger in sub-Sahara Africa (Wonder 2014; Mungandi et al. 2012; Kadigi et al. 2013; Issues 2014). Studies of the welfare effect of value chain for example shows that it has a significant positive effect in improving welfare status of smallholder household through increasing their income and employment opportunity (Asfaw et al. 2012; Tirkaso 2013; Vca et al., 2011; Asfaw et al. 2007). It has also positive effect on food and nutritional status of producers who have participated in the value chain market (Halloway et. al., 2000 and 2004; Mitchell et al., 2009). For instance, (Chege et al. 2015) used FCS to measure nutrition impacts of participation in value chain through supermarket in Kenya. The study found that participation in formal value market channel has a significant positive impact on calorie intake. The study by (Miyata et al. 2009) on the other hand, used income as an outcome variable to evaluate the impact of smallholder integration in to

agricultural value chain through contract farming. The study show that contract farming increases the income of participating farmers. It is, therefore, understanding of how to link smallholder farmers to the formal agri-food value chain sustainably and how to promote their competency in the value chain are still a development and research agenda in developing countries.

Similarly, studies show inclusive dairy value chain development in country like Ethiopia is likely to contribute to multiple welfare gains for rural community such as: source of income and employment; improving household food security and nutrition; enhancing production and marketing of agricultural food products. (Makoni et al. 2013 ; Ahmed et al. 2003 ; Redda, 2001; Ahmed et al. 2004). While linking smallholder farmers to formal dairy value chain identifies as a potential pathway to get out of poverty trap by raising incomes and by increasing food availability in Ethiopia, much less is known about the poverty implication of smallholder participation in the formal dairy value chain. Moreover, there is a dearth of empirical studies that have analyzed food security and nutritional impacts of dairy value chain participation using multiple household food access measurements.

Here, we address this research gap using detailed farm households' survey data. In exploring on the linkage between dairy value chain and food security and nutrition, we focused on smallholder mixed crop-livestock farming system of Ethiopian highlands. Ethiopia, particularly the highland mixed crop-livestock production system area is an interesting example because the area is known by its cattle friendly agro climatic condition as well as it is the largest (68%) milk source of the country comes from this area. We focus on smallholder because the largest (95%) share of the country's milk supply comes from the smallholder farmers. The highland mixed crop-livestock area, therefore have huge untapped potentials for inclusive dairy value chain development in Ethiopia (Ahmed et al. 2004).

To enhance the role of dairy subsector for rural development and food security in Ethiopia, there is a need to understand how to integrate into the formal dairy value chain and the integration impact on poverty reduction and food security. We therefore analyzed nutrition impacts of smallholder farmers' participation in the formal milk value chain in Ethiopia. Based on food consumption survey data we conducted, we compare food security and nutritional status between rural smallholder farm households with and without participation in the formal milk value chain. Using propensity score matching (PSM) model, we also analyzed impact pathways using food access outcomes measurements that comprises: incomes, per capita calorie intake,

and dietary diversity score at household level. In addition, level of milk consumption used as nutrition outcome variable.

We hypothesize that smallholder farmers' participation in the formal milk value chain has a significant positive impact on food security and nutritional status improvement of farm households directly through increasing milk consumption due to surplus production. Moreover, participation in the formal milk value chain is high likely to improve nutritional status of smallholder producer households indirectly through higher calorie intake and consumption of better diversified food due to income effect from milk sales. In the next section, we present the research methods with the study area. Follow with a descriptive analysis of covariates and outcome variables of participated households as compare to non-participated households. In a separate section, we present conceptual framework and empirical model specification of the study. Then, we present the result and discussion of propensity score matching analysis on the impact pathways of milk value chain participation. Finally, we present conclusion with policy implications of the study.

6.2 Methods

6.2.1. Farm Household Survey

A farm household level survey was carried out in the major milk producer areas of Kimbibit and Bahir-Dar Zuira districts of Ethiopia during September to January, 2013/2014. We chose the two districts (woredas) because of its considerable potential area for dairy value chain development and they are in highland mixed crop-livestock production system area.

Our sample consists of 333 smallholder farm households which were selected by a three-stage random sampling techniques. First, based potential for dairy production development, the two districts –Kimbibit from Oromia and Bahir-Dar Zuria districts' from Amhara regional state purposefully selected, respectively. Next, with the help of the districts agricultural offices, 7 milk shades study sites also called rural *kebelles* were selected purposefully from the two districts. Then a list of farm households with at least one milking cow was prepared with the help of development agent from each of selected rural *kebelles*. Finally 333 farm sample households were randomly drawn from a complete list of respective selected *kebelles* in conformity to proportionate to size random sampling procedure. Accordingly, 163 farm households were drawn from Kimbibit district and the rest, 170 farm households were drawn from Bahir-Dar Zuira district. The survey questionnaire data from the sample households was collected through a

face to face interview with the wife and the head of selected households. Of the 333 total sampled households, the largest number, 235 or 70 % were not participated in the formal milk value chain; whereas, 98 or 30 % of smallholder households were participated in the formal milk value chain. The data collected include general household demographic and socio-economic characteristics, dairy production and marketing activities, incomes and income sources and food consumption status (see below for details). It is therefore, we used the participated households (n=98) as treatment group and non-participated households (n=235) as control group to analyze the impact pathways of participation in the formal milk value chain.

6.2.2. Outcome variables measurement approach

Food access, is one dimension of food security measurement, define as the household economic and physical access to nutritious food for active life (Roberto et al. 2014; Capone et al. 2014)). To analyze the food and nutrition impacts of smallholder participation in the formal milk value chain, we used household annual income, daily per capita caloric intake and household dietary diversity score as outcome variables to measure food access at household level. These outcomes are the most common food access measurement approaches at household level, and which have also been used for impact assessment in a few studies (Abadi et al., 2013; Abebaw et al. 2013; Adewumi et al., 2013; Babatunde et al. 2010; Gómez et al. 2013; Sharma et al. 2013; Årethun 2012). We also used level of milk consumed in the sampled households as additional outcome variable to analyze the nutritional impact of participation in the milk value chain. Below we discuss the measurement approaches used in this study in detail.

I. Annual household income

Annual household income data collected from the sampled farm households through asking to recall the incomes earned within one year before the survey. The household income here defined as is the sum of farm, non-farm and off-farm incomes as well as remittance income. The farm income here refer to the households own agricultural production outputs consumed and sold out that comprises crop, fruit and vegetables, cash crop and livestock and livestock products. We would expect incomes from milk sales lead to increase the total household income and then increase the households' food access capacity. Limitation of data quality is always an issue in a recall survey with longest period like here in our case one year recall income survey. In order to minimize such data quality problem, we asked respondents to recall the farm income and off-farm incomes based on the different harvesting seasons of the farm business

transaction within one production year and then calculate the total annual farm income. With regard to non-farm and remittance incomes, we asked respondents to recall incomes in a quarterly base of the year prior to the survey. Various studies (Ahmed et al. 2003; Rich et al. 2011; Chege et al. 2015; Barrett et al. 2012; Marani 2012; Miyata et al. 2009) used income as an outcome variable to evaluate the impact pathway of agriculture.

II. Daily per-capita calorie or dietary energy intake

Calorie intakes is one of a commonly use food security indicators that measure food access in terms of quantity of food energy consumed at household level (Abadi et al. 2013; Adewumi et al., 2013; Ahmed et al. 2003). Based on food balance sheet model (FAO 1989), following Degaga (2005) here we used the caloric value of daily per capital consumption of the staple cereals based food in the households as our measure of food security. We use cereals based calorie intake because cereal is the major staple food and largest sources of food energy (accounts 60% of calories) for the rural people in the most Ethiopian highlands (Hirvonen et al. 2015; Francesconi et al. 2007; Gebrehiwot et al. 2015). We therefore used cereals consumed within one year in the sampled households to measure the food security status or calorie intake status at household level. To this end, details in kilograms of the staples cereals food that study households produced, used for seeding, wasted and sold out as well as cereals the households consumed from own production, purchased, transferred, and granted inform of gifts were collected within one year period (2013/2014) before the survey. And then, net cereals food consumed at the household level calculated through subtracting the total amount of cereals comes out from the total amount of cereals comes in the household during one year prior to the survey. Here taking one year food consumption recall survey has both advantage and limitation on the data quality. It is an advantage because it solved the data quality problems due to seasonal consumption differences through collecting the all season's food consumed in the recall survey. On the other hand, it has also limitation on the data quality when respondents asked to recall the amount of food consumed in the household with longest period, one year. Hence our food consumption recall survey was solely based on the main cereals based staples food as well as it was based on the cereals harvesting seasons farm transactions, it was not that much significant problem to recall respondents on the cereals food consumed in the household. Moreover, the respondents were the wife or female adult, who is responsible in preparing food to the household, with the head of the family. To calculate per capita calorie consumption levels, first converted the total cereals consumed at household to calorie levels using standard food composition tables for Ethiopia foods (EHNRI, 2007). The total amount of

these cereal based calorie intake for each household was then divided by the household adult per unit size (AE) to obtain daily per capita caloric intake from the cereals. In these calculations, it is assumed that food within the household is distributed according to individual active adult calorie requirement (EHNRI, 2007). To determine calorie intake or food security status, we compared calorie amounts consumed with the standard levels of requirements. That is, a daily intake of 2200 calories (kcal) is recommended for Ethiopian a moderately active male adult (EHNRI, 2007; Beyene 2014). We defined therefore a food secure household as one whose calorie supply per AE was greater than or equal the minimum daily calorie requirement for adult male of 2200 kcal (EHNRI, 2007). Households whose daily calorie intakes were lower than 2200 kcal therefore defined food insecure or undernourished households. Based on the local standard food composition table (EHNRI, 2007; Beyene 2014); we also used a thresholds category to compare food security status between households with and without participation in the modern milk value chain. Accordingly, the food secured households were those households whose per-capita calorie intakes is greater than or equal 2200kcal; moderately food insecure households comprises households whose per-capita calorie intakes was between 2200 and 1650 kcal and; households with below 1650 per-capita calorie intakes categorized as extremely food insecure households(Beyene 2014).

III. The Food Consumption Score (FCS):

The Food Consumption Score (FCS) is a food frequency measure developed by the World Food Program (WFP) to measure nutrition or dietary diversity consumed at household level (WFP, 2009; FANTA 2006, FAO, 2010). Based on FANTA FCS guideline, we included a seven day food consumption recall in the survey for measuring FCS of the household. To this end, first we collected the number of food variety (out of 8 possible food groups) that any household member has consumed over the previous 7 days with its frequency. Then, we multiplied by the number of days that the food group was consumed, weighted by the nutritional importance of the food group, for a total possible score ranging from 0 to 112 FFS. Only foods consumed in the home were counted in this indicator. Broad food groups and associated FCS weights were: main staples -weighted at 2, pulses - weighted at 3, vegetables - weighted at 1, fruit - weighted at 1, meat and fish - weighted at 4, milk - weighted at 4, sugar - weighted at 0.5, and oil - weighted at 0.5. (Condiments can also be captured but are weighted at 0). The FCS score was constructed so that a higher diet diversity score implies that the household consumed a better nutrition in terms of better diet diversity. Based on the consideration that the sampled households consumed oil and sugar regularly, thresholds were imposed on the continuous score to

differentiate the households into one of three categories: acceptable diet diversity status (> 42), borderline diet diversity status (28–42), and poor diet diversity status (< 28) (WFP, 2008; IFPRI 2006, Coates et al. 2007). Various studies (Abebaw et al. 2010; Maxwell et al. 2013; Tiwari et al. 2013; Nkhata et al. 2014; Cintron et al. 2013; Sharma et al. 2013; Kabunga et al. 2014) use FCS as nutritional outcome variables.

IV. Level of milk consumption

Milk is a source of a highly nutrition-dense food for people of all age groups and particularly for infants and lactating mothers thus reducing the problem of malnutrition among rural households in Ethiopia (Ahmed et al. 2003; Hoddinott et al. 2015). However, because of subsistence production system both milk production and consumption is very low in rural areas (Ahmed et al. 2003). Moreover, milk consumption status in Ethiopia is the lowest (17 litter per capita per year) in the world, even low in sub Saharan Africa (Francesconi et al., 2007; Steen et al., 2014; Yilma et al. 2011). A transition to market oriented production due to integrating in to formal value chain is a pathway to improve milk productivity and then milk consumption at producers' household level (Tegegne et al. 2013; Gebremedhin et al. 2008). To analyze the nutritional impact of smallholders' participation in the formal value chain, therefore, we used the weekly level of milk consumed from own production of the sampled households (participated households as treatment group and non-participated as control group). We hypothesis that households with participation are high likely to be better off in milk consumption compared to households without participation in the formal milk value chain.

6.3 Descriptive Analysis

A T-test analysis on both covariates and nutritional outcomes variables was performed between participants and non-participants of the formal milk value chain. Our result shows except age of the household head, there was a significance difference in the all covariates mean values between households with and without participation in the formal milk value chain (see table 16). Participated households in the sample were significantly higher in education, using cross breed cows in their dairying, investing more on concentrate feeds and milk yield quantity compared to non-participated households as shown in table 2. Moreover, with regard to distance to milk market or milk collection center, there was a significance difference between households with and without participation. The participated households had significantly better by nearly 85 minutes compared to non-participated households to access milk outlet market. Table 16 show important nutritional outcome variables, differentiating between households with and without

participation in the formal milk value chain. The result show there were a significance differences in the mean values of the outcome variables of milk consumption, farm income, food consumption score and per-capita calorie intake between the sampled households with and without participation in the formal milk value chain. The average weekly milk consumption of the participated households (0.7 liter) was significantly lower than the households without participation (4.5 liter). On the other hand, the average household annual incomes and food consumption score of the participated households are 48,217 birr and 69 respectively and, significantly higher compared to non-participated households (22239 birr and 35 respectively). Likewise, the average per-capita calorie intake was significantly higher among households with participation compared to households without participation in the chain. Another way of looking at the latter two outcomes is shown in appendix I, where households are categorized into thresholds using per-capita calorie intake with food-secure, moderately food insecure and extremely food-insecure households. Similarly, using FFS-dietary quality thresholds we categorized households with acceptable, boarder line and poor dietary quality households. The result in appendix I, shows number of food-secure households was higher among participated households (90), while the number of moderately and extremely food-insecure households was higher among non-participated (99 and 79, respectively).

Table 16: T-Test Result on Outcome Variables of Surveyed Households level.

Outcome Variables	Mean Participants	Mean Non-Participants	Differences
Weekly Milk consumption	.6571429	4.479787	-3.822644***
Annal HH income (Birr)	48216.55	22239.2	25977.35***
Food consumption score	67.91837	34.68511	33.23326***
Per-capita calorie intake per day	2921.626	1948.148	973.4781***

Source: Survey2013/2014; *** significance at 1% level.

Similarly, with regard to diet diversity score, the number of households with acceptable status was higher in the participated households (55). Whereas, the number of household with poor and borderline diet diversity scores were larger with non-participated households. However, based on these comparisons alone we cannot conclude that participation in the formal milk value chain causally improves food security and nutrition. This are discussed in the next section where we used these variables of income and nutrition indices as dependent outcome variables in matching model to analyze the impact pathways.

6.4. Analysis of the Impacts Pathways

6.4.1. A Conceptual framework

There is strong linkage between agriculture and nutrition whereby agriculture plays a significant role in improving nutrition and livelihood of the rural community in developing countries (Kumar et al., 2011). Empirical studies shows agri-food value chain can facilitate moving along the agriculture to nutrition impact pathways up to the point to which households have diverse foods on individual plates, through increased production and income, improved storage and improved joint household decision making. In general, the following two impact pathways that dairy value chain can affect nutrition at the farm household level (Ahmed et al. 2003; Lie et al. 2012; Esenaliev et al., 2013; Asfaw et al. 2012). The first pathway is a positive impact on milk production volume or quantity of milk yield that it can affect directly in improving milk consumption through increasing surplus milk availability from own production at household level. The second is an indirect income impact that it can affect access to nutritious food at household level. To analyze the impacts of smallholder participation in formal milk vale chain on farm household food security and nutrition, we used the two conceptual pathways (milk production volume to milk consumption effect and milk income to food purchase effect) between dairy value chain and food and nutrition security linkage. Based on empirical literatures, we hypothesize that food and nutrition security impacts of formal milk value chain participation may mainly occur through two closely related pathways, as shown in Figure 6. The first direct pathway may be through affecting production orientation or farming system choices at the farm level and thus changes in the availability of home-produced nutrient dense food, milk. Previous studies shows that smallholder choice on market oriented production is often associated with on-farm specialization and then surplus production (Kumar et al. 2011; Kaganzi et al. 2009; Ahmed et al. 2003; Asfaw et al. 2012;Tirkaso 2013). However, such market oriented transition choices influence household nutrition either in positive or negative directions will depend on the types of commodities that farmers produce. If farmers specialize on cash crops with no or low nutritional value (such as tea, coffee and etc.) dietary quality may not improve directly from cash crop production. Yet, in our case farmer who were participated as a seller in the formal milk value chain specialized in milk production due to the transition of farming system. This may lead to surplus milk production and then lead to more milk consumption at the household level and thus improved dietary quality.

The second pathway is indirectly through increased household income due to more milk sales. As several studies shows that participation in the formal milk market channels can cause significant income gains at dairy farm household level (Gómez et al., 2013;Chege et al. 2015; Anderson et al., 2015; Ahmed et al. 2003). Higher incomes therefore may improve the economic access to food, which may result in higher food expenditure and this in turn led to higher calorie consumption and better coping capacity with food shortage or hunger (Manson et al. 2014; Steen et al. 2014). Moreover, rising economic capacity of the farm household due to more milk sales may contribute to access better diversified diet at the household level (Ahmed et al. 2003).

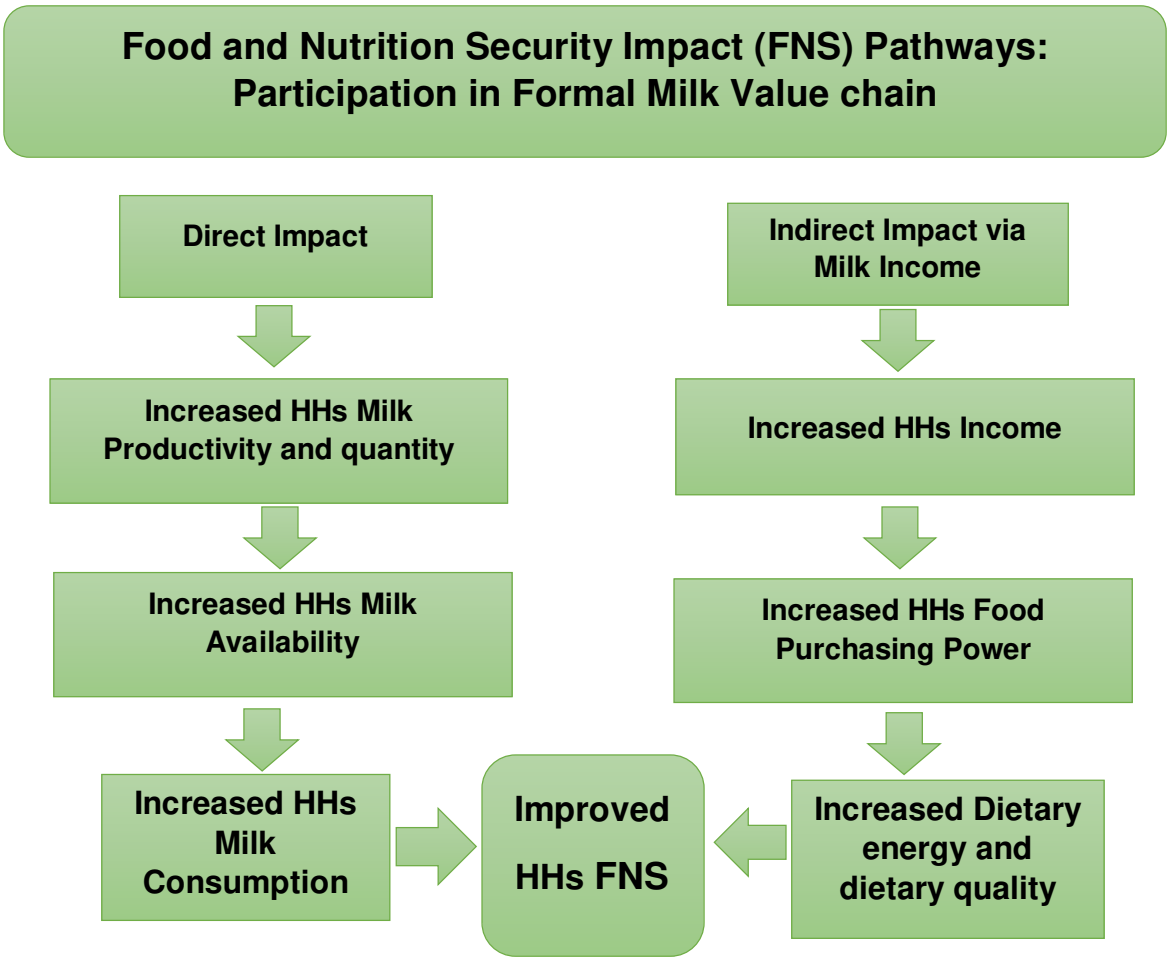

Figure 6: Impact pathways linkage of smallholders' participation in the formal milk value chain and food security and nutrition

Source: Authors own diagram

6.4.2. Empirical strategies

The PSM analysis was aimed at assessing nutrition impacts of modern milk value chain participation using average treatment effect on the treated (ATT) at dairy producer household level. The outcome variables we used to measure food and nutrition security comprises were milk consumption as a direct impact as well as income, calorie intake and a seven day diet diversity score as indirect impact. ATT computes the average difference in outcomes of farm households with and without participation in the formal milk value chain:

$ATT = E\ (Y_{1i} - Y_{0i}\ |D_i = 1) = E\ (Y_{1i}\ |D_i = 1) - E\ (Y_{0i}\ |D_i = 1)$..... (1)

Where $E\ (\cdot)$ denotes an expectation operator, Y_1i Y_1ii Y_1iii Y_1iv were the outcome variables of milk consumption, annual household income, per-capita calorie intake and the seven day diet diversity score for a household with participation in the formal value chain (Participated) respectively. Y_{0i} Y_{0ii} Y_{0iii} Y_{0iv} were the outcome variables of milk consumption, annual household income, per-capita calorie intake and the seven day diet diversity score of the same household without participation in the formal milk value chain (non-participated), and D_i is a treatment indicator equal to 1 (participated) if the household participated in the formal milk value chain and 0 (non-participated) otherwise. Since this study is a non-experimental impact assessment research, presence of selection bias may affect the impact analysis results with bias result if such biases are minimized through following the proper impact analysis model. The selection bias could arise mainly from nonrandom location of the sampled households and nonrandom selection of participant households. There were two potential source of bias in our impact estimation analysis. The first one would be participant households may significantly differ from nonparticipants due to observable characteristics (such as education, age, distance to market, and technology adoption) that may have a direct effect on outcome of interest. The second source of bias would be the difference between the two household groups arises due to unobservable characteristics such as motivation, managerial skills, and risk preference, which may play an important role in decisions related to market participation and market channel choices (Asfaw et al., 2012; Babatunde et al.,2010; Chege et al., 2015; Bahta et al., 2007)

We therefore used the PSM analysis and then minimized the biases of households' relevant observable characteristics by comparing the outcomes between treatment group (participant household) and control group (non-participant households) (Caliendo et. al. 2008). Empirically, this follows two stages: First, we generated propensity scores P (0.29) from a probit model, which essentially indicate the probability of a household participated in the formal milk value chain given observed characteristics:

Pr (Di = 1|Xi) ≡ P (Xi) …… (2)

It is upon this propensity score that a control group was constructed by matching. Participant without an appropriate match from the non-participant category were dropped from further analysis.

In the second stage, we calculated the ATT of participation in the formal milk value chain on outcome variables, Yi-iv, using matched observations of participants and non-participants as follows:

ATT^{psm} = [Y_{1i} |Di = 1, P (Xi)] – E [Y_{0i} |Di = 0, P (xi)] …… (3)

Among several matching methods commonly use in PSM model (Chege et al., 2015; Lee, 2008; Rosenbaum. et al., 1983), the nearest neighbor matching (NNM) and kernel-based matching (KBM) and Radius Matching (RM) methods were the matching methods that we used to estimate ATT impact pathways.

We also controlled the estimated bias through checked in covariate balancing by comparing the pseudo-R2s before and after matching (Lee, 2008; Rosenbaum. et al., 1983). Since no systematic differences should appear in the distribution of covariates between both groups (Rosenbaum et al., 1983).

6.4.3. Empirical Impact estimation Result:

6.4.3.1. Introduction

In the previous section, we presented general overview of the food security and nutritional status difference between households with and without participation in the formal milk value chain. An analysis of impact evaluation would not be complete without performing further econometric analyses to quantify the impact of value chain participation on nutrition. We next move on to discuss the results from the PSM model analysis.

The propensity-score matching estimates analysis involves two steps. First, we employed the probit model to obtain the propensity score. The purpose was to maximize the predictive power of the model through reducing sample selection bias. Probit estimate was done on 8 covariates, which were found to generate best balance between the treated and control group (households with and without participation in modern milk value chain). The probit estimate of determinants of formal milk value chain participation was presented in the table 17 below. The results of binary probit model shows among covariates included in the model, technology adoption inform

of using cross breed cow, investment cost inform of costs for concentrate feeds, amount of milk yield and distance to milk market or collection center were found significant factors determining smallholder participation in the formal milk value chain.

Table 17: The probit estimate result of determinants of formal milk value chain participation choice of smallholder households

Covariates	Coef.	Err.	P>z	Mean Difference
Age-continuous variables #	-.0329186	.0296612	0.267	-1.457
Gender(male) -dummy variable	1.192542	.7495253	0.112	0.191***
HH Education: dummy vb.(illiterate as base)				
Literate	1.585705	1.067605	0.137	0.228*
Elementary level	1.253552	.961083	0.192	
High school level	7875388	5.192792	0.879	
Cross breed use(yes)-dummy variable	2.127986	.6696136	0.001	0.929***
Concentrate feed cost-continuous #	.0005184	.0002238	0.021	2679***
Daily milk yield amount-continuous vb. In liter	.4067465	.1523615	0.008	9.16***
Milk collection dist- continuous vb. In mint	-.000652	.0003066	0.033	84.5***
_cons	-1.177785	1.766791	0.505	
Number of obs = 333 ; Log likelihood = -15.213986 ; Pseudo R2 = 0.9246; Prob > chi2 = 0.000				

Source: Authors' own survey findings

Then, participated (treated group) and non-participated (control group) households were matched using Nearest Neighbor Matching (NNM), Kernel Based Matching (KBM) and Radius Based Matching (RBM) methods. To ensure maximum comparability of the two groups, the sample were restricted to the common support region, defined as the values of propensity scores where both treated and control cases can be found. As depicted in Appendix II, before matching we found that significance covariance mean value difference between treatment group (participated) and control group (non-participated). While after matching the covariates mean difference were fairly reduced. Similarly, the imbalances between the treatment and control samples in terms of the propensity score had been more than 80% before matching as shown in Appendix II and III. This bias was significantly reduced to a level of 43% after matching. These results clearly show that the matching procedure was able to balance the characteristics in the

treated (participated households) and the matched comparison groups (non-participated households). We therefore used these results to estimate the impact of participation in the modern milk value chain among groups of households having similar observed characteristics. As a result we can compare food security and nutrition outcomes for treated (participant households) with those a comparison group (non-participant households) showing a common support. Among the three ATT matching methods we used to analyze the impact pathways, we found significant effect on all outcome variables that we used in this study was with radius matching methods.

6.4.3.2. The Average Treatment Effect (ATT) Result

1. Direct impact pathway of participation in the formal milk value chain

We hypothesized that smallholder farmer participation in the formal milk value chain has a significant positive direct impact pathway on nutritional status at producer household level. This can happen through transition in production orientation, from subsistence to market-oriented due to the integration in to the formal milk value chain. In market-oriented production whereby smallholder farmers are basically produced for market, farmer produces higher volume of milk compared to subsistence farmer. We found that the volume of milk produced in the formal milk value chain participated households were significantly higher compared to non-participated households. Our hypothesis was, therefore, due to more surplus milk production in participated households, milk consumption would be significantly higher compared to non-participated household. As studies show that access to agricultural value chain study in Ethiopia has positive welfare and nutritional impacts on its own through the link between agricultural production and marketing (Ahmed et al. 2003; Asfaw et al. 2012). The direct positive nutritional impact of accessing value chain can happens through improving market access and reducing transaction costs on various agri-food outputs to both rural and urban community (FAO, 2013). Agri-food market access study in Ethiopia for example shows that improving market access to the remote rural community has a significant positive effect on nutrition through providing access to various nutritional outcomes foods in the local market (David et al., 2015).

We however found a miss much result with our hypothesis that participation in the formal milk value chain significantly affected milk consumption of the dairy producer households in negative way. The ATT results from table 19 below indicated that weekly milk consumption of participated households was lower but not significantly lower compared to non-participated households, which is (lowered by 0.07 litters) and (lowered by 0.30 liters) for nearest neighbor

and kernel matching respectively. But, radius matching ATT result shows households with access to formal milk value chain consumed significantly lower milk (lowered by 3.8 liters per week) on average compared to non-participants households. This suggests that households without access to the formal milk value chain were better off in consuming more this (milk) nutrition rich food than households with access to formal milk value chain. There is one study that shows similar result on the negative relationship between market access and milk consumption (Hoddinolt et al., 2015). The study was aimed at the analysis of the nutritional impact of cow ownership on children in the rural community of four major regions of Ethiopia. The study found out that cow ownership has a significantly positive effect on reducing stunting levels through milk consumption among children aged 6 to 24 months. The study also found that milk consumption among children is lower in the village with market access than non-market access. This later result is similar with our result. The possible reasons for this result of our study may be related to production decision of the farm household. In the case of cereals or other staple foods, production and consumption decision are not separated in imperfect market environment of the rural community. Farmers produced first to satisfy the household food demand and then the surplus is marketed. According to our focus group discussion result,

Table 18: ATT Food security and nutrition estimated impact of participation in the formal milk value chain.

Impact Indicators	ATT Matching Method	ATT Participants	ATT Nonparticipants	Difference	t-statistics
Milk consumption	KBM	.657692309	.712019343	-.054327034	-0.07
	NNM	.657142858	.948979592	-.291836734	-0.40
	RBM	.657142858	4.48183761	-3.82469475	-14.00**
Annal HH income (Birr)	KBM	41851.2692	36433.9279	5417.34138	0.56
	NNM	48216.551	35309.6939	12906.8571	2.64*
	RBM	48216.551	22266.6838	25949.8673	7.86*
Food consumption score	KBM	69.3076923	61.0860553	8.22163697	0.55
	NNM	67.9183673	56.0816327	11.8367347	0.79
	RBM	67.9183673	34.6880342	33.2303332	21.80**
Per-capita calorie intake per day	KBM	2647.67757	2477.65616	170.021412	0.63
	NNM	2921.62621	2475.79035	445.835853	1.15*
	RBM	2921.62621	1953.89608	967.730124	3.58*

Source: Author's own survey
, and *** are significance at 1%, 5%, and 10% levels respectively.
ATT-Average Treatment on Treated MBM- Kernel Based Matching

NNM -Nearest Neighbor Matching RBM-Radius- Based Matching

unlike cereals or staple food, animal sources of food like milk are consider cash crop in the study areas and use incomes from this source to solve their cash constraints for food and nonfood expenditures of the household. Most of the rural community depends on agriculture as their main source of income (Ahmed et al. 2003). It is therefore if they get access to dairy market particularly modern market, the likelihood of transition in to market-oriented production is high and then they marketed most of their milk output to solve their cash constraints (Barrett 2008; Stifel et al., 2015). The more surplus milk produced due to transition in to market-oriented production is the more incentive to sell than to consume milk in the study area. It is therefore there is a negative relationship between milk consumption and access to formal milk value chain. However, this result has limitation that intra household milk consumption impact analysis is not included in this study.

2. Indirect impact pathway of milk value chain participation

We hypothesized that via milk income effect, participation in the formal milk value chain can improve food security and nutritional status of dairy producer households indirectly. Based on our estimated result, we therefore accepted the hypothesized indirect impact pathways. The upper part of Table 18 shows that smallholder participation in the formal milk value chain had a positive and significant effect on income, calorie intake and diet diversity consumption on participated households.

When we examined the income impact of participation in the formal milk value chain between participated and non-participated households, we indeed found that the ATTs estimate was significantly higher for households with participation as compared to households without participation. The ATT results from table 18 above indicated that the total annual income of participated households was significantly higher by 12906, 5417 and 25949 birr compared to non-participated household with nearest neighbor, kernel and radius matching results respectively. This implies that participated households are better off in economic access to both quantity in terms of calorie and quality in terms of diet diversity compared to non-participated households. As explained above, if market is accessible to the rural community, milk is considered as cash crop that farmer produced mainly for sales. The higher the income level due to market oriented milk production, the higher the expenditure on food and non-food items (Ahmed et al. 2003; Asfaw et al. 2012). We therefore in this study confirmed this implication and hypothesis that households with participation in the formal milk value chain were significantly better off in calorie intake and diet diversity consumption as compared to the sampled

households without participation (see table 18). The ATT estimate result indicated in the table 18 above that the differences on the mean values of calorie intakes and diet diversity scores between households with and without participation in the formal milk value chain were substantial. Accordingly, the differences on calorie intake and diet diversity consumption were 445, 170,967 calorie and 11, 8 and 33 FFS with nearest neighbor, kernel and radius matching methods respectively. In other words, we can say that households with participation are better off in terms of consumption of diversified diet and higher calorie as compared to households with no participation in the modern milk value chain. In short, participation in the formal milk value chain had a significant positive impact on improving food security and nutritional status of smallholder dairy producers. However, this result has limitation that intra household nutrition impact analysis was not included in this study. Particularly, intra-household impact pathway is more important in country like Ethiopia where women's play a leading role on both dairy production and marketing as well as on household food consumption behavior. Moreover, the study has limitation on using comprehensive nutrition outcome variables that in this study we used only two major nutrition outcome variables (dietary diversity and calorie intake). It is therefore there is a need further research on inter and intra household nutrition impacts of milk value chain participation using multiple nutrition measurement approach.

6.5. Conclusion

Smallholder farmers' integration into formal dairy value chains is considered as an important pathway to reduce poverty and address the recurrent food insecurity problems in Ethiopia. Nonetheless, there is generally a dearth of strong empirical evidence on the relationship between dairy value chain and nutrition in Ethiopia. Using household survey data from the two selected districts in the highlands of Ethiopia, this article analyze nutrition and food security impact of smallholder participation in the formal milk value chain. We use income, milk consumption, calorie intake and diet diversity consumption score to measure food security and nutrition impacts of participation in the formal milk value chain. The result shows that among the total 333 smallholder farm households, only 98 or 30% smallholder households participate in the formal milk value chain. The study finds that participation in the formal milk value chain has a significant positive impact via income on food security and nutrition improvement through better calorie intake and diet diversity consumption. It is, therefore, there is a significant positive relationship between access to the formal milk value chain and food and nutrition security among the rural community in the study areas. On the other hand, the study finds that access to formal milk value chain has a significant negative impact on the household milk consumption. It

is, therefore, improving productivity and market access is not a sufficient condition in rural poor community to improve the consumption of dairy and other nutrient-dense animal sources of food. Rather; in addition to improving access to the formal value chain, a comprehensive approach that can address the cash constraints as well as awareness issue to promote dairy and other animal sources of foods consumption behavior has to be consider in the promotion of pro-poor dairy value chain development. These results in general ,therefore, call for public and public-private partnership interventions that can improve the enabling environment for inclusive or pro-smallholder dairy value chain development so that to reduce poverty and food insecurity.

CHAPTER SEVEN

SUMMARY, GENERAL CONCLUSION AND RECOMMENDATION OF THE STUDY

7. SUMMARY, GENERAL CONCLUSION AND RECOMMENDATION OF THE STUDY

7.1.1. Summary

Using pro-poor high value food value chain approach, this study was aimed at analyzing the linkage between smallholder access to dairy value chain and food and nutrition security in mixed farming system of Kimbibit and Bahir-Dar Zuria districts in Ethiopia. The specific objectives of the study were examining the structure of dairy value chain, analyzing the determinants of milk sales decisions and formal milk value chain participation choice of smallholder farm household and, analyzing food security and nutritional impact pathways of smallholders' participation in the formal milk value chain. The data were generated from both primary and secondary source.

A sequential exploratory mixed methods research design that can be presented using the following notation: Qual → Quan was employed to gather and analyze both qualitative and quantitative data. However, priority is given to quantitative methods to be used dominantly in this study. Using individual interviews and focus group discussions, qualitative data collected from purposely selected key informants. Using face to face structured interview, quantitative data collected from 60 and 333 randomly selected dairy traders and smallholder households respectively. The sample of dairy traders included 6 milk collectors, 3 milk cooperatives, 3 milk processors and 48 milk retailers. Mapping and content analysis were employed to analyze the qualitative data, while descriptive statistics, accounting method and regression analysis such as a two-step binary logit and propensity score matching models were used for quantitative data analysis. This article based thesis is structured in to three manuscripts that include structure of dairy value chain, determinants of smallholders' milk market participation behavior, and food security and nutrition impacts of smallholders' participation in formal milk value chain.

7.1.2. Structure of Dairy Value chain

The first manuscript of the thesis focused on the structure of dairy value chain analysis. It is structured in three main parts include: inputs-outputs structures of the dairy value chain, performance of the milk value chain and constraints of the dairy value chain.

I. Inputs-Outputs Structures of the Dairy Value Chain

The result shows that the dairy value chain structured in to formal and informal dairy value chain. The major function of formal dairy value chain include input supply, production, collecting, processing, retailing and consumption; whereas major process of informal value chain includes production, collecting, retailing and consumption. The key actors along the formal milk value chain include input suppliers, smallholder farmers, milk cooperatives, milk processors, retailers and consumers. On the other hand, smallholder farmers, collectors, retailers and consumer are actors of the informal value chain.

Input supply is the first core function in the dairy value chain. The inputs supply services in the study areas include provision of feed supply, breeding services, veterinary services, and credit and extension services. The major inputs providers' include smallholder farmers, government agricultural office at district and rural *kebelle* levels, small scale oil and flour processing mills, milk marketing cooperative and private drug suppliers. Both type of feeds, conventional and non-conventional feeds are provided and supplied in the two districts. The conventional feeds that are provided and supplied in the study areas include open grazing, hay, crop-residue, improved forage and concentrates. Concentrates feeds provided by mixing industrial by-products, such as wheat bran and oilseed cakes. The study shows that smallholders accessed improved forage, open grazing, crop residue, hey and *attella* feeds largely from their own on farm production with the respective percentage of 100%, 95%, 92% 76%. It is, therefore, on farm production is the major sources of feeds in the study areas. With regard to breeding services, smallholder largely depend on natural bull but a limited (29%) smallholder uses AI government services. In each district of the study area, there is one veterinary clinic located in the district's town. With regard to animal health post distribution ratio at kebelle level, one animal health post served for three *kebelles* in each district. It is, therefore, the demand much higher to the supply of veterinary services in the study areas whereby 2 veterinarians in Kimbibit, and one veterinarian in Bahir-Dar Zuria district serving 10,000 and 8, 050 smallholder households, respectively.

With regard to extension services, smallholders largely depend on government extension services. However, the study data showed that government animal extension services provision coverage has limited to small proportion of smallholder farmers. Of the total sampled households, 31%, 5%, 29%, 24% and 40 % of smallholders' farmers reported that they have used the government animal extension services of technical advice, market information, AI, forage seeds supply and capacity building trainings, respectively. Developmental organization

particularly international NGOs have significant role in dairy value chain development of the study area in addition to government agricultural extension services roles. The PRA survey result showed that international NGOs such as ACDI/VOCA-USAID, SNV and Land O' Lakes provides technical training and material support to smallholder farmers' group milk marketing cooperatives in the two districts. With regard to credit service, the government micro institution at district level are the dominant credit providers for smallholder farmers. However, access to credit services are limited and the largest (86%) of samples smallholder lacks access to credit in the study areas.

Dairy production is the second core function of dairy value chain and smallholder are the key players in the dairy production system of the study areas. Smallholder dairy production system in the study areas is structured into subsistence and market-oriented production system. Subsistence dairy production dominates the dairy value chain which accounts 70%, while 30% of smallholders are market-oriented. It is, therefore, the heard structure, feeding and productivity are different between these two groups of smallholder farmers. Market-oriented smallholder farmers largely depend on better yielding crossbreed cows with an average size of 1.85; whereas subsistence smallholder farmers largely depends on low yielding local breed cows with an average size of 1.9. The average milk yield per cow/day across cross and local breeds' cows are of 5.5 liters and 1.45 liters, respectively. With regard to feeding, all market-oriented smallholders utilizes protein rich concentrate feeds, whereas only 3% of subsistence farmers use the concentrate feeds. The average milk yield of market-oriented smallholder farmers are 11 liters per day, while it is 3 liters per day for the subsistence farmers. It is, therefore, a relatively modern production system practicing by market-oriented smallholders, whereas subsistence farmers largely follow traditional production system.

Milk and milk products marketing or distribution is the third core function in the dairy value chain process. Milk and milk products channeled to consumers through formal and informal market channels. Major dairy marketing activities in the informal dairy value chain are collecting, bulking and retailing. And major marketing actors includes, local collectors, wholesalers and retailers. On the other hand collecting, controlling milk quality, bulking, transporting and retailing are the major milk marketing activities in formal fluid milk value chain. Major milk marketing actors across the formal milk value chain includes milk marketing cooperatives and retailers. The retailers classifies as formal retailers which includes supermarket and min-supermarket with modern marketing infrastructure like freezing equipment. While, traditional retailers includes milk

and butter shops and kiosks without modern marketing facilities. In addition, cafes and pastry, hotels and restaurants are also retailing boiled milk with coffee and without coffee.

Milk market cooperative are the major key players in linking smallholders to the formal milk value chain in the study areas. All milk supplies to the formal milk value chain pass through milk marketing cooperatives. There are three milk cooperatives, one in Kimbibit and the other two in Bahir-Dar Zuria districts. The cooperatives major activities in the dairy value chain of the study areas includes establishing rural milk collection centers, milk collecting from the cooperatives members (smallholder farmers), controlling the milk quality during collection, bulking, transporting and supplying the collected milk to milk processing firms. In addition to the above collective milk supply provision services, the services provided by the cooperatives to its members (smallholders) include: market information, consultancy and training facilitates. More importantly, Sheno cooperative provides credit and credit based concentrate feeds supply services to its members. It is, therefore, collective action through milk marketing cooperatives is a major milk marketing strategies for smallholder farmers' in the formal milk value chain of the study areas.

We have stated above that milk and milk products channeled to consumers through formal and informal dairy market channel in the study areas. Of the total sampled households (n=333), 65%, 5% and 30% smallholder households are participated in the informal butter value chain, informal fluid milk value chain and formal fluid milk value chain, respectively. The result show that the largest (70%) of smallholders milk production channeled through the informal dairy value chain. While, 30% of smallholders milk production channeled through formal milk value chain. In the informal dairy value chain, butter and fluid milk channeled to consumers either directly from smallholder producers to rural consumers or indirectly from smallholder producer s to urban consumers through intermediaries ranged from one to three. On the other hand, in the formal milk value chain fluid milk channeled to urban consumer from smallholder producers to milk marketing cooperative, then from the cooperative to milk processors, and procurers to retailers and then urban consumers.

Dairy processing is the fourth key function of dairy value chain. Dairy processing function is structured in to two in the study areas include traditional dairy processing at smallholder household level and modern dairy processing at firm levels. Traditional dairy processing practices at rural smallholders' household level using naturally fermented soured milk to produce traditional butter. The traditional dairy processing has a maximum of 11 litters of milk processing capacity per churning and almost all (95%) of the samples smallholder households'

uses from 6 to 11 liters milk per single churning process. The amount of milk that samples smallholder households uses to produce 1 kg butter is ranges from 17 to 19 liters of milk and they uses and average of 17.5 liters of milk to produce 1 kg of traditional butter. Traditional dairy processing is time consuming that takes from 1.5 to 2 hours per churning process in the study areas.

The modern dairy processing activities in the two districts is structured in to large scale and small scale processing include one large scale and two small-scale processors. Lame (Sholla) dairy processing is located in Addis Ababa and it is the second large scale dairy processing industry in Ethiopia. The processor has a maximum of 60, 000 liters of milk processing capacity per day, however, because of supply constraints currently the processor is operating at less than 50% of its capacity. Pasteurized half liter milk packed by plastic packets is a dominant product line that the industry distributes to costumers in Addis Ababa through retailers. The processor produce and distribute additional dairy product lines to customers in Addis Ababa such as ice-cream, table butter, flavored yogurt and different from of cheeses. The processor milk supply sources is largely depend on milk marketing cooperative around Addis Ababa. Sheno milk marketing cooperative is one of raw milk supply source of Lame processor and supplies average of 1200 liters of milk per day. Wawi and Yom dairy processors are small scale processors located in Bahirdar city, 650 km from Addis Ababa. These processors engages in niche market business of cheese processing. Bahir-Dar zuria milk marketing cooperative is the only milk supply source for Wawi processor with an average supply of 220 liters of milk per day. While Addis-Alem and Bahirdar city milk marketing cooperatives are the only sources of milk supply for Yom dairy processor with an average supply 190 and 100 liters of milk per day respectively.

Milk and milk products consumption is the last segment in the dairy value chain process. Rural and urban consumers are the two types of end market segments of the dairy value chain in the study areas. Rural smallholder households are the largest rural consumer of dairy products in the study area. Rural dairy products consumptions are limited to raw milk, natural fermented milk (ergo), traditional butter, cottage cheese *(Ayib)* and whey (*arrera*). Rural consumers have no access to the modern dairy products such as pasteurized milk, yogurts, cheese and creams. Dairy product consumption in urban areas is classified in to two: direct consumption without adding to other food stuffs and indirect consumption as supplementary food by adding the dairy products in to other food stuffs. Dairy products such as raw milk, fermented milk (ergo), and pasteurized milk are directly consumed without adding into other food stuffs. Whereas,

traditional butter and cottage cheese (*Ayib*) dairy products are indirectly consumed by adding in to other food stuffs as supplementary and flavored ingredients.

With regards to smallholders dairy product market outlets, rural milk collection centers are predominate (which holds 86.1% of the total supply) fluid milk market outlet in the formal milk value chain, while farm gate is a major fluid milk market outlet in in the informal milk value chain. Local market on the other hand is a major market outlets for traditional butter in the study areas.

With regards to quality standards and control system of the dairy value chain, there is no any formal standards sets for the dairy products in the study areas. However, there is informal standards for traditional butter product in the traditional dairy value chain of the study area. This informal quality standards set predominately based on the geographical origin of the butter. The formal milk quality control predominately is practicing at upstream stage of the formal milk value chain. Smallholder farmers' group milk marketing cooperatives control the milk quality when they are collected from smallholder farmers at milk collection centers. During the milk collection phase, milk cooperative conducted instantaneous milk quality tests using of lactometer and lacto-scan. However, there is no any quality controlling system in the informal dairy value chain.

2. Performance and Constraints of Dairy Value Chain

Production cost is one of the important components in any production system that helps in the evaluation of the performance of the value chain. Total milk production costs and detail costs such as fodder costs, concentrates feeds costs and crop residue costs between formal and informal fluid milk value chain participated sampled households were 8,352.89, 1,019.89, 5,965, 985 and 2,249 389, 1,459, 300 birrs respectively. These results show that the average annual milk production costs, detail costs such as fodder costs, concentrates feeds costs and crop residue costs of modern fluid milk value chain participated smallholder sampled households were significantly higher by 78.8%, 72%, 80.3% ,76.6%, compared to traditional fluid milk participated sampled households, respectively .

Gross profit earned annual income from milk sales between the formal and informal fluid milk value chain participated sampled households are 22,307.11 and 2,131 birr, respectively. These results show that the average annual milk income or gross profit from milk sales of the formal fluid milk value chain participated smallholder sampled households are significantly higher by 91%, compared to the traditional fluid milk participated sampled households in the study areas.

Gross market margin share across (GMM) actors in the milk value chain, processor got the highest (54.5%) and next smallholders got the higher (36.5%) in the formal milk value chain, whereas in the informal milk value chain, producer got the highest GMM share (60%) and next collector got the higher GMM share (30%). Retailers got the lowest GMM share in both formal (9%) and informal milk value chain (10%). Over all, the data show processor gained the highest gross profit and gross market margin share. Smallholder producers in the informal milk chain gained higher profit share (60%) compared to producer in the formal milk chain (36.5%) in the study areas.

Constraints hindering the development of dairy value chain are found in all the stages of the dairy value chain. Shortage and high cost of feeds, shortage of AI supply, poor access to credit, insufficient extensions and business support services, low standard and expired drug supply, low productivity and production, traditional processing and marketing, and high transaction costs, adulterations, lack of formal quality standards and high seasonal based demands fluctuation of dairy products are major constraints of dairy value chains in the study areas.

7.1.3. **Determinants of Smallholders Milk Market Participation Behavior**

The second manuscript of the thesis focus on the determinants of dairy market behaviors of smallholder farmers. A two-step binary logit regression was conducted to analyze determinants of milk sales decisions and formal milk market participation choice of smallholder farmers in the study areas. The first step analysis of determinants of milk sales decision of smallholder farmers result show that of the total 333 samples of smallholders' farmers, 35 % of smallholders were participated in fluid milk market. Whereas, the largest portion (65%) were not participated in fluid milk market. The comparative t-test analysis between milk sales participated and non-participated households shows that there is significance difference in milk marketing factors between these two groups. The t-test result show that milk sales participated smallholders were significantly higher by 21% in education level of the household head compared to non-participated households. Similarly, Mean annual costs of oils seeds cakes and wheat barn feeds of milk participated smallholder households were significantly higher by 2746 and 3236 birr compared to non-milk market participated households, respectively. Milk sales participated households have an average of 1.82 cross breed cow, while non-participated households have an average of 0.08 cross breed cows. The average milk yield of milk sales participated household was 11 liters per day, whereas, average milk yield of non-participated households was 3 liters per day. These result show that milk sales participated households are significantly

better off in dairy production resources compared to non-participated households and, on consequence they are better off in milk production as well.

The average travel distance to milk collection centers, nearest town and asphalt roads for milk sales participated households significantly were lower by 79, 64, 68 minute compared to non-participated households. These result implies that high transaction costs such as high market search and transport costs can be among the key factors that impeding smallholders' participation in milk sales market in the study areas. The result show that all milk sales participated households were members of milk marketing cooperatives, whereas, non-participated household were not member of milk marketing cooperative. The travel distance to veterinary services is significantly lowered by 79 minute for milk sales participated than non-participated households. On the other hand, there is no significance difference to access credit services between the two groups and overall access to credit is limited in the study areas.

The first step binary logit results show that transaction costs factors such as distance to milk collection center, nearest town and cooperative membership; resource constraints factors such as costs of concentrates feeds, crossbreed cow size, quantity milk yield per day and; access to veterinary services are significantly determines smallholders' milk sales decisions.

The results of show that of the total milk market participant households, 86.1 % of smallholder households were participated in the formal milk value chain, while 13.9% smallholder households participated in the informal milk value chain. The comparative t-test analysis show that there is a significant difference in the determinants factors for milk market channel choice between smallholder households in the formal and informal milk value chains. The educational status of household heads in the formal milk value chain is significantly higher (50%) than that of heads of households in the informal milk value chain. Households operating in the formal milk value chain are better off in terms of resource allocation for their dairy business and milk production than households opting for the informal milk value chain. The mean annual cost of oils seed cakes and wheat barn feed in households who supplied their milk to the formal milk channel is significantly higher (by 2,192 and 2, 489 birr respectively) than households who supplied their milk to informal channel. Similarly, there is significant difference in mean cross-breed cow size between households supplied their milk to formal and informal milk market channels. The households who are supplied to the formal milk value chain have an average of 1.9 cross-breed cows, while households who are supplied to the informal milk value chain have an average of 0.71 cross-breed cows. Average milk production of households with supplied to formal channel is significantly higher (by 8 liters/day) than households with supplied to the

informal channel. The average distance travelled to milk collection centers, the nearest town and asphalt roads for households who are supplied to formal milk value chain is shown to be significantly lower (by 96, 85, 47 minutes, respectively) compared to households who are supplied to the informal milk value chain. All households operating in the formal milk value chain were members of milk marketing cooperatives, whereas none of households operating in the informal milk value chain were members of such cooperatives. Similarly, the survey results show that households supplied to the formal milk value chain are better at getting pre-transaction information about milk buyers' availability than those households supplied to the informal milk value chain. The distance travelled to obtain veterinary services is significantly lower (by 93 minutes) for households operating in the formal milk value chain than for households operating in informal milk value chain.

The second-stage binary logistic model was estimated to determine the factors that influenced smallholder households' decisions to participate in a formal milk value chain. The results show that the probability of formal milk value chain participation choices of smallholder farmers in the two districts were significantly affected by age and educational level of the household head, transaction costs factors such as distance to milk collection center, nearest town and cooperative membership; resource constraints factors such as costs of concentrates feeds, cross breed cow size and; access to veterinary services.

7.1.3. Food Security and Nutrition Impacts of Smallholders' Participation in Formal Milk Value Chain

The third manuscript of the thesis focus on food security and nutrition impact pathways of smallholder farmers' participation in formal fluid milk value chain. Of the 333 total sampled households, the largest portion (70 %) of smallholder households were not participated in the formal milk value chain; whereas, 30 % of smallholder households were participated in formal milk value chain. It is therefore, we used the participated households (n=98) as treatment group and non-participated households (n=235) as control group to analyze the food security and nutrition impact pathways of participation in the formal milk value chain.

To analyze the food and nutrition impacts of smallholder participation in the formal milk value chain, we used level of milk consumed in the sampled household as a direct food access measurements and we used household annual income, daily per capita caloric intake and household dietary diversity score as an indirect outcome variables to measure food access at household level.

A T-test analysis on food security and nutritional outcomes variables was performed between participants and non-participants of the formal milk value chain. The result show there were a significance differences in the mean values of the outcome variables of milk consumption, farm income, food consumption score and per-capita calorie intake between the sampled households with and without participation in the forma milk value chain. The average weekly milk consumption of the participated households (0.7 liter) was significantly lower compared to the households without participation (4.5 liter). On the other hand, the average household annual incomes and food consumption score of the participated households were 48217 birr and 69, respectively and, significantly higher compared to non-participated households (22239 birr and 35, respectively). Likewise, the average per-capita calorie intake was significantly higher among households with participation than without participation in the formal milk value chain.

The threshold or categorical comparison of the food security and food consumption outcome variables result show that there was a significance different between the two groups. The result shows that number of food-secure households was higher among participated households (90), while the number of moderately and extremely food-insecure households were higher among non-participated (99 and 79, respectively). Similarly, with regard to diet diversity score, the number of households with acceptable status were higher in the participated households (55). Whereas, the number of household with poor and borderline diet diversity scores were larger with non-participated households.

The PSM model was run to estimate food security and nutrition ATT effects of participation in the formal milk value chain. The result show that there was negative association between smallholders accessed to the formal milk value chain and smallholders' milk consumption. However, as hypothesized the result show that smallholder households' participation in the formal milk value chain has a positive significant effect on their daily per-capita caloric intake, dietary diversity and income.

7.2. General Conclusion and Recommendations

7.2.1. General Conclusion

Value chain analysis is an important approach to understand the structures and dynamics of the dairy industry. The dairy value of the two districts is structured in to formal and informal dairy value chains whereby the informal chain dominates the sub-sector. Inputs and services node of the dairy value chain is the most poorly coordinated and predominately traditional. In the studied

areas, smallholders are largely depend on traditional and poor quality feeding system, and local zebu cattle breed, which has low milk production capacity. Public extension services is a key business support services player of the dairy value chain, but it is insufficient and limited in terms of accessibility. In addition to public extension services, international NGOS are the other business support providers who play an important role for dairy value chain development in the area studied. The private sector participation in dairy inputs and services provision is underdeveloped in both formal and informal dairy value chains.

Major actors of the dairy value chain in studied areas include smallholders, collectors, processors and retailers. Processors are leading actors who holds the largest value added share in the formal milk value chain, whereas, smallholders hold the largest value added share in the informal chain. However, the linkages along value chain actors are weak and informal, this is particularly true in the informal value chain activities. There was no responsible body who is working for effective and efficient linkage between and along value chain actors of different nodes.

Limited milk market access is a key bottleneck to the expansion of smallholder milk production and processing in areas studied. Only small portion of smallholders have access to the formal milk market. Most smallholders have very little access to market fluid milk and milk is often processed into traditional butter. As a result, fluid milk is the dominant marketed dairy product in the formal dairy value chain. Whereas, traditional butter is a dominant in the informal dairy value chain, which is largely produced, consumed and marketed product in the informal dairy value chain of studied areas. It is, therefore, the sub-sector in the study areas dominated by traditional production and processing system, and informal marketing system.

Transaction cost factors such as being in a close distance to the milk collection centers or milk markets, and collective marketing through smallholders' group milk cooperative are crucial in determining smallholders' access to the formal milk value chain in areas studied. The dairy production systems of households operating within a formal milk value chain are market-oriented, while smallholders who opt for an informal milk value chain focus on subsistence. As a result, smallholders, opt for the formal milk value chain, are significantly better-off in technology adaptation and dairy inputs allocation than smallholders opt for the informal dairy value chain do. Hence, this in turn, smallholders opts for the formal value chain are significantly better-off in their milk production and marketing than stallholders in the informal chain. It is, therefore, milk market access is a key pull factor that can determine smallholders' transition from subsistence

to market-oriented dairy production system, and milk co-operatives are a key pathway to expand smallholders' participation in the formal fluid milk markets in the studied areas.

The Dairy value chain in the studied area is constrained by multifaceted factors such as limited access to dairy inputs and services, largely subsistent and traditional production system, traditional processing, smallholders have limited access to formal dairy market, and high seasonal based demand fluctuations. Feed and crossbreed cows shortage in terms of quality and quantity is the major constraint in both formal and informal dairy value chains. Both roughage and concentrate feeds are either too expensive or unavailable in sufficient quantity and quality to improve dairy production. Similarly, shortage and high cost of improved or high breed heifer is a critical factor that impend milk production and productivity in the value chain. Poor access to dairy services is also the major constraints for dairy value development. The extension service has not satisfied the needs of farmers in terms of providing need-based service and coverage that tailored to different dairy production systems and market orientation. The credit system for dairy development is not well developed in the studied areas and smallholder have limited access. Access to animal health service as well has serious limitations, particularly, in terms of accessibility and quality, and luck of quality standards and formal quality controlling system. Generally, the dairy value chain predominately traditional and loosely coordinated.

Smallholders' participation in the formal milk value chain has a significant positive effect via milk income on smallholder households' food security and nutrition improvement through better calorie intake and diversified diets consumption in areas studied. This is because, smallholders, opts for formal milk market, are more productive, supplied more of their produce to the market and earned higher net income as a result of increased level of input use. Moreover, formal milk market offers better and stable fixed milk sales price for smallholders than informal market do. However, the study finds that there is a tradeoff between smallholders' access to formal milk value chain and their milk consumption. It is, therefore, improving milk productivity and market access is not a sufficient condition to improve the consumption of dairy and other nutrient-dense animal sources of food in rural poor community of the studied areas. Rather, there is a need to look for other alternatives solution to solve this trade-off.

7.2.2. Recommendations

Given the need for upgrading the dairy sector to enhance productivity, increase production and market access, and improving the incomes, food security and nutrition status of smallholder

households, these findings suggest several points for further consideration. We recommend for policies and programs:

1. There is a need to upgrade the dairy inputs and services system through designing and establishing a sustainable dairy inputs and services delivery system that could increase accessibility, affordability and quality of the inputs and services delivery, particularly, for smallholders. This can be achieved through the following upgrading strategies:

a. Increase available feed quantity through improved food-feed crops from multidimensional crop improvement, niche forage and specialized forage production and use of by-products from agro-food processing sectors;

b. Develop small and medium scales feed processing enterprises and, facilitate feed market;

c. Promote the development and expansion of public and/or private crossbreed heifer multiplication centers at least at woreda/district level.

d. Promote community based breeding schemes.

e. Establish and promote bull breeding schemes and facilitate the involvement of the private sector in AI service provision.

f. Promote the establishment of, and strengthen technical, institutional and financial capacities of local public and private veterinary service providers to ensure delivery of better quality services

g. Promote the provision of credit facilities and insurance for small and medium scale dairy enterprises.

h. Develop an innovative institutional arrangements for market-oriented and demand driven dairy inputs and services delivery at farm and village level to address the lack of economies of scale so prevalent in the system. Using business development service model, therefore, there is a need to develop producers or business groups to allow collective action in the system for clustering of services and form sector based 'business hubs' or business associations such as: dairy inputs suppliers, feed processors, veterinary centers, breeding centers, forage seed development and supply centers, credit and insurance services, technical and market information centers. There is also a need to provide a capacity building

supports for these business hubs through providing need based and entrepreneurship trainings, access to credit, technical support, and facilitating local business net-workings'.

i. The extension system need to be adopted towards market-oriented and demand driven extension approaches.

2. There is also a need to upgrade smallholders dairying towards market-oriented dairy production, and increase smallholders participation and competency in the formal dairy value chain through the following upgrading strategies:

a. Provide technical trainings on feeding management practice, feed formulation and cultivation and treatment of forages and crop residues, and feed and fodder preservation techniques;

b. Promote a reliable and accessible credit and insurance services for smallholders' market-oriented dairy production;

c. Promote collective action for smallholders' market-oriented dairying through scaling-up and scaling-out smallholder' groups dairy cooperatives to actively and efficiently engage in dairy inputs and output marketing activities. Moreover, there is a need to provide a capacity building supports for the cooperatives to upgrade their vision, governance, entrepreneurship skills, networking, and financial and technical needs;

d. The policies need to give due emphasis on the development and expansion of roads access to the marginalized areas and, establishment of appropriate dairy marketing infrastructures to promote pro-smallholders dairy value chain development;

e. Policies need also provide a conducive business environment for the promotion and expansion of small, medium and large scale dairy processors and dairy enterprises.

f. Given there is week linkage along the dairy value chain, there is a need to establish an innovative local networking platforms to strengthen the dairy business linkages along and between smallholders and/or dairy cooperatives and unions, dairy business services supporters, dairy processors, dairy business wholesalers and retailers, government agricultural offices, and local and international NGOs who are working on the development of dairy value chain;

g. Policies need to work on establishment of consistent quality standards and effective quality controlling system for the dairy products to make the sub-sector competent at the global market. This is can be achieved through establishing competent laboratory centers and institutions that measures and certify the quality of dairy products, establishing innovative institutional arrangement (example, formation of cooperatives and dairy business associations) for the quality control at all level, and established and motivate quality based payment system.

3. Policies and programs need to be mainstreamed pro-poor agri-food value chain approach to address issues of availability, accessibly, affordability and sustainability of nutrition rich food for smallholder households. Moreover, policies and programmes are needed to address the trade-off between smallholders accessed to dairy market and their milk consumption behavior using alternative strategies. Creating awareness on the nutritional value of milk and milk products using an appropriate and effective behavioral communication channels could be one important strategy that need to be implemented to address the trade-off.

7.3. Suggestions for Further Research

The author sees this thesis not so much as an end point but as a starting point. It has raised many questions, such as those in the previous section, that in turn provide further avenues for investigation. Some of these questions arise from the short comings of this thesis. Given the time and scope of a doctoral thesis only so much can be investigated to a certain level of depth and breadth which, given the systemic nature of the dairy industry today, leaves areas that require further investigation. Other areas relate to where there were apparent gaps in the available data that could help add a greater understanding of the underlying mechanics of the pro poor dairy value chain under investigation.

One of the key areas that require further investigation is how to design and establish a sustainable pro-poor dairy inputs and services delivery system that could increase, availability, accessibility, affordability and quality of the inputs and services delivery, particularly, for poor smallholders and women in rural areas? This thesis was only able to assess the constraints of pro-poor dairy value chain development inclusive of inputs and services level constraints, and found there is serious challenges of availability, accessibility, affordability and quality of dairy inputs and services for pro-poor dairy value chain development. It is, therefore, one key research question that needs further investigation is that what is the most efficient strategy/ model for organizing pro-poor dairy inputs and services delivery systems that promote market-

oriented smallholders dairy production system. Furthermore, this investigation would also enable the examination of viable: innovative institutional arrangements including collective action and private sector solutions, adoptable technological and technical innovations, marketing system, quality control mechanisms and policies to the provision of accessible, affordable, and quality of dairy inputs and services delivery for marginalized people or groups and smallholders.

Ultimately, there is a question (upon which further research is required) as to how promote private business sectors involvement and public-private sectors partnership for pro-poor dairy value chain development in Ethiopia. The findings of this research and other empirical evidences highlight that private sectors participation and public-private sectors partnership are underdeveloped in dairy business in Ethiopia. However, there is luck of in-depth empirical understanding on how to promote private sectors participation and public-private sectors partnership in the dairy sector business. It is, therefore, we suggest that analysis of how to promote private sectors participation and public-private sectors partnership in the dairy business for pro-poor dairy value chain development is an important further research avenue that needs be investigated. To this end, there is a need to investigate the following sub-research questions: (1) what are the existing dairy business enterprises; their character, governance, capacity, strengths and weakness at all level of the dairy value chain? (2) What are the constraints and opportunities, for the development of small, medium and large scale dairy enterprises, and for public-private partnership development? (3) Why private sectors participation and public-private sectors partnership in the dairy business are underdeveloped? (4) What are incentives for various key actors (farmers, input providers, traders and animal health providers etc.) to invest in the dairy business? And how can these actors cooperate? (5) How to create incentives for increased private sector investment/participation and public-private sectors partnerships in in the dairy business through innovative reforms in national and regional policy and institutional frameworks? (6) How to develop new approaches to deliver technical interventions to promote private sectors participation and public-private sectors partnership, such as innovation platforms, hubs systems in the dairy value chain?

Another area of consideration, particularly from a pro-poor dairy value chain point of view, is gendered dairy value chain analysis to understand the differing roles of women, men, children and the poor in different segments of the value chain, female and poor dominated enterprises, decision-making, access to resources and their share in the benefits. Gender inequalities are often critical to understanding and addressing the 'weakest links' within value chains, and the

most critical areas for upgrading quality and growth as well as poverty reduction. Gender analysis is, however, ignored in this thesis and the weakest point for most dairy value chain empirical studies in Ethiopia. To promote pro-poor dairy value chain development for food security and poverty reduction, therefore, gendered dairy value chain analysis is an important area of research that needs to be further investigated.

Given limited empirical evidence in this thesis and other studies as well on in the area, we suggest that a quantitative analysis of gender and intra-household dynamics of nutritional impact pathways of smallholders' participation in formal dairy value chain, is another important area of research that need to be investigated. To his end, therefore, it would be important to investigate the research question such as: (1) what are the effect of smallholders' participation in dairy value chain on women's empowerment using women's empowerment in agriculture index? (2) What are effects of smallholders' participation in formal dairy value chains on children and women nutritional status using multiple nutritional outcome measurements? Additionally, to address the trade-off between access to formal milk market and milk consumption behavior, it would be interesting to investigate determinants of dairy products consumption behavior between household with and without participation in the formal dairy value chain using gender disaggregated data.

7.4. Final Remarks

The current knowledge of pro-poor agri-food value chain analysis is thin in Ethiopian context. Dairy value chain operate under the complex and uncertain environment of agriculture and involve actors from different parts of the chain that ranged from pre-production to delivery to the final consumer. On the other hand, food security is a complex concept that needs multidisciplinary approaches analysis. It is, therefore, there is a need to develop a compressive approach to understand the linkages of these two complex concepts. To this end, pro-poor dairy value chain framework has developed to analyse the linkage between smallholders' access to formal dairy value chain and food and nutrition security. It has been constructed based on the GVC analysis framework (Gereffi et.al. The framework highlighted how the dairy value chain structured and gives a holistic pictures of inputs and outputs structures of the dairy value chain such as major functions, actors and their activities, market channels, market information flows and power relationship along the value chain actors. The framework helped us to examine the performance of dairy value chain in in terms of products cost and market margin distribution along the value chain actors. It enabled us to understand production cost and profit margin

difference between formal and informal dairy value chains. The framework also helped us to identify constraints of the dairy value chain for up grading strategies. In smallholder market dynamic analysis, the framework explained the drivers of smallholders' production and marketing behavior that determines smallholders' access to formal dairy value chain. There is an empirical studies gap on impact pathways linkage between smallholder farmers' access to formal dairy value chain and poverty and food security in Ethiopia (Hoddinott et.al. 2013). Using a mixed research methods, therefore, the framework provided us a holistic and comprehensive understanding in the linkages between smallholders' access to dairy value chain, and food and nutrition security.

The approach outlined in this thesis could be utilized in many other ways to facilitate multiple assessments of high value agri-food value chain, as well as its impact on food security and nutrition. As such, this thesis constitutes a major empirical and conceptual contribution to the debates on the nexuses between smallholder access to the formal dairy value chain, and food security and nutrition in Ethiopian context.

8. REFERENCES

Abadi Nigussie,Techane Ataklti, Tesfay Girmay,Maxwell Daniel, Vaitla, Bapu, 2013. The Impact of Remittances on Household Food Security : A Micro Perspective from Tigray , Ethiopia.

Abafita J., Atkinson, J. & Kim, C.S., 2016. Smallholder commercialization in Ethiopia: Market orientation and participation. *International Food Research Journal*, 23(4).

Abebaw D., Fentie, Y. & Kassa, B., 2010. The impact of a food security program on household food consumption in Northwestern Ethiopia: A matching estimator approach. *Food Policy*, 35(4).

Abebaw L., Alemu, T., Kassa, L., Dessie, T. and Legesse, G. 2013. Analysis of goat value chains in Sekota Abergelle district , northern Ethiopia, Addis Ababa: ICARDA.

Abera G., 2009. Commercialization of Smallholder Farming: Determinants and Welfare Outcomes. A Cross-sectional study in Enderta District, Tigrai.

Ade H.F., Simeon, K, E. & Mohammad, A, J., 1998. Credit Constraints and Smallholder Dairy Production in the East African Highlands: Application of a Switching Regression Model.

Adewumi M.O. & Animashaun J.O., 2013. Dietary Diversity , Farm Income and Technical Efficiency Correlates : Empirical Evidence from Small-scale Farming Households in Nigeria Key words. *Agris on-line Papers in Economics and Informatics Households '*, V(4).

Ahmed M.M., Bezabih Emana, Jabbar M.A., Tangka F. and Ehui S. 2003. Economic and nutritional impacts of market-oriented dairy production in the Ethiopian highlands. ILRI (International Livetock Research Institute) Nairobi, Kenya. *Policy*, (51).

Ahmed M., Ehui, S. & Saleem, M., 2002. Adoption of crossbred cow technologies and increased food security among smallholder dairy farmers in the East African highlands. *Journal of Crop Production*, 6(1/2).

Ahmed M., Ehui, S. & Assefa, Y., 2004. Dairy development in Ethiopia. , 1(123), pp.1–58.

Alemu Abebe, Erik Mathijs , Miet Maertens, Jozef Deckers, Kidanemariam G.egziabher, Hans Bauer, Kindeya G.hiwot., 2012. Vertical Coordinaion in the Local Food Chains: Evidence from Farmers' in Ethiopia. *International Journal of Economics and Finance Studies*, 4(1), pp.11–20.

Alemye G., 2011. By : Determinants of Choosing a Particular Market Arrangement from Northern Ethiopia , Tigray. , (May).

Alvarez-Coque, Jose Maria & Marco, Lorena & Sleva, Maria Luisa, 2015. "Investigating differences in safety border notifications on fruita nd vegetables imports," 2015

Conference, August 9-14, 2015, Milan, Italy 211645, International Association of Agricultural Economists

Álvarez-Coque, José María García & Bautista, Romeo M., 1994. "Sources of EC horticultural import growth from developing countries," Agricultural Economics of Agricultural Economists, International Association of Agricultural Economists, vol. 10(2), April.

Alwang J.R., Peterson, E.B. & Taylor, D.B., 2012. Going the Distance : The Impact of Distance to Market on Smallholders Crop and Technology Choices Amy D . Buckmaster Thesis submitted to the faculty of the Virginia Polytechnic Institute and State University.

Årethun T., 2012. Contribution of Rural Roads to Access to- and Participation in Markets: Theory and Results from Northern Ethiopia. *Journal of Transportation Technologies*, 2(April), pp.165–174.

Asaminew Tassew and Eyassu Seifu, 2009. Smallholder Dairy Production System and Emergence of Dairy Cooperatives in. , 4(2), pp.185–192.

Asfaw S. et al., 2012. Impact of modern agricultural technologies on smallholder welfare: Evidence from Tanzania and Ethiopia. *Food Policy*, 37(3), pp.283–295.

Ayalew Y., 2015. Factors affecting fruit supply in the market: The case of Habru Woerda, North Wollo, Ethiopia. *European Journal of Business and Management*, 7(4), pp.309–318.

Bahta S.T. & Bauer, S., 2007. Analysis of the Determinants of Market Participation within the South African Small-Scale Livestock Sector. TROPENTAG PAPER Tropentag, October 9-11, 2007, Witzenhausen: "Utilisation of diversity in land use systems: Sustainable and organic approaches to meet human needs"

Bair J., 2005. Global Capitalism and Commodity Chains: Looking Back, Going Forward. *Competition & Change*, 9(2), pp.153–180.

Bakar W.A., 2010. Measuring and exploring perspectives on food insecurity. , pp.1–193.

Bardhan, D., Sharma, M.L. & Saxena, R., 2012. Market Participation Behaviour of Smallholder Dairy Farmers in Uttarakhand : A Disaggregated Analysis §. *Agricultural Economics Research Review*, 25(2), pp.243–254.

Barrett C.B. & Bachke, M., 2010. Smallholder participation in agricultural value chains: Comparative evidence from three continents. *Available at SSRN …*, (27829).

Barrett C.B., 2008. Smallholder market participation: Concepts and evidence from eastern and southern Africa. *Food Policy*, 33(4), pp.299–317.

Barrett C.B., Bellemare, M.F. & Osterloh, S., 2006. Household level livestock marketing behavior among Northern Kenyan and Southern Ethiopian pastoralists. *Pastoral Livestock Marketing in Eastern Africa: Research and Policy Challenges*, (November), p.288.

Bellemare M.F. & Novak, L., 2015. Contract farming and food security. , (MPRA Paper), p.58.

Berhanu K. & Poulton, C., 2014. The Political Economy of Agricultural Extension Policy in Ethiopia: Economic Growth and Political Control. *Development Policy Review*, 32(s2), pp.s197--s213.

Bernard Wonder,2013. Smallholder value chain for food security in E Africa. A Milestone Report prepared for AIFSC Study of A Landcare Based Approach to Food Security in East Africa - Scoping Study, ACIAR, Canberra.

Bernard T. & Spielman, D.J., 2009. Reaching the rural poor through rural producer organizations? A study of agricultural marketing cooperatives in Ethiopia. *Food Policy*, 34(1), pp.60–69.

Bernard T., Gabre-Madhin, E. & Taffesse, A.S., 2007. Smallholders' Commercialization through Cooperatives: A Diagnostic for Ethiopia. *Historical Studies*, (October), p.33.

Berry Elliot M, Sandro Dernini, Barbara Burlingame, Alexandre Meybeck and Piero Conforti, 2015. Food security and sustainability: can one exist without the other? *Public Health Nutrition*, 18(13), pp.2293–2302..

Beyene A.M., 2014. Dimensions of Poverty in Northeastern Ethiopia: Looking into Multitude Facets of Poverty for Poverty Reduction. *Journal of Economics and Sustainable Development*, 5(15), pp.89–102..

Beyene F., 2010. Determinants of Food Security among Rural Households of Central Ethiopia : An Empirical Analysis. , 49(4), pp.299–318.

Birachi A., E., 2006. Determinants of Coordination and Supply Chain Performance: The Case of Fresh Milk Supply Chains in Kenya Department of Agricultural Economics. *Department of Agricultural Economics,University of Kiel,Germany*, p.212.

Bolwig Simon, Stefano Ponte, Andries du Toit, Lone Riisgaard and Niels Halberg., 2008. Integrating poverty, gender and environmental concerns into value chain analysis DIIS-Danish Institute For International Studies Working Papers no 2008/16, Denmark.

Boniphace N.S. (Institute of A.I.-C.A. of A.S., Fengying, N. (Institute of A.I.-C.A. of A.S. & Chen, F. (FAO), 2015. an Analysis of Smallholder Farmers' Socio-Economic Determinants for Inputs Use: a Case of Major Rice Producing Regions in Tanzania. *Russian Journal of Agricultural and Socio-Economic Sciences*, 38(2), pp.11–25.

Boughton Duncan, David Mather, Christopher B. Barrett, Rui Benfica, Danilo Abdula, David Tschirley and Benedito Cunguara, 2007. Market Participation by Rural Households in a Low-Income Country : An Asset-Based Approach Applied to Mozambique Market Participation by Rural Households in a Low-Income Country. *Faith and Economics*, 50,

pp.64–101.

Burke W.J., 2009. Triple Hurdle Model of Smallholder Production and Particiaption in Kenya's Dairy Sector. *MS Thesis. Department of Agriculture Food and Resource Economics. Michigan State University.*

CARE, 2008. Pro Poor Analysis of the Dairy Value Chain: Strengthening the Dairy Value Chain in Bangladesh. , pp.1–80.

Central Statistical Agency (CSA). 2013, Crop Production Forecast Sample Survey, Addis Ababa,Ethiopia,

Central Statistical Agency (CSA). 2014, Population projection of Ethiopia for all Regions at wereda level from 2014 - 2017

Central Statistical Agency(CSA). 2014, Livestock Sample Survey , Addis Ababa,Ethiopia,

Chagomoka T., Afari-sefa, V. & Pitoro, R., 2014. Value chain analysis of traditional vegetables from Malawi and Mozambique. *International Food and Agribusiness Management Review*, 17(4), pp.59–86.

Chege C.G.K., Andersson, C.I.M. & Qaim, M., 2015. Impacts of Supermarkets on Farm Household Nutrition in Kenya. *World Development*, 72, pp.394–407.

Chikazunga Davison, Andre Louw, Orient Muloongo, Choolwe Haankuku., Small-scale producers in modern agrifood markets Agrifood Sector Studies Smallholder farmers' participation in restructuring markets : The beef subsector in Zambia.Working paper, Department of Agricultural Economics, Extension and Rural Development University of Pretoria, South Africa.

Chirwa, E.W., 2009. Determinants of Marketing Channels among Smallholder Maize Farmers in Malawi. , pp.1–25.

Cintron Julio R. López, Nicki J. Engeseth, Faye M. Dong, Jennifer C. Greene, Alicia Wuth, Ross Peterson, Pablo Torres, Juan E. Andrade and William G. Helferich, 2013. Household food security and dietary diversity in the context of an agricultural and market development program in Guatemala. *Faseb Journal*, 27(620), p.620.

Creswell J.W., 2003. Research design Qualitative quantitative and mixed methods approaches. *Research design Qualitative quantitative and mixed methods approaches*, pp.3–26.

Creswell J.W., 2009. *Research Design: Qualitative, Quantitative and Mixed Approaches (3rd Edition)*,

Creswell J.W., 2013. Steps in Conducting a Scholarly Mixed Methods Study. *DBER Speaker Series*, pp.1–54.

David Stifel and Bart Minten, 2015.Market Access, Welfare, and Nutrition: Evidence from

Ethiopia

Dayanandan R., 2011. Production and marketing efficiency of dairy farms in highland of Ethiopia-An economic analysis. *International Journal of Enterprise Computing and Business Systems*, 1(2).

Debele G. & Verschuur, M., 2014. Analysis of milk value chain : the case of Ada ' a dairy cooperative in Ada'a district,East Shawa zone of Oromia regional state , Ethiopia. *Wudpecker Journal of Agricultural Research*, 3(1), pp.16–25.

Degaga D.T., 2005. *Rural livelihoods , poverty and food insecurity in Ethiopia A case study at Erenssa and Garbi communities in Oromiya Zone , Amhara National Regional State*,

Degu G., 2012. Assessment of The Livestock Extension Service In Ethiopia : The Case of Southern Region. , 1(10).

Dercon S. & Zeitlin, A., 2009. Rethinking agriculture and growth in Ethiopia: A conceptual discussion. *… of the Agricultural Strategy in Ethiopia*, (February), pp.1–33.

Devereux S., 2000. Food insecurity in Ethiopia. *Discussion Paper for DFID*, (October 2010),

Dominique Barjolle and Bertil Sylvander, 2002, Some Factors of Success for Origin Labelled Products in Agri-Food Supply Chains in Europe: Market, Internal Resources and Institutions Économies et Sociétés, origin-food.org

Dries, Liesbeth , Etleva Germenji, Nivelin Noev and Johan f.m. Swinnen, 2009. Farmers, Vertical Coordination, and the Restructuring of Dairy Supply Chains in Central and Eastern Europe. *World Development*, 37(11), pp.1742–1758.

Du, Lidan, Victor Pinga, Alyssa Klein and Heather Danton, 2015. *Leveraging agriculture for nutrition impact through the feed the future initiative* 1st ed., Advances in Food and Nutrition Research, Elsevier Inc.

E.Montaigne., Value chains – fili è res - Sector studies : methodology and recent developments illustrated in applications Plan 1 . Classic approaches :

El-Sayed, A.-F.M., Dickson, M.W. & El-Naggar, G.O., 2015. Value chain analysis of the aquaculture feed sector in Egypt.

Emana, B.B., 2012. Cooperative Movement in Ethiopia. *Prospectives for Cooperatives in East Africa*.

Emilia Schmitt , Daniel Keech , Damian Maye , Dominique Barjolle and James Kirwan, 2016. Comparing the Sustainability of Local and Global Food Chains: A Case Study of Cheese Products in Switzerland and the UK8(5), 419

Esenaliev D. & Teichmann, I., 2013. Determinants and Welfare Effects of Smallholder Export Participation in Kyrgyzstan. , (April).

European Commission, 2011. Analysis and development of inclusive value chains to support small-scale producers to access agriculture markets. *Rural Development, Food security and nutrition*, (November).

FAO , 2013. Guidelines for measuring household and individual dietary diversity.

FAO, 1989. Annex 9 "Use of balance sheets for estimation of deficits and surpluses" Strengthening National Early Warning and Food Information System in Africa, Food and Agricultural Organization of United Nations Workshops, Accra, Ghana, 23-26, October, 1989.

FAO, 2013. Milk and dairy products in human nutrition,

FAO, 2014. *Developing sustainable food value chains-Guiding principles*,

Faure Guy, Elodie Maître d'Hôtel, Jean-François Le Coq and Fernando Sáenz, 2007. Can supply chain's coordination mechanisms include small holders ? Insight from an empirical work in Costa Rica . Paper prepared for presentation at the 106th seminar of the EAAE on Pro-poor development in low income countries:Food, agriculture, trade, and environment 25-27 October 2007, Montpellier,France, pp1–21.

Ferris, Peter Robbins, Rupert Best, Don Seville, Abbi Buxton, Jefferson Shriver, and Emily Wei, 2014. Linking Smallholder Farmers to Markets and the Implications for Extension and Advisory Services. MEAS Discussion Paper Series No.4 on "Good Practices and Best Fit Approaches in Extension and Advisory Service Provision".

Fischer E. & Qaim, M., 2012. Linking Smallholders to Markets: Determinants and Impacts of Farmer Collective Action in Kenya. *World Development*, 40(6), pp.1255–1268.

Fischer E. & Qaim, M., 2014. Smallholder Farmers and Collective Action: What Determines the Intensity of Participation? *Journal of Agricultural Economics*, 65(3), pp.683–702.

Francesconi G.N. & Ruben, R., 2007. *Impacts of Collective Action on Smallholders' Commercialisation: Evidence from Dairy in Ethiopia*,

Francesconi G.N., 2009. *Cooperation for competition: linking Ethiopian farmers to markets*,

Garoma Dawit, Asefa Admassie, Gezahegn Ayele and Fekadu Beyene., 2013. Analysis of determinants of gross margin income generated through fishing activity to rural households around Lake Ziway and Langano in Ethiopia. Journal of Economics and Sustainable Development, Vol.4, No.18, pp.595–607.

Gaull G.E. & Goldberg, R.A., 1993. The Emerging Global Food System: Public and Private Sector Issues. , p.12896.

Gebrehiwot T. & Veen, A. Van Der, 2015. Estimating the impact of a food security program by propensity-score matching. , 7(880758), pp.38–47.

Gebremedhin B. and Jaleta Moti, 2010. Commercialization of Smallholders: Is Market Participation Enough? .

Gebremedhin B. & Hoekstra, D., 2008. Market orientation of smallholders in selected grains in Ethiopia: Implications for enhancing commercial transformation of subsistence agriculture. , (11), p.44.

Gebremedhin B. & Jaleta, M., 2010. Commercialization of smallholders: Does market orientation translate into market participation? , (22).

Gebremedhin B. & Tegegne, A., 2012. Market Orientation and Market Participation of Smallholders in Ethiopia: Implications for Commercial Transformation. *2012 Conference August 1824 2012 Foz do Iguacu Brazil*.

Gebremedhin B., Tegegne, A., Hoekstra, D., Jemaneh, S., Shiferaw, K., Bogale, A. and Getahun, Y. 2014. Developing the butter value chain in Ethiopia. LIVES Working Paper 1. Nairobi, Kenya: International Livestock Research Institute

Gebru A., 2006. The determinants of modern agricultural inputs adoption and their productivity in Ethiopia.

Geleti Diriba, Mekonnen Hailemariam, Ashenafi Mengistu and Adugna Toler, 2014. Analysis of fluid milk value chains at two peri-urban sites in western Oromia, Ethiopia: Current status and suggestions on how they might evolve. *Global Veterinaria*, 12(1), pp.104–120.

Generic T. & Chain, V., 2002. Framework for Sustainable and Pro-poor Value Chain Development in Mountains. , pp.9–12.

Georges Giraud,a Corinne Amblard,b Elise Thiel,b Martine Zaouche-Laniau,c, Zaklina Stojanovi´c,d Jure Pohar,e Ruˇzica Butigan,f Miljan Cvetkovi´c,g Boban, Mugosa,h Vladimir Kendrovski,i Cristina Moraj and Dominique Barjollek, 2013 A cross-cultural segmentation of western Balkan consumers: focus on preferences toward traditional fresh cow cheese J Sci Food Agric 2013; 93: 3464–3472

Gereffi G. & Fernandez-stark, K., 2016. Global Value Analysis : A Primer. , (July).

Gereffi, Gary, John Humphrey, Raphael Kaplinsky and Tim Sturgeon, 2001. Globalisation , Value Chains and Development, IDS Bulletin Volume 32 No 3 'The Value of Value Chains: Spreading the Gains from Globalisation'.

Gezimu Gebre, G., 2012. Determinants of Food Insecurity among Households in Addis Ababa City, Ethiopia. *Interdisciplinary Description of Complex Systems*, 10(2), pp.159–173.

Gómez M.I. & Ricketts, K.D., 2013. Food value chain transformations in developing countries: Selected hypotheses on nutritional implications. *Food Policy*, 42(13), pp.139–150.

Graef S. Sieber, K. Mutabazi, F. Asch d, H.K. Biesalski et. al., 2014. Framework for participatory

food security research in rural food value chains. *Global Food Security*, 3(1), pp.8–15.

Haddad L., 2000. A conceptual framework for assessing agriculture-nutrition linkages. *Food and Nutrition Bulletin*, 21(4), pp.367–373.

Haggblade S. & Theriault, V., 2012. A Conceptual Framework for Promoting Inclusive Agricultural Value Chains by Table of Contents. *Small*, (November), pp.0–37.

Haile G., 2009. The impact of Global Economic and Financial Crises On the Ethiopian Dairy Industry. *Least Developed Countries Ministerial Conference*, p.68.

Hambloch Caroline, Denisse MCLEAN, Fabien Eric Florent, JEAN-LOUIS and Karolin Andersson, 2014. Factors Influencing Small- scale Farmers ' Choice of Formal or Informal Raw Milk Markets. LFKK10246U – Interdisciplinary Land Use and Natural Resource Managemen, pp.1–57.

Hawkes C. & Ruel, M.T., 2011. Value Chains for Nutrition Case. *Leveragin Agriculture for Improving Nutrition and Health*, (June), p.50.

Heckman J.J., Ichimura, H. & Todd, P., 1998. Matching as an econometric evaluation estimator. *Review of Economic Studies*, 65(2), pp.261–294.

Hoddinott J. & Headey, D., 2013. Cows , missing milk markets and nutrition in rural Ethiopia. *Farm production and nutrition workshop, World Bank*, (June), pp.1–27.

Holloway, Garth, Charles Nicholson and Chris Delgado, 1999. Agroindustrialization through institutional innovation: Transactions costs, cooperatives and milk-market development in the Ethiopian highlands. *MTID Discussion Paper*, 35(35), p.30.

Holste J.H., 2015. Local firm upgrading in global value chains: A business model perspective.

IFPRI. 2006. "Review and Validation of Dietary Diversity, Food Frequency and Other Proxy Indicators of Household Food Security." Rome: International Food Policy Research Institute.

Jabbar M.A., 2010. Policy Barriers for Dairy Value Chain Development in Bangladesh with a Focus on the Northwest Region. *Research study*, pp.1–77.

Jaffee S., Henson, S. & Rios, L.D., 2011. Making the grade: Smallholder farmers, emerging standards, and development assistance programs in Africa. *A Research Program Synthesis. Washington DC: …*, (62324).

Jagwe J., Machethe, C. & Ouma, E., 2010. Transaction costs and smallholder farmers' participation in banana markets in the Great Lakes Region of Burundi, Rwanda and the Democratic Republic of Congo. *African Journal of Agricultural and Resource Economics*, 6(1), pp.302–317.

Jaleta M., Berhanu, G. & Hoekstra, D. a, 2009. Smallholder commercialization : processes,

determinants and impact. *Discussion paper / International Livestock Research Institute*, (no 18), p.v, 49 .

Kabunga, N.S., Dubois, T. & Qaim, M., 2014. Impact of tissue culture banana technology on farm household income and food security in Kenya. *Food Policy*, 45, pp.25–34.

Kadigi Reuben, Ibrahim L. Kadigi, Germana H. Laswai and Japhet J. Kashaigili, 2013. Value chain of indigenous cattle and beef products in Mwanza region , Tanzania : Market access , linkages and opportunities for upgrading. , 1(August), pp.145–155.

Kaganzi Elly, Shaun Ferris b, James Barhamc, Annet Abenakyo, 2009. Sustaining linkages to high value markets through collective action in Uganda. *Food Policy*, 34(1), pp.23–30

Kaplinsky, R. & Morris, M., 2000. A HANDBOOK FOR VALUE CHAIN An Important Health Warning or A Guide for Using this Handbook. , (September).

Kherallah, M., Camagni, M. & Baumgartner, P., 2015. Sustainable inclusion of smallholders in agricultural value chains - Scaling up note. , pp.1–12.

Kiprono P., 2014. Roads and Farming : The Effect of Infrastructure Improvement on Agricultural Input Use , Farm Productivity and Market. , (25101002).

Kuma B., 2012. Market Access and Value Chain Analysis of Dairy Industry in Ethiopia : The Case of Wolaita Zone A Dissertation Submitted to the School of Agricultural Economics and Agribusiness , School of Graduate Studies, Haramaya University.

Kumar Anjani Kumar, Harbir Singha, Sant Kumara and Surabhi Mittal, 2011. Value Chains of Agricultural Commodities and their Role in Food Security and Poverty Alleviation - A Synthesis. *Agricultural Economics Research Review*, 24(June), p.169–181.

Kumar Niraj, Kbrom Tkui, Desalew Tadesse Tegegne and Awot Teklu Mebratu , 2014. Productive Performance of Crossbred Dairy Cows and constraints faced by dairy farmers in Mekelle , Ethiopia. IOSR Journal of Agriculture and Veterinary Science , 7(1), pp.62–66.

Land O'Lakes, 2010. The next stage in dairy development for Ethiopia Dairy Value Chains. *End Markets and Food Security Cooperative Agreement 663-A-00-05-00431-00Land O'Lakes Inc., Adis Ababa, Ethiopia (2010)*, (November), p.88.

Lee W., 2008. Propensity Score Matching and Variations on the Balancing Test. *3rd Conference on Policy Evaluation*, ZEW, Mannheim (Germany), 27-28 October

Leonardo W.J., Bijman, J. & Slingerland, M.A., 2015. The Windmill Approach: Combining transaction cost economics and farming systems theory to analyse farmer participation in value chains. *Outlook on Agriculture*, 44(3), pp.207–214.

Leykun Birhanu Demeke, J.H., 2014. Econometric analysis of factors affecting market participation of smallholder farming in Central Ethiopia. *Journal of Agricultural Extension*

and Rural Development, 2(6), pp.94–104.

Liu Y., 2013. The Evolution of the Global Value Chain : Theory and Evidence ∗. , (December), pp.1–67.

Luoga W., L. R. Kurwijila, D. Nyange and R. Ryoba, 2014. Determinants of Access and Participation of Smallholder Farmers in Dairy Input and Output Markets in Tanzania Case study of Rungwe District. *Tanzania Journal of Agricultural Sciences*, 8(1), pp.57–66.

Mahmud Yesuf and Gunnar Köhlin, 2010. Market Imperfections and Farm Technology Adoption Decisions : Case Study from the Highlands of Ethiopia Department of Economics Göteborg University. , pp.1–22.

Makoni, Nathaniel, Raphael Mwai, Tsehay Redda, Akke van der Zijpp, Jan van der Lee, 2013. White Gold: Opportunities for Dairy Sector Development Collaboration in East Africa. *Centre for Development Innovation*, p.203.

Manson H. & Lopez-montes, A., 2014. Workshop on Global Value Chains for Food and Nutrition Security 25-26 September , 2014 - Roma Tre University. , (September), pp.1–28.

Martey Edward, Prince M Etwire, Alexander N Wiredu and Wilson Dogbe, 2014. Factors influencing willingness to participate in multi-stakeholder platform by smallholder farmers in Northern Ghana: implication for research and development. *Agricultural and Food Economics*, 2(1), p.11.

Maxwell D., Coates, J. & Vaitla, B., 2013. How Do Different Indicators of Household Food Security Compare ? Empirical Evidence from Tigray. *Feinstein International Center*, (August).

Megersa Bekele, AndréMarkemann , Ayana Angassa & Anne Valle Zárate, 2013. The role of livestock diversification in ensuring household food security under a changing climate in Borana, Ethiopia. *Food Security*, 6(1), pp.15–28.

Melesse K. & Jemal, J., 2013. Dairy Technology Impacts on Livehoods of Dairy Producers in Central Ethiopia. *International Journal of Food and Agricultural Economics*, 1(1), pp.109–118.

Minot N. & Hu, D.H., 2009. Impact of Contract Farming on Income: Linking Small Farmers, Packers, and Supermarkets in China. *World Development*, 37(11), pp.1781–1790.

Mitchell Jonathan, Coles Christopher, Keane Jodie, Kaplinsky Raphael, Morris Mike, Barker, R C, Altenburg, Tilman and Affairs Foreign, 2002. M4P Making Value Chains Work Better for the Poor: A Toolbook for Practitioners of Value Chain Analysis. *COPLA Global: ODI*, 2006(January), pp.1–165.

Miyata S., Minot, N. & Hu, D.H., 2009. Impact of Contract Farming on Income: Linking Small

Farmers, Packers, and Supermarkets in China. *World Development*, 37(11), pp.1781–1790.

Montaigne E. & Coelho, A., 2012. Structure of the producing side of the wine industry: Firm typologies, networks of firms and clusters. *Wine Economics and Policy*, 1(1), pp.41–53.

MoARD 2009. "Amhara Livelihood Zone, Reports- Bahir Dar Zuria Woreda West Gojam Administrative", the Ministry of Finance and Economic Development Addis Ababa.

Muchopa C.L., 2013. Agricultural Value Chains and Smallholder Producer Relations in the Context of Supermarket Chain Proliferation in Southern Africa. *International journal of Managing Value and Supply Chains*, 4(3), pp.33–44.

Mungandi S., Conforte, D. & Mary, N., 2012. Integration of Smallholders in Modern Agri-food Chains : Lessons from the KASCOL Model in Zambia . , 15(3), pp.155–176.

Nangole Eddah, Dagmar Mithöfer and Steven Franzel, 2011. Review of Guidelines and Manuals for Value Chain Analysis for Agricultural and Forest Products. *ICRAF Occasional Paper No. 17* .

Nkhata R., Jumbe, C. & Mwabumba, M., 2014. Does irrigation have an impact on food security and poverty: Evidence from Bwanje Valley Irrigation Scheme in Malawi. , (APRIL 2010), p.20..

Note T.G. & Edition, F., 2015. Food Consumption Score Nutritional Analysis (FCS-N) Guidelines. , (August).

Omiti, John.M., David j Otieno, Timothy O Nyanamba and Ellen Mccullough Bill, 2009. Factors influencing the intensity of market participation by smallholder farmers : A case study of rural and peri-urban areas of Kenya. *World*, 3(1), pp.57–82.

Onoja, Anthondy, B. B. Usoroh, D. T. Adieme and N.J. Deedam, 2012. Determinants of Market Participation in Nigerian Small-Scale Fishery Sector: Evidence from Niger Delta Region. *The Journal of Sustainable Development*, 9(1), pp.69–84.

Plahe J., 2005. the Global Commodity Chain (Gcc) Approach and the Organisational Transformation of Agriculture. , pp.1–11.

Poole N.D., Chitundu, M. & Msoni, R., 2013. Commercialisation: A meta-approach for agricultural development among smallholder farmers in Africa? *Food Policy*, 41(September 2007), pp.155–165.

Raikes B.P., Jensen, M.F. & Ponte, S., 1999. Global Commodity Chain Analysis and the French Filière Approach : Comparison and Critique. , pp.1–30.

Rich Karl M., R. Brent Ross, A. Derek Baker , Asfaw Negassa, 2011. Quantifying value chain

analysis in the context of livestock systems in developing countries. *Food Policy*, 36(2), pp.214–222.

Roberts B., Helping Ethiopian Dairy Sector to Realize Its Potential. , (Vd).

Rosenbaum, P.R., and D.B. Rubin, 1983. "The Central Role of the Propensity Score in Observational Studies for Causal Effects", Biometrika 70(1), 41-55

Saenger Christoph, Matin Qaim, Maximo Torero and Angelino Viceisza, 2013. Contract farming and smallholder incentives to produce high quality: Experimental evidence from the Vietnamese dairy sector. *Agricultural Economics (United Kingdom)*, 44(3), pp.297–308.

Sebatta Christopher, Johnny Mugisha, Enid Katungi, Apolo Kashaaru,Harriet Kyomugisha, 2014. Smallholder Farmers ' Decision and Level of Participation in the Potato Market in Uganda. *Modern Economy*, (July), pp.895–906.

Seifu E. & Reiner, D., 2014a. Analysis of the dairy value chain : Challenges and opportunities for dairy development in Dire Dawa , Eastern Ethiopia. *International Journal of Agricultural Policy and Research*, 2(June), pp.224–233.

Senyolo G.M., P. Chaminuka, M. N. Makhura and A. Belete, 2009. Patterns of access and utilization of output markets by emerging farmers in South Africa: Factor analysis approach. *Journal of Agricultural Research*, 4(3), pp.208–213.

Sharma V.P., 2009. Determinants of Small-Scale Farmer inclusion in Emerging Modern Agrifood Markets : A Study of the Dairy Industry in India Determinants of Small - Scale Farmer inclusion in Emerging Modern Agrifood Markets : A Study of the Dairy Industry in India 1. *Management*, pp.1–36.

Sharma V.P., 2015. Determinants of Small Milk Producers' Participation in Organized Dairy Value Chains: Evidence from India. *Agricultural Economics Research Review*, 28(2), p.247.

Silvia Silvestri, Douxchamps Sabine, Kristjanson Patti, Förch Wiebke, Radeny Maren, Mutie Ianetta, Quiros F. Carlos, Herrero Mario, Ndungu Anthony, Ndiwa Nicolas, Mango Joash, Claessens Lieven and Rufino Mariana Cristina, 2015. Households and food security: lessons from food secure households in East Africa. *Agriculture & Food Security*, (2015).

Simons D., Francis, M. & Jones, D., 2005. Food value chain analysis. *Consumer Driven Electronic …*, (APRIL 2010).

SNV, 2008. Dairy Investment Opportunities in Ethiopia. *Development*, Addis Ababa, Ethiopia.

Sonam T. & Martwanna, N., 2011. Performance of smallholder dairy farmers' groups in the East and West central regions of Bhutan: Members' perspective. *Journal of Agricultural Extension and Rural Development*, 4(1), pp.23–29.

Staal S.J, Baltenweck, L. Njoroge, B.R. Patil, M.N.M. Ibrahim, E. Kariuki., 2006. Smallholder Dairy Farmer Access to Alternative Milk Market Channels in Gujarat . *Dairy Farmer*.

Stamm A., 2004. Value Chains for Development Policy: Challenges for Trade Policy and the Promotion of Economic Development: Concept Study

Steen M. & Maijers, W., 2014. Inclusiveness of the small-holder farmer key success factors for Ethiopian agribusiness development. *International Food and Agribusiness Management Review*, 17(SPECIALISSUEB), pp.83–88.

Stifel D. & Minten, B., 2015. Market Access , Welfare , and Nutrition : Evidence from Ethiopia. , (September).

Stringer R., Sang, N. & Croppenstedt, A., 2009. Producers, Processors, and Procurement Decisions: The Case of Vegetable Supply Chains in China. *World Development*, 37(11), pp.1773–1780.

Swinnen J., 2014. Global Agricultural Value Chains, Standards, and Development.

Swinnen, J., Maertens, M. & Vandeplas, a., 2010. Governance and smallholder farmer competitiveness in high value food chains. *Agriculture for Development-Revisited*, pp.1–44.

Tassew A. & Seifu, E., 2009. Smallholder Dairy Production System and Emergence of Dairy Cooperatives in Bahir Dar Zuria and Mecha Woredas, Northwestern Ethiopia. *World Journal of Dairy & Food Sciences*, 4(2), pp.185–192.

Tefera Tesfaye, Azage Tegegne, Ranjitha Puskur and Dirk Hoekstra, 2008. Moving Ethiopian smallholder dairy along a sustainable commercialization path: missing links in the innovation systems. *Smallholder dairy production in Ethiopia: challenges and future prospects. Proceedings of a workshop jointly organized by SIDA/SAREC and Faculty of Veterinary Medicine*.

Tefera T., 2014. Analysis of Chickpea Value Chain and Determinants of Market Options Choice in Selected Districts of Southern Ethiopia. *Journal of Agricultural Science*, 6(10).

Tegegne Azage, Berhanu Gebremedhin, Dirk Hoekstra, Berhanu Belay and Yoseph Mekasha, 2013. Smallholder dairy production and marketing systems in Ethiopia: IPMS experiences and opportunities for market-oriented development. IPMS (Improving Productivity and Market Success) of Ethiopian Farmers Project Working Paper 31. Nairobi: ILRI. , (31).

Temu A.E and N.W Marwa, 2007. Changes in the Governance of Global Value Chains of Fresh Fruits and Vegetables: Opportunities and Challenges for Producers in Sub-Saharan Africa.

Tirkaso W.T., 2013. The Role of Agricultural Commercialization for Smallholders Productivity and Food Security. , (827).

Tiwari S., Skoufias, E. & Sherpa, M., 2013. Shorter, cheaper, quicker, better: linking measures

of household food security to nutritional outcomes in Bangladesh, Nepal, Pakistan, Uganda, and Tanzania. , (August)..

Tolossa D., 2006. Combining household qualitative data and quantitative data in food security research Addis Ababa.

Torero M., 2011. A Framework for Linking Small Farmers to Markets. *Paper Presented at the IFAD Conference on New Directions for Smallhloder Agriculture 24-25 January, 2011, Rome, Italy*, p.41.

Tovignan D.S., 2010. " World Food System — A Contribution from Europe " Agricultural Value Chain Modelling and Governance : The Case of Shea Butter in Benin. , p.35390.

Turner Rachel, Corinna Hawkes, Jeff Waage, Elaine Ferguson, Farhana Haseen, Hil- ary Homans, Julia Hussein, Deborah Johnston, Debbi Marais, Geraldine McNeill, and Bhavani Shankar, 2013. Agriculture for improved nutrition: The current research landscape. *Food and Nutrition Bulletin*, 34(4), pp.369–377.

UNIDO, 2009. Agro-Value Chain Analysis and Development: The UNIDO Approach. A staff working paper. Vienna, Austria: UNIDO

UNIDO, 2011.Pro-poor Value Chain Development. *United Nations Industrial Development Organization, Vienna, Austria*. United Nations Industrial Development Organization.

Urquieta N.R.A., Christie, M.E. & Taylor, D.B., 2009. Effects of access to information on farmer ' s market channel choice : The Case of Potato in Tiraque Sub-watershed (Cochabamba - Bolivia).

Vaitla B., Coates, J. & Maxwell, D., 2015. Indicators to Inform Acute Food Insecurity Phase Classification. , (December).

Verhofstadt E. & Maertens, M., 2013. Cooperative membership and agricultural performance : Evidence from Rwanda.

Wonder B., 2014. Smallholder Value Chains for Food Security. , (April)

World Bank, 2015. Inclusive global value chains : policy options in trade and complementary areas for GVC integration by small and medium enterprises and low-income developing countries. , (October), pp.1–107.

Yilma Z., Guernebleich, E. & Sebsibe, a., 2011. A Review of the Ethiopian Dairy Sector.

Zewdie A.A., 2012. Innovation Capacity in Dairy Production Systems : A Study in the Northwest of Ethiopia. , (November), p.103.

Zivenge E., 2012. Analysis of factors influencing market channel access by communal horticulture farmers in Chinamora District, Zimbabwe. *Journal of Development and*

Agricultural Economics, 4(6), pp.147–150.

APPENDICES

Appendix 1. Food Security and Food Consumption Score Category of the Sampled Households with and With Participation in Modern Milk Value Chain

Outcome variables	Threshold category	Participated HH	Non-participated HH	Total
Food security	Food secure	90	57	147
	Moderately insecure	6	99	105
	Extremely Insecure	2	79	81
	Total	98	235	333
Food consumption	Poor	18	80	98
	Borderline	40	136	176
	Acceptable	55	4	59
	Total	98	235	333

Source: Author's survey data

Appendix 2. Covariate Balancing Indicators Before and After Matching

Variables		Mean		Mean %bias	t-test		V(T)/ V(C)
		Treated	Control		t	p>t V(C)	
HH Age	Before matched	45.99	40.939	44.7	4.17	0.000	5.01*
	After matched	2233.8	1699.7	46.8	4.52	0.000	5.67*
Concentrate feed cost	Before matched	2862.4	3325.7	-24.9	-1.68	0.094	4.80*
	After matched	1.4e+07	1.2e+07	10.1	0.72	0.475	29.88*
Daily milk yield	Before matched	11.704	6.1224	107.2	7.58	0.000	148.46*
	After matched	189.3	37.837	88.2	6.18	0.000	888.64*
Milk market dist	Before matched	1190.2	1249	-3.4	-0.90	0.369	14.30*
	After matched	1.8e+06	1.6e+06	1.1	1.05	0.294	15.72*

Source: Author's survey data

Appendix 3. PS Balancing Indicators Before and After Matching

	Before matching	After Matching
Mean standardized difference (bias)	72%	43.3%
Pseudo R2	0.83	0.00
X^2P-value of LR	222.31***	271.71

Appendix 4. The study process and methodological framework

Reviewed Literatures related to:

GVC and Pro-poor GAFVC approaches, conceptualization of factors that affects smallholders' participation and benefits in agri-food value chain, collective action as pathways to link smallholder to the modern value chain,
Household Food security measurements and, food and nutrition security impact pathways of smallholder' participation in modern high value food value chain in case of Ethiopia.
Empirical studies on smallholder and agricultural value chain, overview of the dairy sub-sector in Ethiopia

↓

Study Approach:

Value chain analysis: using Pro-poor GAFVC framework

↓

Research Design:

A sequential exploratory mixed methods: Qual → Quan (Creswell et. al. 2011)

Dominantly used a quantitative method

↓

Preliminary Qualitative Analysis using Participatory Rural Appraisal (PRA) survey

Objectives: to select sub sector for the value chain analysis from livestock sector in the two districts and then selected dairy subsector ; to be an informative pilot study for next quantitative analysis of the study , to develop questionnaires for surveys, to select samples of study learning sites and samples population for survey from two districts and then purposefully selected seven samples of rural *kebelles*

1st phase: documentary analysis and four key informant interview with purposefully selected respondents at district level.	**2nd Phase**: Four FGDs and six key informant interview with purposefully selected respondents at rural *kebelles* level of samples study areas.

Qualitative data analyzed using content methods.	

Developed Questionnaires for surveys	
Structured questionnaire for MMRA survey	Structured questionnaire for household survey

Sampling Strategies and Samples size for the Surveys	
Using three stage sampling strategies, 60 actors in the milk value chain were randomly selected from the two districts	Using three stage sampling strategies, 333 smallholder households randomly were selected in proportion to the study populations.

Quantitative Analysis using survey	
➢ Conducted MMRA survey with randomly selected 60 actors in milk VC	➢ Conducted Smallholder household survey with 333 randomly selected smallholder farmers
➢ using descriptive statists and profit margin analysis method, analyzed MMRA survey data	➢ Using descriptive statists and binary and PSM regression models, analyzed the household survey data

Manuscript I: Assessment of Dairy Value chain Structures	
Objectives were to: 5. Asses the input and output structures of dairy value chain 6. Identify profit margin and production costs of dairy business in formal and informal MVC **7.** Examine constraints of dairy value chain development	
Data collection Methods: mixed methods ➢ Qualitative data: using PRA tools ➢ Quantitative: MMRA and HH surveys	**Samples:** ➢ 60 randomly selected actors in milk VC ➢ 333 randomly selected smallholders HHs
Qualitative data analysis: content method	**Quantitative analysis:** descriptive statics

	and profit margin

Manuscript II: Determinants of smallholders' market participation behaviors in Milk VC	
Objectives were to: 1. assess determinants of smallholders' decision in milk output market participation 2. examine determinants of smallholders' choice to participate in formal milk value chain	
Data collection Methods: mixed methods ➢ **Quantitative:** HH survey with qualitative data supplementation	**Samples:** ➢ 333 randomly selected smallholders HHs
Qualitative data analysis: content method	Quantitative analysis: descriptive statics and regression analysis
Two stage binary logit regression analysis	
1st stage: ➢ Using a binary logit regression analyzed determinants of SHFs decision whether to sell or not surplus milk ➢ Dependent variables: 0 = not sold milk 1= sold milk	
2nd stage: ➢ Using binary logit regression analyzed determinants of SHFs choice whether to supply to modern or traditional milk value chain ➢ Dependent Variables: 0= choose informal milk market channel 1= choose formal milk market channel	
❑ **Independent variables:** ➢ ***Household level factors:*** age, gender, education and dairy business experiences as well as resource endowments such as number of cross breed cows owned , investment on concentrate feeds and average daily milk yield ➢ ***Transaction cost factors:*** distance to milk collection center, distance to asphalt roads and distance to nearest town ➢ ***Institution business support services factors:*** access to credit, number of visit by extension worker, distance to veterinary services	

Manuscript III: Food and Nutritional Security Impact Pathways of SHFs Participation in Formal milk VC	
Objectives were to: 1. Compare food and nutrition security status between SF HHs with and without participation in modern milk Value chain 2. Examine average FNS effect of smallholders' participation in formal milk value chain	
Data collection Methods: mixed methods ➢ Quantitative: HH survey with qualitative data supplementation	**Samples:** ➢ 333 randomly selected smallholders HHs
Qualitative data analysis: content method	**Quantitative analysis:** descriptive statics and regression analysis
Using PSM model, analyzed Average Treatment Effect(ATT) analysis	
ATT Analysis Groups:	

- **Control group :** **0**= HHs without participation in modern milk VC # 222 HHs
- **Treatment group: 1**= HHs with participation in modern milk VC# 99 HHs

Outcome Variables

- Household annual income
- Weekly HHs milk consumption amount in litters
- Per-capita calorie intake
- Household FFS score(Food consumption score)

- **Independent variables:**
- ***Household level factors***: age, gender, education and dairy business experiences as well as resource endowments such as number of cross breed cows owned , investment on concentrate feeds and average daily milk yield
- ***Transaction cost factors:*** distance to milk collection center, distance to asphalt roads and distance to nearest town
- ***Institution business support services factors:*** access to credit, number of visit by extension worker, distance to veterinary services

General Conclusion and Policy implication of the study

Appendix 5. Conversation factor of family size in to adult per unit size.

Table : Adult equivalence scales		
Years of age	**Men**	**Women**
0-1	0.33	0.33
1-2	0.46	0.46
2-3	0.54	0.54
3-5	0.62	0.62
5-7	0.74	0.70
7-10	0.84	0.72
10-12	0.88	0.78
12-14	0.96	0.84
14-16	1.06	0.86
16-18	1.14	0.86
18-30	1.04	0.80
30-60	1.00	0.82
60 plus	0.84	0.74
Source: Dercon and Krishnan, 1998		

Appendix 6. Frist round PRA check list guide for preliminary qualitative data collection at district level

Check lists for the Second round Participatory Rural Appraisal (PRA) Survey with key informant in the area of dairy value chain at Kimbibit and Bahirdar-Zuria district levels.

Introduction:

The study title – Smallholder access to dairy value chain for food security and nutrition improvement

Introducing the study objective – for the partial fulfillment of PhD degree in Economics

Objective of the PRA: To gather information/data for the study

Rules of the PRA:

- ✓ Feel free to express your idea/reflection about the discussion topic
- ✓ Respect each other's' opinion
- ✓ Expression of your idea/reflection should be bounded only within the topic under discussion

Time: 2 hrs

Topics of the discussion:

1. General Socio-economic characteristics of population in the districts or woredas and PAs
2. Major crop production in the area
3. Major livestock production in the area
4. livestock production
5. livestock marketing participation at urban/pre-urban and rural household level
6. Constraints of livestock market participation at rural and pre-urban household level
7. Possible solution for the constraints of livestock market participation

1. Administrative division
    - ♦ Number of rural kebelles
2. Mapping of institutions
    - ✓ Type: GOs, NGOs, civil and privates
    - ✓ Number
    - ✓ Responsibility /service or role
    - ✓ Beneficiaries

3. Infrastructures distributions to Each PAs, villages and at HH levels

- Hard infrastructures
  - ✓ Roads
  - ✓ Electricity
  - ✓ Water: portable, rivers, lakes and etc
  - ✓ Telephone
- Soft infrastructure
  - ✓ Health institutions
  - ✓ Schools
  - ✓ Bank or micro finance
  - ✓ Market center
  - ✓ Insurances

4. BIOPHYSICAL DATA
   - ❖ Agro ecological zones
   - ❖ Population density/distribution

I. Human population under different age and sex category in the woreda:

Age category Male Female Total

- ✓ Household
- ✓ ≤5 years
- ✓ 5<x<15 years
- ✓ 15≤x ≤64years
- ✓ > 64years
- ✓ Total
- ❖ Soils
- ❖ Mean annual temperatures, rainfall distribution
- ❖ Land distribution:

5. Land utilization structures in district.

No Type of land use	Before 10 years	Currently
1 Homestead /backyard		
2 Cultivated land including fallow land		
3 Grazing land: Communal		
Private		
4 Area under forage cultivation		
5 Wood-land and/ or shrub-land open for grazing		
6 Protected forest land		
7 Closed plantation land		
8 Area occupied by different construction		

9 Area occupied by church and mosque		
10 Urban land		
11 Unusable land		
Total		

- HH land size :

6. Livelihood strategies: interims of type , purpose, performance and impacts on HH

I. Crop farming

No	crops	Rain feed		Irrigation		Double cropping
		Area(Ha)	Average yield (Qt)	Area	Average yield	Mark X for double cropping
1						
2						
3						

- ❑ Livestock
- ❑ Non-farm
- ❑ Off-farm
- ❑ Remittance

7. Food security/insecurity trend and status distribution
8. Developmental projects:
   - ✓ Project Area and name
   - ✓ Implementer: GOs, NGOs and bilateral
   - ✓ Beneficiaries
   - ✓ impacts

9. Major problem in relation to
   - ✓ Health and diseases
   - ✓ Land
   - ✓ Food insecurity
   - ✓ Infrastructures
   - ✓ Shocks or disasters
   - ✓ Peace and instability

Appendix 7. Check lists for Second round PRA survey with key informant in the area of dairy value chain at rural kebelle level.

Introduction:

The study title – Smallholder access to dairy value chain for food security and nutrition improvement

Introducing the study objective – for the partial fulfillment of PhD degree in Economics

Objective of the PRA: To gather information/data for the study

Rules of the PRA:

- ✓ Feel free to express your idea/reflection about the discussion topic
- ✓ Respect each other's' opinion
- ✓ Expression of your idea/reflection should be bounded only within the topic under discussion

Time: 2 hrs.

Topics of the discussion:

8. General Socio-economic characteristics of the rural kebelle or Pas
9. Dairy Input supply
10. dairy production in the area
11. dairy marketing
12. Constraints of dairy market participation at rural household level
13. Possible solution for the constraints of dairy market participation

1. General socio-economic condition of the rural household in the PAs:

A. What are the major livelihood strategies of the rural household?
   - Major Farming activities, performance and condition
   - Major non-farming activities and condition
   - Major off-farm activities and condition
   - Remittance and its effect on their livelihood

B. How is the wealth status stratification of the household in the PAs?-
   What are the bases for categories the household relative wealth status such as rich, better off, poor, very poor?

C. How is the condition of infrastructures in theworedas/ PAs? Like access, distance, quality and quantity of:

- Road
- Water
- Light
- School
- Health service
- Bank

D. Land access, land utilization and average land size in the area

2. Crop production
   - ✓ Major crop production
   - ✓ Average crop production in both bad year and good year in the household
   - ✓ Crop production purpose- for HH consumption, selling for HH income, for livestock feeding
   - ✓ Average annual HH income from crop production
3. Livestock production
   - ✓ What are major types of livestock production in the area?
   - ✓ Major source of fodder
   - ✓ Major fodder supplier in the area
   - ✓ Major problem in related to livestock production
   - ✓ how is the effect of livestock production to household food security and income

4. Input supply and business development service providers:

4.1 Major stakeholder who are working with dairy production and marketing activities of the rural people

- ✓ Input supplier
- ✓ Credit service provider
- ✓ Veterinary service provider
- ✓ Training and technical support provider
- ✓ Dairy related projects
- ✓ Strategic plan

5. Dairy production

5.1. Heard structure and composition at rural kebelle

Species	Type	Number of livestock				Main purpose of keeping livestock
Cattle		Local breed	Cross breed	Exotic breed	Total	
	Ox					
	Bull					
	Cow					
	Calf (<1year)					
	Heifer					
	Young bull					
Sheep						
Goat						
Donkey	Equine Donkey					
	Horse					
	Mule					
Chicken	Chicken					
Beehive	Beehive					

5.2. What are the major feed resources in the kebelle? (Rank 1, 2, 3…in order of feed cover)

Rank	Type of feed resource							
	Natural pasture	Untreated Crop-residues	Stubble grazing	Hay	Silage	Urea-treated crop residues	Feed supplement	Browse trees
Dry								
Wet								

5.3 Major problem in related to livestock production

- ❑ how is the effect of dairy production to household food security and income

5.4 Milk production and productivity:

- ➢ Average milk yield per day for both local and cross breed cows in the area
- ➢ Average No. cows the rural household owned in the area- Max and Minm
- ➢ Average milk yield per day in the rural household –Maxm and Minm

5.5. Purpose of dairy production in the area

5.6 Division of labor in dairy production

5.7 Major dairy products produce and purpose of each of dairy production – consumption and sold

5.8 How many litters used to produce 1 kg of butter/cheese?

6. Dairy market participation

A. Marketing factors

- ✓ dairy products supply for sale
- ✓ Major buyer
- ✓ Average Quantity sold per day by the rural household - Maxm and Minm
- ✓ Sales outlet
- ✓ Price per unit in different seasons –fasting and non-fasting, dry and wet
- ✓ Mode of payment
- ✓ Who is determined the price
- ✓ Minimum and maximum acceptable requirement of each buyer and buying unit
- ✓ Quality standard measurement of buyer
- ✓ Who is selling the dairy products?

B. Distance factor

- ✓ Average distance to road, credit, support giving institutions
- ✓ Mode of transportation used for livestock product sales activity

C. Institutional factors

- ✓ Major Service and support to livestock production and who is support giving institution and no. of visit by DA
- ✓ How is the credit service

6. What are the major dairy marketing participation constraints of the rural household in the area?

7. What are possible solution?

Appendix 8. Structured Questioner for Smallholder Households Survey

Household Level Survey Questionnaire

Purpose: This questionnaire is prepared with the aim of collecting data pertaining to smallholder participation in dairy value chain market and food and nutritional security outcomes of their participation in a mixed farming system of two districts, Bahirdar-Zuria and Kimbit. This questionnaire will serve as a major input for the PhD dissertation research being conducted in pursuit of purely academic purpose. Hence, the respondent is kindly requested to provide us his/her genuine responses to the sets of questions included herewith in the questionnaire. We would like to firmly assure the respondent on the confidentiality of the responses. Thank you in advance for your cooperation!!!

No.	Information type	Name
1.1	Region	
1.2	Zone	
1.3	District	
1.4	PA (Kebele)	
1.5	Village/ *Got*:	
1.6	Identification Number of the household (code)	
1.7.Name of the Household head:		
1.8. Date of Interview (DD/M/2013):		
1.9. Name of enumerator:		
1.10. Enumerator‘s signature:		
1.11. Name of the supervisor:		
1.12.Supervisor‘s signature:		

Direction

1. For questions with listed choices please follow the multiple choices
2. For open-ended questions, you are requested to tell your genuine and free opinion

Part I: General Information (Area Identification)

No.	Information type	Name	Code
1.1	Region		
1.2	Zone		
1.3	District		
1.4	PA (Kebele)		
1.5	Village/ *Got*:		
1.6	Identification Number of the household (code)		
1.7.Name of the Household head:			
1.8. Date of Interview (DD/M/2005):			
1.9. Name of enumerator:			
1.10. Enumerator's signature:			
1.11. Name of the supervisor:			
1.12.Supervisor's signature:			
Code for region: 1-Amahara 2- Oromia			
Code for Zone: 1-West Gojjam 2-North Showa			
Code for PA: 01-Zengo 02- Lay-Komibolcha 03-Addadi-Mato 04-Yugoma/Andassa 05-Sebat-Amit 06-Robit 07-Wondata			
Code for Got/Village			

Part II: Demographic characteristics of the household head and the household members

2. Household Head (HH) Characteristics			
	Characteristics	Code	Response
2.1	Age of the HH		
2.2	Sex of the HH.	1=Male 0=Female	
2.3	Religion of the HH	0=Orthodox 1=Muslim 2=Protestant 0=others/ specify	
2.4	Educational status of the household head (HH)	0= illiterate 1= Literate 2= Elementary level 3= High school level 4=TVET level; 5=1st degree; 6= Postgraduate	
2.5	Marital status of the HH	0=Single 1=Married 2=Divorced 3=Widowed 4= separated 5= Polygamy	
2.6	Ethnicity of the HH	0=Oromo 1=Amhara 2=Tigre 3=Gurage4=Welayta =Others	
2.7	Total number of the current household members		
2.8	Total number of Male in the household		
2.9	Total number of Female in the household		
2.9	The roof of the house for the household is made of	0=grasses/straw 2=Iron 3=other	

3. Age distribution of the household members			
Code	Age group	Total numbers of household members who are	
		a. male	b. female
1	less than 5 years old		
2	between 5 and 12 years old		
3	between 13 and17 years old		
4	between 18 and 24 years old		
5	between 25 and 35 years old		
6	between 36 and 45 years old		
7	between 46 and 65 years old		
8	greater than 65 years old		

Part III: The Household Assets status

4. Land Access and size /utilization

4.1. Do you have land access for agricultural use? If no to Q4.1, skip to Q4.3 1= Yes 0= No		
	Circle on the represented in local measurement unit and write the seize on the space: *1-Qada 2-Timad*	Response in hectare
4.2 If yes to Q4.1, what are the total sizes of your farm plot?		
4.3 What is the size of your farm-gate land or resident?		
4.4. If you have a private grazing land, what is the size of your a private grazing land?		
4.5. If you have a communal grazing land, what is the size of a communal grazing land?		
4.6. If you have a shared-crop land, what is size of the land?		

5. Livestock assets status

code	Type of livestock	5.1. Total number that you had last year	5.2 Total number that lost or died last year	5.3 Total number that sold last year	5.4 Amount of Annual Income earned from sales of the products in Birr	Q5.5.Change in the number of livestock in last 3 years. Code: 1=Increased 2=Decreased 3=No change
1	Lactating cows					
2	Non-lactating cows					
3	Calf/Calves					
4	Oxen					
5	Young Bulls					
6	Bulls					
7	Heifer					
8	Sheep					
9	Goat/s					
10	Donkey/s					
11	Horse/s					
12	Mule/s					
13	Hen/chicken					
14	Eggs					
15	Total					

	Response
Q6. Do you save cash money in Bank, saving or any microfinance institution? 1. Yes 0. No	

Crop production

Q7. Did you raise crops last production seasons (Meher or Belg) of the year, 2005E.C? Yes = 1 No= 0 if no, skip to Q9	

Q8. If you yes to Q7, would you tell us the size of farmlands and the amount of crops you harvested during 2005E.C (Meher or Belg season)?							
No.	8.1. Type of harvested crop	8.2. Amount of harvested	8.3.Farm size		8.4.Amount consumed	8.5 Amount sold out	8.6 Amount of annual sales income earned
	Code	In quintal/ kg	Circle on the represented in local measurement unit and write the seize on the space: *1-Qada* *2-Timad*	*In Hectare*		In quintal/ kg	In Birr
1							
2							
3							
4							
5							
6							
7							

Code for Q8:
1. Barley 2. Wheat 3. White-Teff 4. Black/mixed teff 5.Maize 6. Sorghum
7. Haricot beans (Boloke) 8.Cow bean 9.chickpeas 10. Lentils 11.Dagusa
12. Sinar/gerima 13. Adenguare 14. Horse beans (Bakela) 15. Guaya (Vetch) 16.others

9. Did you produce any vegetables, fruits or cash crops in2005E.C? Yes-1 No-0 if no skip to Q10	

Q10. If yes to Q9, would you tell us about your perennial crops, fruits and vegetables and the income you earned from them during 2005E.C?		
10.1. fruits and vegetables type	10.2. Amount of harvested/produced	10.3 Annual sales income earned in birr

Code for Q10: 1. Chat 2. Coffee 3. Papaya 4. Eucalyptus 5. Onion 6. Garlic (Nech Shinkurt) 7.Beet root (Key Sir)
8. Sugarcane 9.Cabbage (Gomen) 10. Spinach (Quosta) 11. Selata (Lettuce) 12. Pepper
13. Pineapple (Ananas) 14. Red pepper 15.Banana 16. Mango 17.Zeyutuna 18. Carrot
19. Tobacco 20. Potato 21.Others

Q11.Would you tell us the sources of water your household use for household consumption and for various agricultural purposes?		
Uses	A .Source during dry season	b. Source during wet/rainy season
11.1. Household consumption		
11.2. Livestock consumption		
11.3. Crops farming consumption		
Code: 1.Irrigated-water 2. Hand-dug well 3. Tap/pipe 4.River 5. Pond 6. River, using Pump engine 7. Rain water 8.Others		

Module one: Dairy production and Marketing
Part IV: Milk production

Q12	How long since you have started the dairy farming?	
Q13	How many milking cows did you have when you started dairy farming?	
Q14	What type of breeds that you started dairying? 1=local 2 =cross 3= Pure 4= all	

Q15.What is the main objective of the household to engage in dairy farming?	
Reasons	Response: yes=1 no=0
15.1. Major Source of livelihood;	
15.2. Additional source of livelihood/part time job;	
15.3. Survival/adaptive strategy;	

Q16. Labor division in the management, operation and marketing of dairy related activities								
No	Activities	Response: 1 = Yes 0= No.						
		a. Husband	b. Wife	c. Both husband and wife	d. Boys	f. Girls	h. Both Boys and girls	i. Hired
16.1	Cleaning, Feeding, Watering and Fetching forages/ grasses							
16.2	Milking							
16.3	Processing milk in to milk products							
16.4	Transporting milk for sale							
16.5	Selling processed milk products like butter and cheese							
16.6	Buying dairy inputs (feed, medicine, etc							
16.7	Buying dairy animals							
16.8	Selling animals							
16.9	Decisions on the money obtained from sales of dairy products							

Q19-29. Used Dairy farm inputs, production costs that have you used and purchased for 2005 E.C dairy production year?

Input type	Q19 Did you use **Code:** 1=yes 2=No If no skip to the next inputs	Q20 If you use, how common that you used the **Code:** *1=Very often common 2= very common 3=common 4=not often common 5= not common*	21. If you use, in which season that you have regularly used the **Code:** 1=winter 2=summer 3= 1 & 2	Q22. If you use it, source of **Code:** 1=self-production 2=purchased 3=farmer milk cooperative 4=extension aid 5=1 & 2 6=1 & 3 7=1 & 4 8=2 & 3 9=2 & 4 10=3 & 4 11=from 1 to 4	Q23 If you use it, estimated annual costs in birr for	24 If you use it, was it purchased **Code:** 1-Yes 0-No If no skip to Q30	Q25. If you purchased, Who is the seller of? **Code:** 1= Agricultural office 2=milk cooperative 3=Private traders 4-Neigbhour farmer 5=1 & 2 6=1 & 3 7=1 & 4 8=2 & 3 9=2 & 4 10=3 & 4 11=from 1 to4	Q26. Transaction place for **Code:** 1= Farm gate 2= Local market center 3= The district market center/town 4= 1 & 2 5= 1 & 3 6= 2 & 3	Q27. mode of payment **Code:** 1= cash 2= credit	Q28. Price per unit	Q29. Total annual purchasing costs in Birr for

01.Improved cultivated Forage:											
02. *Fagulo*											
03. *Furushika*											
04. Molasses											
05.Crop residue											
06. Hay											
07.Open grazing											
08. Byproducts of Local drinks-*Atela*											
09.Drugs											
10. Veterinary											
11.Artificial Insemination											
12.Hired labor											
13.Power											
14.Transport											
15. Total											

Q30.If you are not purchased any one or all of the above mentioned inputs, what are the possible reasons?	
Reasons	1= Yes 0=No
30.1.The price is unaffordable/very expensive	
30.2.The selling point is very far	
30.3.Unavailability of the input	
30.4.There is no transportation access for the inputs	
30.5.I used my own production products	
30.6 I don't have any awareness about its importance	
30.7.Others (specify)	

Q31- Which of the following dairy farm inputs have you sold out in 2005 E.C production year?							
Input type	Q31. Did you sell? 1=yes 2=No If no skip to Q38	Q32. Amount sold out per year in kg	Q33 Who is the buyer? 1=Milk cooperative 2=Private trader 3= Neighbor farmer 4= 1 & 2 5= 1 & 3 6= 2 & 3	Q34. Transaction place 1= Farm get 2= Local market center 3= District market center 4= 1 & 2 5= 1 & 3 6= 2 & 3	Q35. mode of payment 1= cash 2= credit	Q36. Sales Price per unit	37. Annual total sales income in birr
01.Improved cultivated Forage:							
02.*Fagulo*							
03. *Furushika*							
04.Crop residue							
05.Hay							
06.Byproducts of Local drinks-*Atela*							

Q38.What kind of milk products do you currently handle/produce? *Please provide information by filling as requested in the table.*		
No.	*Product*	*Response: Yes= 1; No=0*
38.1	Fresh milk	
38.2	Butter	
38.3	Cheese	
38.4	Yoghurt	
38.5	Arera	
38.6	Milk's cream	

Q39-41.What is the size of your dairy related workforce/employee? Please state their number and wage.				
Type	Q39.Number of workforce		Q40.Wage in birr per month	41.Annual total labor costs in Birr
	a. Male	b. Female		
1. Permanent				
2. Temporally				
3. Family labor				

Q42. Do you keep local breeds cows currently? Please tick the appropriate ones and also indicate their numbers. 1=Yes 0=No. If your response to Q.42. is no, skip to Q. 47		
Q42	How many milking cows do you have?	
Q43	How many dry or non-milking cows do you have?	
Q44	How much litter milk is currently produced per day per local cow	
Q46	Would you tell us the daily average total milk amount that you produced from your all local breed cows? In litter	

		Response:
Q47.	Do you keep improved or cross breeds cow? If your response to Q.47. is no, skip to Q52 1=Yes 0=No	
Q48	How many improved or cross breeds milking cow do you have now?	
Q49	How many improved breeds or cross breed non-milking cows do you have now?	
Q50	How much litter milk is on average currently produced per day per cow by your improved or cross breed cow?	
Q51	How much litter milk is on average currently produced per day by your total improved or cross breed cow?	

		Respons e
Q52	Do you keep Pure breeds? If your response to Q.52 is no, skip to Q56 1=Yes 0=No	
Q53	How many pure breeds milking cow do you have now?	
Q54	How many pure breed non-milking cows do you have now?	
Q55	How much litter milk is on average currently produced per day per cow by your pure breed cow?	
Q56	How much litter milk is on average currently produced per day by your total pure breed cow?	

Q57-59. The average, highest and lowest daily milk yield of the household		in litter
Q57	Would you tell us the average total milk amount that you produced per day?	
Q58	Would you tell us the highest total milk amount that you produced per day?	
Q59	Would you tell us the lowest total milk amount that you produced per day?	

Q60.Do your household consume any volume of milk from the milk you produced? 1=Yes 0=No If no, skip to Q62		
Q61.What quantity of the milk is consumed by your family per day on average?	Response in litter	

Q62.Have you ever participated in any dairy production and marketing training for last three years? 1=Yes or 0=No if no, skip to Q61	
Q63.If yes to Q62, has the training been helpful in gaining knowledge and skills to solve your practical problems in related to dairy production and marketing? 1= Yes 0=No	

V. Milk marketing activities

Q64. Did you sell Fresh milk last year? Yes= 1 No = 0 *If no skip to Q91*	

Q65 If yes to Q64, Which of the following factors motivated you to sell the products?		
Q.	Motivation	Response: 1 = Yes 0 = No
65.1	The existence of milk collecting center or cooperative in your livening area	
65.2	The presence of many milk buyers in your livening area	
65.3	The need for additional income in the family	
65.4	Because of my neighbors' is selling milk	
65.5	The price is attractive	
65.6	Others (specify	

VI. Seasonal Milk production and marketing distribution

Q66.was there seasonal differences in terms of any one the following points in last year, 2005E.C-volume of milk production output and sold out and, price? 0=Yes 1=No. If no, skip to Q68		
No.	Seasonal distributions	Fresh milk
		Quantity in litter
67.1	Quantity produced per day in fasting season	
67.2	Quantity sold per day in fasting season	
67.3	Price in fasting season per litter	
67.4	Quantity produced per day in non-fasting season	
67.5	Quantity sold per day in non-fasting season	
67.6	Price in non-fasting season per litter/	
67.7	Quantity produced per day in wet season	
67.8	Quantity sold per day in wet season	
67.9	Price per litter in wet season	
67.10	Quantity produced per day in dry season	
67.11	Quantity sold per week in dry season	
67.12	Price in dry season per litter	

Q 68.For how many buyers did you sell your Fresh milk last year? *Code: 1 = only one buyers 2 = two buyers 3 = three buyers 4 = more than three buyers*	

Milk market channel: Modern Vs. Traditional

Q.69. If you did sale milk, in which of the following buyer groups did you sell your milk product?	
Code: 1=producer's milk marketing cooperative 0=local traders, and or Neighbor farmers	

Q.70.What was reasons- explain why you traded with this your current buyers? *Please write the numbers*		
No.	**Reasons**	Code:1-Agree 2-Partly agree 3-Not agree
70.1	The buyer provide inputs with faire price	
70.2	Located to nearby to my house	
70.3	Reliability of the buyer	
70.4	The buyer offer better prices	
70.5	Cost of finding a new buyer is high	
70.6	Good Personal relations and contacts with the buyer	
70.7	Presence of legal contracts	
70.8	Others/specify	

Q.71-77*).Your Buyers characters and milk transaction behavior*

Buyers Group	Q71 Did you sell your milk to? *1=Yes 0=No If no, skip to Q75*	Q72.What is the daily average quantity you sold out to? In litter	Q73 Who did determine the price? *1= seller 2= buyer 3= both of us negotiating*	Q74 What was the mode of payment ? *1=in cash 2= credit that payable every 15 days*	Q75 How frequent the following traders bought your milk product? *1=Regularly 2=irregularly*	Q76 How did you measure the quality when you are trading with the following trader? *1=Visual; 2=Mechanical*	Q77 What was the selling agreement *1=Verbal 2=written*
1.Producer's milk cooperative							
2.Hotels							
3.Milk bar/kiosk							
4.Costmers/ Neighbors							
5. Retailers							
6.Wholesalers							
7.Brokers							
8.Big Processing institution							
9.Others							

Q.78-80. Producer's milk trading activities: Milk sales outlet, average distance, means and costs of transporting. (If you are trading only to dairy cooperative, after filling the cooperative part skip to Q80)

No.	Buyers Group	Q78. What was the sales price per litter to?	Q79. Where was the sales outlet in trading with the? Code: *1= local market place; 2= Farm gate 3= milk collection centers; 4= hotels/restaurants*	Q80. How long minute do you walk for selling your milk from your home to?	Q81. What type of transporting you used in trading with? Code: *1= Vehicles; 2= Foot; 3= Animals ; 4=Bicycle*	Q82.How much round trip transport costs you are incurred in trading with?
1	Producer's milk cooperative					
2	Hotels					
3	Milk bar/kiosk					
4	Costumers/ neighbors					
5	Big processing institutions					
6	Retailers					
7	Wholesalers					
8	Brokers					
9	Others					

VI. Collective action in milk marketing

Q83.Are you a member of producer's milk cooperative? 1=Yes or 0=No If no, skip to Q.91	
Q84.If so, what were the main reasons that motivated you to join the milk dairy marketing cooperative?	1=Yes 0= No
84.1.to get secured market for the milk	
84.2.To get dairy farm inputs timely and with fairly price	
84.3.To get dividend from the cooperative	
84.4.To get education, training and advisory services from the cooperative	
84.5. to get credit access	

Q85.How long you sold your milk outputs to the producer's milk cooperative?	
Q86.Being a member of dairy cooperative, would you tell us which of the following services you are benefiting / accessing from the dairy cooperative? Yes/no	1=Yes 0=No
86.1. Provision of dairy inputs timely and with fairly price	
86.2. Provision of vet service	
86.3. Provision of credit service	
86.4. Provision of cross breed cows with fairly price	
86.5. Advisory and training in milk management (production, processing and marketing)	
86.6. Providing dairy market information	
Q87.Is there any positive change since you have been marketing your milk output through producer' cooperative in the following points? 1=Yes 0= No	
Q87.1.Improvement in quality of the milk	
Q87.2.Milk Production level/quantity	
Q87.3.Milk sales increased	
Q87.4.Dairy income increased	
Q88.Do you think that dairy cooperative is doing a good jobs in solving problems you/other' members are facing in dairy production and marketing in these days? 1=Yes 0= No	

Q89. What is the share size of milk that you sold out to the cooperative out of the total sold out per day? *1= The total 100% 2= 80 to 100% 3= 50 to 80% 4= 50% 5= 25 to 50% 6= below 25%*	

Q90 How satisfied you are on your relationships with the cooperative buyer over the last 12 months? *Using a five point scale please indicate the number in the table* 1=Very unsatisfied 2=Dissatisfied 3=Neither satisfied nor dissatisfied 4=Satisfied 5=Very satisfied	Response

Q91.If you didn't sell milk last year (2005E.C), what was the main reason?	
Reasons	Response:1 = Yes 0 = No
91.1. Price too low	
91.2. No surplus to be marketed	
91.3. No Milk receiving Agents near by	
91.4. The milk market is not satisfactory	
91.5. No/Poor transport service	
91.6. Others	

VII. Butter production

Q92. Did you process your milk like at home to change it to butter in last year, 2005E.C? 1= Yes 0= No *If No to Q92, skip to 94*	

Q93. If yes to Q. 92 what was the main reason of processing?	
Reasons	Response:1=Yes 0=NO
93.1. For home consumption only	
93.2.There is high demand of butter products than selling the milk	
93.3.For both home consumption and sale	
93.4.To get better market price than selling milk	
93.5. Others (specify) :	

Q94. If you didn't sell butter, what was the main reason?	
Reasons	Response: 1= Yes 0=No
94.1.There is no high demand for butter as compared to fresh milk	
94.2.Processing of milk to butter requires labor and time	
94.3. There is no secured market for butter; like the milk cooperative didn't receive these products.	
94.4. The profit from butter sales is lower than milk sales	
94.5.Others (specify):	

Q95 What is your maximum and minimum capacity to process butter product once in your own house?		In Kg
Q95.1	What is the maximum amount of butter you could produce at once processing capacity?	
Q95.2	What is the minimum amount of butter you could produce at once processing capacity?	

Q96. Converting factors

	Type of produced dairy product	Quantity of fresh milk used for processing in litters:
		Quantity used in litter
Q96.1	Quantity of fresh milk used to produce one kg butter	
Q96.2	Quantity of fresh milk used to produce one kg cheese	

VIII. Butter marketing

Q. 97.Did you sell butter last year, 2005E.C? 1 = Yes or 0 = No *If no skip to Q115*	

Q98. Which the following sales out let did you sell most of your butter output?	
98.1.Woreda's /district's town or market	Response: 1=Yes 0=No
98.2.Around the village ,	
98.3.Road side,	
98.4.Nearest town	
98.5. Nearest local market	
98.6.Market center at Addis Ababa	
98.7.Others	

Q99.For how many buyers did you sell your butter product last year? If the answer is other than number one, skip to Q102	Response
1 = only one buyers 2 = two buyers 3 = three buyers 4 = more than three buyers	

Q.100.If you did sale only for one buyer, in which of the following groups this buyer belongs to?	Response
1= Retailer 2= Local trader 3= Wholesalers 4= Consumers 5= Mobile traders 6=Traders in Addis Ababa 7= Brokers 8= others (specify) ----	

Q.101.What reasons explain why you traded with this your current sole buyers? *Please write the number*		
Q. No	**Reasons**	1-Agree Partly 2-Agree 3-Not Agree
101.1	Provide inputs	
101.2	Located in nearby place to my house	
101.3	Buyer's reliability	
101.4	Better prices offered by the buyers	
101.5	Cost of finding a new buyer is high	
101.6	Personal relations and contacts with the buyer	
101.7	Presence of legal contracts with the buyer	
101.8	Others (*specify*)	

Q.102-107. your butter output buyers' identity and your butter transaction behavior

Type of Buyer	Q102. Did you sell to? *1=Yes 0=No If no skip to 107*	Q103. What is the weekly average quantity you sold out to?	Q104. Who did determine the price? *1= seller 2= buyer*	Q105. What was the mode of payment? *1=in cash 2=Letter of credit*	Q106. How frequent supplied your butter product to? *1=Regularly 2=irregularly*	Q107. How did you measure the quality when you are trading with the following trader? *1=Visual; 2=Mechanical*
1.Local traders						
2.Retailer						
3.Trader in Addis						
4.Wholsaler						
5.Mobile trader						
6.consumers						
7.Brokers						
8.Others(*specify*)						

Q.108-112. Producer's butter trading activities: butter sales outlet, average distance, means and costs of transporting.						
No.	Buyers Group	Q.108. What was the sales price per kg to?	Q109. Where was the sales outlet in trading with? Code: *1= local market place; 2= Farm gate 3= district market center; 4= Addis Ababa market center 5= buyer shopping center in the district*	Q110. How long minute do you walk for selling your butter from your home to the?	Q111. What type of transporting you used in trading with? Code*: 1= Vehicles; 2= Foot; 3= Animals ; 4=Bicycle*	Q112.How much round trip transport Costs you are incurred in trading with the?
1	Local traders					
2	Retailer					
3	Traders in Addis Ababa					
4	Wholesalers					
5	Mobile traders					
6	consumers					
7	Brokers					
8	Others(specify)					

Q113.Was there seasonal difference in terms of any one of the following process- amount produced, sold out and price in your last year butter operation? 1=Yes 0=No, If no , skip to Q115		
Q114.Would you tell us how much butter you have produced, and sold out per month in both fasting and non-fasting seasons in this year?		
No.	Seasonal distributions	Butter
		Quantity in Kg
114.1	Quantity produced per week in fasting season	
114.2	Quantity sold per week in fasting season	
114.3	Price in fasting season per kg	
114.4	Quantity produced per week in non-fasting season	
114.5	Quantity sold per week in non-fasting season	
114.6	Price in non-fasting season per kg	
114.7	Quantity produced per week in wet season	
114.8	Quantity sold per week in wet season	
114.9	Price per kg in wet season	
144.10	Quantity produced per week in dry season	
114.11	Quantity sold per week in dry season	
144.12	Price in dry season per kg	

Q115-113. Would you tell us your average quantity of production output and consumption per week by the household in last year?			
No	Type dairy product products	Average quantity of production output and sales of dairy products per week	
		Q.115 Quantity produced in Kg	Q.116.Quantity consumed in Kg
1	Fresh milk		
2	Butter		
3	Yoghurt		
4	Chesses (*Ayib)*		
5	Arera		

IX. Transaction costs determinants

A. Distance factors

Q117-120. How long do you walking to get the following economic services from your farm get?		
No	Key Places	Average walking distance in minute
117	To the district's/woreda's city	
118	To nearest local market center	
119	To graveled roads	
120	To asphalt roads	
121	To milk collection center	

Q122-123. How long do you walking to get the following economic services and how frequently you are visited by the following support giving institutions			
No	Institution	Q122.What is the average walking distance to get the following economic services from your home? In minute	Q123.How frequently you have been visited by the following support giving institutions in every 3 months
1	Veterinary center		
2	the district animal agency		
3	FTC- farmer training center		

Type of infrastructures and services	**Q124.Do you have access to? 1=Yes 0=No**
1.Transport to the market	
2.Asphalt road to market center	
4.Value adding machinery (e.g. packers, abattoir)	
5.Telephone	
6.Electricity	
7.Mobile	
8.Water(tap/pipe)	
9.Others	

Q125.Did the extension services of your *Wereda/District/* has offered you----? 1=Yes 0= No	
Services	Response: 1=Yes 0=No
125.1 Technical advice	
125.2 Market Information (input or/and output)	
125.3 Credits	
125.4 Farm equipment	
125.5 Improved breeds	
125.6 Fodders	
125.7 Capacity building training	

Q126.How do you rate the services provided by extension officers in your area?	Response
1. Not helpful 2. Helpful enough 3. Very helpful	

Group name	Q127.Are you the member of? 1-Yes 0-No if no, skip to the next group	Q128. If you are, how long you have been the member?
1. Farmer union		
2. Farmer comprehensive union		
3. Self-help group		
4. Saving and credit associations		
5. Women association		

B. Market information factors

Q129. Did you get market information through formal way about the dairy market such as market price and conditions from any institutions? 1= Yes 0= No	

Q130-131. How do you acquire market information pertaining to dairy business **most often**?		
Means of Accessing Information	Q130.Have been you using 1=Yes 0=No	Q131.Rank as 1st, 2nd , 3rd, etc according to frequency of use
1 Radio		
2 Government/Extension agents		
3 Television		
4 Mobile		
5 Traders/Middlemen		
6. Dairy cooperative		
6 Neighbors		
7 Other (specify		

Q132. Did you get cash/kind credit in the last 12 months for your dairy production?	Response
1= Yes 0= No if yes, skip to Q134	

Q133. If no to Q. 132, what was the reason?	
Reasons	Response:1=Yes 0=No
1.no awareness about the credit service in the area	
2.the credit giving institution needs collateral to lend money	
3.the interest rate is high	
4.There is no credit service giving institution	
5.Others	

Q134.Do you perform price surveys for your input and output dairy marketing activities? 1=Yes 0=No	

X. Constraints of dairy production and marketing

Q135. Would you tell us how the following problems affecting your dairy productions activities? (Multiple choice possible)

1=A very high serious problem, 2= serious problem 3= a problem 4= somehow a problem 5= not a problem

No	Problems	Response
135.1	Lack of veterinary services	
135.2	Animal diseases	
135.3	Shortage and poor quality of fodder and,	
135.4	Lack of grazing fields	
135.5	Labor constraints	
135.6	Luck of credit service	
135.7	Poor processing capacity	
135.8	the price is getting expensive	
135.9	Less selling dairy products price	
135.10	Others (specify) :	

Q136. Would you tell us how the following constraint affected your dairy marketing activities? Using the following scale, Please indicate the ranking number in the appropriate places

Scale: 1= very high constraints, 2 = high constraints, 3 = Medium constraints, 4= simple constraints, 5 = not a constraints

Code	**Constraints**	**scale response**	
		a. Milk	b. Butter
136.1	Fluctuation in the quantity of milk obtained from cows		
136.2	Distance of milk collection centers from my home		
136.3	Lack of getting adequate market especially during fasting time		
136.4	Inadequacy of labor in the household to transport the output		
136.5	Spoilage of milk during transportation		
136.6	Unable to get market information		
136.7	High quality demand by the buyers		
136.8	Luck of adequate preservation materials		
136.9	Distance of market center from my home		
136.10	Transportation problems		
136.11	Others(specify)		

(Module II) Part two: household income and food security

A. Questionnaire on the household income distributions

Q137.How much income on average the household encored and earned respectively from the following sources of income in the last year or 2005 E.C		
No	Sources of non-farm incomes	Q137.Annual income amount earned in birr If you have not engaged in, fill 0 to the space
1	Selling food and drink	
2	Selling dung/firewood	
3	Selling grass, timber,	
4	Petty trade	
5	Selling crafts	
7	Others	
8	Total non-farm and cost income	

No.	Off-farm Income sources	Q138.Annual income amount earned in from *If you have not engaged in, fill 0 to the space*
1	Farm labor income	
2	Cash for food income	
3	Wage laborer	
4	Total off-farm income	

Q. Remittance income

Q.139. Has your household has been receiving remittances? 1. Yes 0. No If no , skip to 141	

Q140. Amount money received from any family members or relatives who have sent to you or to any one of the household members from other part of the country or aboard in the last year?	

Household Food security measurement

Q141-144.The staples that your household consumed and stocked in 2005E.C are:				
Type	141. Did your family in the your house consumed 1=Yes 0= No *If no, skip to Q146*	Q142 The household currently has stocked in a total of? *in kg*	143. Source of crops: 1=self-won production 2=purchased 3= relief support 4= 1 & 2 5= 1 & 3 6= 2 & 3 7= From 1 to 3	Q144 The three most important staples crops (rank)
				1st
				2nd
				3rd
Code for consumed crops: 1. Barley 2. Wheat 3. White-Teff 4. Black/mixed teff 5.Maize 6. Sorghum 7. Haricot beans (Boloke) 8.Cow bean 9.chickpeas 10. Lentils 11.Dagusa 12. Sinar/gerima 13. Adenguare				

14. Horse beans (Bakela)	15. Guaya (Vetch)	16.others

Q145. Question for calculating per capita calorie intake of the household using household food balance model

Q145. Would you tell us the amount of the following crops that the household produced, used for seed, sold out, post-harvest lost, purchased and gained from relief support in last year, 2005 E.C?

Crop type	145.1.Amount of production output in kg	Q145.2 Amount used for seed in kg	145.3 Amount sold out in kg	145.4 Amount of post-harvest lost in kg	145.5 Amount purchased in kg	145.6 Amount gained from relief support in kg	145.7 Amount net crop available for the household consumption In kg *Not for respondent*
1 sorghum							
2 maize							
3 Teff							
4 barley							
5 wheat							
6.Cow bean							
7.chickpeas							
8.Horse beans (Bakela)							
9.Lentils							
10.Teliba							
11.selit							
12.Nug							
13. Food-oil							
14.Others							

Q146.Months of Adequate Household Food Provisioning (MAHFP) for Measurement of Household Food Access:

Q146.Now I would like to ask you about your household's food supply during different months of the year. When responding to these questions, please think back over the last 12 months, from now to the same time last year. Circle the answer given (Q146 Months of Adequate Household Food Provisioning)	Yes	No
Q146.Were there months, in the past 12 months, in which you did not have enough food to meet your family's needs? *N.B:* *If the answer is **no**, move onto Q149. If the answer is **yes**, proceed to Q147*	**1**	**0**

Q147.Which were the months in the past 12 months during which you did not have enough food to meet your family's needs? (*include any kind of food from any source, including own production, purchase, exchange, from food aid, or borrowing*)
(Do not read the list of months out. Circle the months that the respondent identifies as months in which the household did not have enough food to meet their needs. Use a season calendar if needed to help the respondent remember different months. Probe to make sure the respondent has thought about all the past 12 months.

1	January	5	September	9	May
2	December	6	August	10	April
3	November	7	July	11	March
4	October	8	June	12	February
148	Total months (insert total number of months circled as months without enough food)				_____

Q149.Household Dietary Diversity Score (HDDS) for Measurement of Household Food Access:

	QUESTIONS AND FILTERS	CODING CATEGORIES
1	Now I would like to ask you about the types of foods that you or anyone else in your household ate yesterday **(in the last 24 hours)** during the day and at night. *Read the list of foods. Place **one** in the box if anyone in the household ate the food in question, place **zero** in the box if no one in the household ate the food.*	
A	Any Enjera*, Wott, Genfoo*, bread, biscuits, or any other foods made from millet, sorghum, maize, rice, wheat, or Teff?	A..... |___|
B	Any potatoes, yams, manioc, cassava or any other foods made from roots or tubers?	B.....|___|
C	Any vegetables?	C.....|___|
D	Any fruits?	D.....|___|
E	Any beef, lamb, goat, chicken, duck, or other birds, liver, kidney, heart, or other organ meats?	E..... |___|
F	Any eggs?	F.....|___|
G	Any fresh or dried fish?	G.....|___|
H	Any foods made from beans, peas, lentils, or nuts?	H.....|___|
I	Any cheese, yogurt, milk or other milk products?	I.....|___|
J	Any foods made with oil, fat, or butter?	J.....|___|
K	Any sugar or honey?	K.....|___|
L	Any other foods, such as condiments, coffee, tea?	L..... |___|
Q150	**HHDDS**	

Q151.Food Consumption Score (FSC) for the nutritional adequacy of the food consumed on household level through the 7 days recall of the quality and the frequency the household members consumed in the last 7 days.

Q151.How many days, in the last 7 days, have you eaten the following food items at your home?	Number of times (0-7)
Number of times (0-7)	
1 Cereals (Enjera, maize porridge, rice, sorghum, millet pasta, bread, rice or other)	
2 Roots and tubers (cassava, potatoes, sweet potatoes or other)	
3 Pulses/legumes/nuts (beans, peas, chick peas or other)	
4Vegetables and leaves	
5 Fruit	
6 Meat, poultry, offal (beef, goat, lamb, poultry), eggs, fish and seafood	
7 Milk/Dairy products (milk, yogurt, cheese or other)	
8 Sugar, sugar products, honey	
9 Oil/fats (oil, fat or butter)	
10 Condiments (spices, tea, coffee) or other miscellaneous food	
Q152. Food consumption score calculation (not a question for respondents)	

Q.153-154. Household Food Insecurity Access Scale (HFIAS):

No	153.Question	Response Options CODE	
		Code: 0=No 1= Yes	**Q154 Frequency:** How often did this happen? *N.B: If the response is 'No' skip this frequency question.* ***Code:*** ***1=****Rarely (once or twice in the past four weeks)* ***2=****Sometimes (three to ten times in the past four weeks)* ***3=****Often (more than ten times in the past four weeks)*
1	In the past four weeks, did you worry that your household would not have enough food?		
2	In the past four weeks, were you or any household member not able to eat the kinds of foods that you preferred because of a lack of resources?		
3	In the past four weeks, did you or any household member have to eat a limited variety of foods due to a lack of resources?		
4	In the past four weeks, did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?		
5	In the past four weeks, did you or any household member have to eat a smaller meal that you felt you needed because there was not enough food?		
6	In the past four weeks, did you or any household member have to eat fewer meals in a day because there was not enough food?		
7	In the past four weeks, was there ever no food to eat of any kind in your household because of a lack of resources to get food?		
8	In the past four weeks, did you or any household member go to sleep at night hungry because there was not enough food?		
9	In the past four weeks, did you or any household member go a whole day and night without eating anything because there was not enough food?		
Q155	**HFIAS calculation (NOT A QUESTION FOR RESPONDENT)**		

Q156. According to your own self-assessment how is your household? Yes=1; No=2		Response
1. Food secured	2. Food insecure	
3. Varies from one year to another	4.Varies from season to season	

Q157.If "food secure" or "1" for Q. 156, to what aspect the family feels food secured?	
Aspects of food security	Response: 1 =Yes 0= No
157.1 Increased food availability at HH	
157.2 diversified food HH consumption pattern	
157.3 Diversified sources of income	
157.4. Increased the frequency of HH dairy products consumption	

157.5 Increased income in absolute terms	
157.6 Job opportunity	
157.7 Other (specify)	

Q158.If the answer for Q156 above is “food insecure” or “2”, give the reason why you still become insecure in related with your dairy farming?	Response: Yes=1; No=0
158.1 Lack of sufficient space for production (Land and pasture land);	
158.2 Lack of inputs (fodders, breeds, drugs, credit facilities);	
158.3 Low market access (low price, low demand of products etc);	
158.4 Threat of animal diseases	
158.5 Other (specify	

Q159.In last 24 hours for how many eating occasions the food was prepared for the HH members?	
Eating Occasions	**Food consumed during the eating occasion Yes=1 and No=0**
1.A morning meal	
2.A midday meal	
3.Any food between midday and evening meals	
4.An evening meal	
Total	

Q160.Would you tell us the amount of grains and other foodstuffs that cover the annual consumption food requirements of your household members?		
Grain type	160.1.Amount in quintal or kg	160.2. Equivalence in cash (*birr*)
1.Cereals		
2.Pulses		
3.Oil seeds		
4.Vegetables		
5.Fruits		

Q161.Do you meet the all-year round food requirements of your household members from own production? Code: 1. Yes 0. No	
Q162. Does the income you earn from dairy farming activities enable you to buy food for bridging the deficiency? Code: 1. Yes 0. No	

---------- Thank you very much ----------

Appendix 9. Structured questionnaire Rapid Milk Market Appraisal survey

Milk and butter trader Survey Questionnaire

Purpose: This questionnaire is prepared with the aim of collecting data pertaining to dairy value chain analysis in a mixed farming system of two districts, Bahirdar-Zuria and Kimbit. This questionnaire will serve as a major input for the PhD dissertation research being conducted in pursuit of purely academic purpose. Hence, the respondent is kindly requested to provide us his/her genuine responses to the sets of questions included herewith in the questionnaire. We would like to firmly assure the respondent on the confidentiality of the responses. Thank you in advance for your cooperation!!!

No.	Information type on the Trader's:	Name
1.1	Region	
1.2	Zone	
1.3	District	
1.4	PA (Kebele)	
1.5	Village/ *Got*:	
	Identification Number(code)	
Name of the Trader :		
Date of Interview (DD/M/2013):		
Name of enumerator:		
Enumerator's signature:		
Name of the supervisor:		
Supervisor's signature:		

Direction

1. For questions with listed choices please follow the multiple choices

2. For open-ended questions, you are requested to tell your genuine and free opinion

Part II: Trader's Demographic characteristics

2. Household Head (HH) Characteristics			
	Characteristics	Code	Response
2.1	Age of the trader		
2.2	Sex of the trader.	1=Male 0=Female	
2.3	Religion of the trader	0=Orthodox 1=Muslim 2=Protestant 0=others/ specify	
2.4	Educational status the trader	0= illiterate 1= Literate 2= Elementary level 3= High school level 4=TVET level; 5=1st degree; 6= Postgraduate	
2.5	Marital status of the	0=Single 1=Married 2=Divorced 3=Widowed 4= separated	

	trader	5= Polygamy	
2.6	Ethnicity of the trader	0=Oromo 1=Amhara 2=Tigre 3=Gurage4=Welayta =Others	

Part III: Dairy marketing

Q3. How long since you have been involved in dairy business activities? ----------

Q4. Number of employee who are working under your dairy business----------

Q5. Product lines of trader's dairy business----------

1. Fresh milk 2. Butter 3.Yoghurt (ergo) 4. Cheese

Q6. Trader's type----------

1. Retailer 2.wholsaler 3. Local trader 4. Mobile trader 5. Broker

6. Hotels/restaurants / Milk kiosk 7.Producer's milk marketing cooperative 8.Processor

Q7.Trader's registration/certification status----------

1. Registered 2. Non – registered

Q8.Who is you're suppler of Fresh milk? ----------

1. Smallholder farmer, 2) Retailer 3.wholsaler 4. Local trader 5. Mobile trader

6. Broker 7. Hotels/restaurants / Milk kiosk 8.Producer's milk marketing cooperative

Q9.)How much do buy fresh milk in fasting season per litter? ----------

Q10.) How much do buy fresh milk in non-fast season per litter? ----------

Q11. Where do buy fresh milk? ----------

1. Farm get 2. Local market center 3. Woreda's market center 4. Adddis Ababa

Q12. Do you sell fresh milk? If the response is no, go to question? ----------

1. Yes 2. No

Q13If you sell fresh milk, where do you sell it? ----------

1. on my business center 2. Local market center 3. Woreda's market center 4. Adddis Ababa

Q14. How much do you sell fresh milk in fasting season per litter? ----------

Q15.How much do you sell fresh milk in non-fasting season? ----------

Q16.For whom do you sold out fresh milk? ----------

1) Milk processor 2) Retailer 3.wholsaler 4. Local trader 5. Mobile trader

6. Broker 7. Hotels/restaurants / Milk kiosk 8.Producer's milk marketing cooperative

Q17. Do you participate in milk processing activities? ----------

1. Yes 2. NO

Q18. Do you participate in butter output marketing activities? If the response is no, end up the interview.

1. Yes 2.No

Q19. Where do buy butter? ----------

2. Farm get 2. Local market center 3. Woreda's market center 4. Adddis Ababa

Q20) where do you sell butter? ----------

1. on my business center 2. Local market center 3. Woreda's market center 4. Adddis Ababa

Q21. How much do you sell butter in fasting season per kg? ----------

Q22.How much do you sell butter in non-fasting season per kg? ----------

Q23.For whom do you sold out butter? ----------

1) Consumer 2) Retailer 3) wholesaler 4. Local trader

5) Mobile trader 6). Broker 7) Hotels/restaurants