ANALYSIS OF BUTTER SUPPLY CHAIN: THE CASE OF ATSBI-WENBERTA AND ALAMATA WOREDAS, TIGRAY, ETHIOPIA

M.Sc. Thesis

BY

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Haramaya University

ANALYSIS OF BUTTER SUPPLY CHAIN: THE CASE OF ATSBI-WENBERTA AND ALAMATA WOREDAS, TIGRAY, ETHIOPIA

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As Thesis Research advisors, we here by certify that we have read and evaluated this Thesis prepared, under our guidance, by Embaye Kidanu entitled 'Analysis of Butter Supply Chain: The Case of Atsbi-Wonberta and Alamata Woredas, Tigray, Ethiopia. We recommend that it be submitted as fulfilling the thesis requirement.

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DEDICATION

To the smallholder dairy producer households of the country

STATEMENT OF THE AUTHOR

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

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BIOGRAPHICAL SKETCH

The author was born on march18, 1984 in Wukro town, eastern zone of Tigray region. He attended his elementary school at Dinglet Primary School and Secondary school at Agazi Comprehensive High School during the period between 1991 and 2002/3 G.C at Wukro. Joined the then Debub University in 2003/4, he graduated with B.Sc. degree in Agricultural Resource Economics and Management on 12th of July 2006.

Until he joined Haramaya University for postgraduate studies in Agricultural Economics in October 2007, he was working as socio-economic researcher for Tigray Agricultural Research Institute.

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The only viable way of completing a project of any significant magnitude is to partly relinquish control to others. My thesis was not an exception to this rule. I, therefore, share the ownership of this work with several others and wish to acknowledge their contributions.

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ABBREVIATIONS

BMP	Butter Market Participation
BMS	Butter Market Supply
BoARD	Bureau of Agriculture and Rural Development
CSA	Central Statistical Authority
DA	Development Agent
DDA	Dairy development agency
DECSI	Dedebit Credit and Saving Institution
EARO	Ethiopian Agricultural Research Organization
ETB	Ethiopian Birr
FAO	Food and Agriculture Organization
FTC	Farmers' Training Center
GDP	Gross Domestic Product
GCC	Global commodity chain
Ha	Hectare
IFPRI	International Food Policy Research Institute
ILRI	International Livestock Research Institute
IPMS	Improving productivity and Market success
kms	Kilometers
m.a.s.l	meters above sea level
MEDAC	Ministry of Economic Development and Cooperation
MIS	Market information system
MoARD	Ministry of Agriculture and Rural Development
MOI	Ministry of Information
MT	Metric Tone
NGO	Non-Governmental Organization
NRM	Natural resource management
OLS	Ordinary Least Squares
PA	Peasant Association

ABBREVIATIONS (CONTINUED)

Qt	Quintal
REST	Relief Society of Tigray
RMA	Rapid Market Appraisal
Rs	Indian Rupees
S-C-P	Structure Conduct Performance
SPSS	Statistical Package for Social Sciences
SSA	Sub Saharan Africa
TAMPA	Tigray Agricultural marketing Promotion Agency
TARI	Tigray Agricultural Research Institute
TGMM	Total Gross Marketing Margin
TLU	Tropical Livestock Unit
VIF	Variance Inflation Factor
WET	World economic triangle
WoARD	Woreda Office of Agriculture and Rural Development

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ANALYSIS OF BUTTER SUPPLY CHAIN: THE CASE OF ATSBI-WEMBERTA AND ALAMATA WOREDAS, TIGRAY, ETHIOPIA

ABSTRACT

Butter is an important source of food, cosmetics and common marketable form of dairy product in the study areas. The total butter production in the survey year was 18880 kg in both the woredas, out of which 87.6% was supplied to market. The objective of this study is to investigate the butter supply chain in Atsbi-wonberta and Alamata woredas of Tigray region. The specific objectives were to analyze production and marketing supporting services, to identify structure of production costs and determine profitability, to analyze determinants of butter supply, to analyze structure-conduct and performance of butter market and to identify major production and marketing constraints and opportunities. To accomplish these tasks formal and informal data collection tools of both primary and secondary data were used. a survey was conducted in the districts in which data was collected from randomly selected 200 butter producer households of Atsbi and Alamata woredas using a structured questionnaire and from 56 butter traders at different level of the chain from Alamata, Atsbi and the terminal market, Mekelle. The econometric result of market participation decision indicated quantity produced, number of extension visit, market information access, family size, distance to nearest market and distance to development center are the significant factors. Similarly, quantity produced, distance to nearest market and distance to development center are significant factors affecting level of supply. As to the probit model of determinants of access to crossbreed cows; number of extension visit, participation in extension demonstration, access to veterinary service and distance to the woreda town are significant factors. Likewise, dairying experience, labor availability, distance to feed market and access to formal credit are significant factors determining farmers' access to feed in the probit model. Among the hypothesized determinants of access to cattle drug; number of extension visit, number of cows and distance to the nearest market found to be significant factors. The probit model of households' credit constraint condition reveals herd size, distance to development center, off farm income and frequency of extension contact are the significant factors associated with credit constraint condition. The net returns, generated after deducting all economic cost of resources used for butter production, found to be 1623ETB per cow/year

from crossbreed cows and 213ETB per cow/year from local breed cows with overall average net return of 918.3ETB per cow annually. Following the market structure criteria of concentration ratio, butter market shows competitive nature in Atsbi market with C_4 of 31%, and weak oligopolistic nature in Alamata and Mekelle markets as their concentration ratios are 39% and 44% respectively. Entry barriers were not observed in relation to licensing and working capital. However, considerable burrier was observed with respect to years of experience at the wholesale level and risk of seasonal variation in demand and price of butter. Based on the channel comparison and marketing margin analysis of butter market performance, the producer's share of the consumer's price was found to be the highest along producer-consumer channel followed by producer-woreda retailer-consumer and producer-rural assembler-wholesaler-consumer. The major constraints of butter production and marketing in the studied areas were inadequate availability and supply of feed, the low productivity of the endogenous cattle breeds, low supply of crossbreed cows, lower demand of butter during fasting periods, adulteration and seasonal fluctuation of butter price. Therefore, taking into account these factors in designing butter production and marketing improvement programme may help policy makers come up with policies aimed at ameliorating the butter supply chain in the districts.

1. INTRODUCTION

1.1. Background

In the realm of economic growth, markets may provide the incentives to profit maximizing participants to develop new technologies, products, resources of supply, new markets and methods of exploiting them. Agricultural marketing acts as an agent of rural development. Moreover, agricultural marketing will play a coordinating rule, steering supply and demand with respect to place, time and form utilities. If the production system works efficiently, it produces suitable incentives to meet consumer's needs more accurately in terms of type, quality and quantity of supply. Production is thus adapted to the need of consumers in response to price signals transmitted by the marketing system (Vincent, 1967).

Agricculture in Ethiopia, depending on agro-climatic conditions in the respective areas, is characterized by smallholder and traditional cultivation. Agricultural production is based on obsolete practices and low utilization of productivity-enhancing inputs. Consequently, the quantity of surplus supplied to the market is very limited. Some studies indicate that even in a bumper harvest year, the marketable surplus is no more than 28% on the average. The situation is equally bleak in the livestock sector. Despite the huge livestock population, the low off-take rate and the poor quality of the livestock itself implies that the marketed surplus of livestock products (meat, milk, butter, eggs, etc) is very low (Dawit, 2005).

Similarly, Ethiopia ranked first in cattle population in Africa but the dairy industry is not developed even as compared to east African countries like Kenya, Uganda, and Tanzania. Regarding dairy production, the national milk production remains among the lowest in the world, even by African standards (Zegeye, 2003). As the current development in the country is characterized by rapid population growth in general, the demand for dairy products is increasing as ever. However, the current levels of contributions of the livestock subsector in Ethiopia, at either the macro or micro level is below potential. The levels of foreign exchange earnings from livestock and livestock products are much lower than would be expected, given the size of the livestock population (Berhanu *et al*., 2006).

In Ethiopia, dairy policy does not favor the producer farmer, no subsidy and no support of price floor is given. Therefore, dairy prices reflect the cost of producing and distributing them. However, many developed countries have established the intervention price of butter. When price intervention was common for butter produced in the European Union. The wholesale price of packed butter was close to the intervention floor and the retail price a few percentage points higher: as low as 5 percent according to the Milk Marketing Board (1987), which argued that butter was keenly priced by supermarkets in order to attract customers into stores. Rural producers around Adisababa sells about 36% of total sales to restaurants, while those to itinerant traders accounted for 33% and sales to individuals and those to wholesalers in Addis Ababa accounted for 31% of sales (Debrah, 1990). Similarly, butter production is the long-life activity in Atsbi-Wonberta and Alamata woredas and due to some cultural barriers of milk transaction; it is also the most common marketable dairy product. Different marketing agents like rural assemblers, retailers, wholesalers and hotels and restaurants are participating along the chain of butter supply.

1.2. Statement of the Problem

Dairy production, among the sectors of livestock production system, is a crucial issue in Ethiopia where livestock and its products are important source of food and income, and dairying has not been fully exploited and promoted in the country. Despite its huge numbers, the livestock subsector in Ethiopia is low in production in general, and compared to its potential, the direct contribution it makes to the national economy is limited. A number of fundamental constraints underlie these outcomes, including traditional technologies, limited supply of inputs (feed, breeding stock, artificial insemination and water), poor or non-existent extension service, high disease prevalence, poor marketing infrastructure, lack of marketing support services and market information, limited credit services, absence of effective producers' organizations at the grass roots levels, and natural resources degradation (Berhanu *et al*., 2006). In addition, policy decision on milk and milk product marketing are taken in the absence of vital information on how they affect dairy producers, traders, exporters, and consumers. Similarly, current knowledge on dairy product market structure, performance and prices is poor for designing policies and institutions to overcome the perceived problems in the marketing system (Ayele *et al.,* 2003).

However, the fundamental development objective of the country is to establish a strong market-oriented agricultural production system. Likewise, the Poverty Reduction Strategy outlines, rapid economic development that benefits all citizens can only be achieved when the market-led transformation of the agricultural sector of the economy could enact. Thus, it is necessary to survey the present problems of production and marketing, formulate recommendations, devise, and implement a strategy, which enables the establishment of an efficient production system and transparent and efficient marketing system of these products.

Moreover, as milk transaction is culturally prohibited and considered as a taboo in the rural areas of the districts, butter is found to be a sole marketable commodity of dairy products. Furthermore, butter is an important cash source for household consumption expenditure in the woredas. Based on this ground, for progressive development of the dairy sector, then households' income generation and transformation the small-scale and subsistence producers to commercial operators, investigation of butter supply chain needs to be carried out, as there was not done such research in this area. Therefore, in line with the market-oriented production strategy of the country's policy, the study is intended at bridging the information gap with regard to butter production and marketing in Atsbi-Wonberta and Alamata districts of Tigray region.

1.3. Objectives of the Study

The overall objective of this study is to examine butter supply chain in Atsbi and Alamata woredas. The specific objectives of the study are:

1. to analyze the production and marketing support services such as extension, input supply, credit and marketing
2. to analyze the structure of production costs and determine profitability of butter production
3. to analyze the determinants of butter market supply
4. to analyze the market structure, conduct and performance of butter marketing
5. to identify major constraints and opportunities of production and supply

1.4. Research Questions

The thesis attempted to answer the following research questions:

1. Which factors determine butter market supply in Atsbi and Alamata districts?
2. How is butter marketing system organized, functioning and performing?
3. What is the structure of butter production costs and how profitable is butter production for producers?
4. What are the key constraints and opportunities in butter production and supply?
5. What are the production and marketing support services and to what extent they serve to producers and different marketing actors?

1.5. Scope and Limitations of the Study

As the study is being the first in the region, it lacks many detailed investigations, which could have reinforced understanding of the whole system especially in relation to demand side and consumption preference studies. Hence, due to time and financial constraints, the study narrowed down to concentrate on butter-supply chain in Atsbi-Wonberta and Alamata woredas as well as final market of the product, Mekelle. In addition to this, butter production accounts for the major proportion of dairy production in the areas and passed through a number of marketing stages and agents. Furthermore, other dairy products are not included because transaction of these products is culturally prohibited in the rural areas of the studied woredas. As a result, special attention was given to butter of the dairy products. To this effect, butter market channels, chain actors and their roles, institutions involved directly or indirectly in butter production and marketing as well as factors affecting marketable supply of butter has been discussed and identified.

1.6. Significance of the Study

Various efforts to promote small-scale farming have been noted in the past decades. Farmers in these areas are not really part of commercial agriculture. This is one of the reasons why contribution of smallholder agriculture to the gross national product is still not realized as what would be expected. This kind of subsistence farming is characterized by low production (and productivity), poor access to markets, and poor access to inputs and credit.

It is, however, possible for smallholder farming to survive economically when given a set of opportunities. After all, subsistence farmers are used to take rational decisions in order to adapt to conditions they find themselves in. Since such a study was not done before in the region, many stakeholders could use the output of this finding for development of the subsistent farmers. Hence, the critical analysis of butter supply chain is very important before suggesting for production and marketing development issues. Therefore, the study gives detail information on how butter production and marketing is functioning particularly in the specified districts, which are the potential butter producing areas in the region.

Mainly, the results of the study favor small-scale dairy farmers and the actors of the supply chain. Analysis of the whole system and identifying clearly the challenges will benefit policy makers and implementers in indicating the area of advantage for what should be done to improve butter production and marketing. Besides, it would be a useful reference for researchers and other interested persons in the area of study. Therefore, it was hoped that, results from this study would have practical use mainly to this area and can serve as a base for any further studies to be conducted in other similar areas within this line of study.

1.7. Organization of the Study

Firstly an over view of the unique characteristics of Ethiopian dairy production and marketing was discussed. A review of the selected conceptual and methodological framework is dealt in chapter two. Chapter 3 introduces background information about the study area and verifies the methods of data collection and data analyses, followed by chapter four that presents the results of the study. Finally, chapter five offers a brief summary, conclusion and policy implication of the empirical findings.

2. LITERATURE REVIEW

2.1. Overview of Dairy Production Systems in Ethiopia

In the late 1980s, agriculture in Ethiopia contributed about 45% of national gross domestic product. The livestock sector contributed about 40% of agricultural GDP or 18% national GDP, and 30% of agricultural employment. Dairy output accounted for about half of the livestock output (Feleke and Geda, 2001). During 1993-2001, per capita income remained at about US$100. Livestock production increased by much less than the production increase for the agriculture sector as a whole, so relative share of livestock to AGDP declined over time. During this period, per capita livestock, output fell by 5% while crop, food and agriculture grew at 14, 7 and 6% respectively (Halderman, 2004).

Four main dairy production systems may be identified in the country: a small commercial sector consisting of large private farms and state farms. Small urban/peri-urban systems raising crossbred or both crossbred and local cattle having access to milk collection centers or cooperatives. Smallholder mixed farming systems in the highlands using indigenous breeds, and pastoral/agro- pastoral system in the low lands. Reliable figures on the relative importance of these systems in terms of number of farms/herds, dairy population, share of milk produced are not available. However, a rough estimate indicate that currently, out of about 1430 million liters of milk produced annually, 900 million liters (63.3%) is produced by rural small-scale mixed farms in the highlands. 205 million liters (14.3%) by small urban/peri-urban farms in the highlands, 320 million liters (22.4%) by pastoral/agro- pastoral producers in the lowlands, and 5 million liters (less than 0.03%) by large private and state farms (Ahmed *et al*, 2003; Feleke and Geda, 2001).

Household consumption and expenditure surveys indicate that livestock products comprise only 8% of total food expenditure, with 4 percent of expenditure allocated to dairy products. About 56% of milk in the country is processed into butter, cheese and yoghurt and 44% is consumed fresh. Although levels of consumption vary according to income levels, relative shares of fluid milk and other products mainly butter remain about the same across income groups

The rural system is non-market oriented and most of the milk produced in this system is retained for home consumption. The level of milk surplus is determined by the demand for milk by the household and its neighbors', the potential to produce milk in terms of herd size and production season, and access to a nearby market. The surplus is mainly processed using traditional technologies and the processed milk products such as butter, ghee, *ayib* and sour milk are usually marketed through the informal market after the households satisfy their needs (Tsehay, 2001). Pastoralists raise about 30% of the indigenous livestock population, which serve as the major milk production system for an estimated 10% of the country's human population living in the lowland areas. Milk production in this system is characterized by low yield and seasonal availability (Zegeye, 2003). The highland smallholder milk production is found in the central part of Ethiopia where dairying is nearly always part of the subsistence, smallholder mixed crop and livestock farming. Local animals raised in this system generally have low performance with average age at first calving of 53 months, average calving intervals of 25 months and average lactation yield of 524 liters (Zegeye, 2003).

Peri-urban milk production is developed in areas where the population density is highland agricultural land is shrinking due to urbanization around big cities like Addis Ababa. It possesses animal types ranging from 50% crosses to high grade Friesian in small to medium-sized farms. The peri-urban milk system includes smallholder and commercial dairy farmers in the proximity of Addis Ababa and other regional towns. This sector owns most of the country's improved dairy stock (Tsehay, 2001). The main source of feed is both home produced or purchased hay; and the primary objective is to get additional cash income from milk sale. This production system is now expanding in the highlands among mixed crop–livestock farmers, such as those found in *Selale* and *Holetta,* and serves as the major milk supplier to the urban market (Gebrewold *et al.*, 2000).

Urban dairy farming is a system involving highly specialized, state or businessmen owned farms, which are mainly concentrated in major cities of the country. They have no access to grazing land. Currently, a number of smallholder and commercial dairy farms are emerging mainly in the urban and peri-urban areas of the capital and most regional towns and districts (Nigussie, 2006). Smallholder rural dairy farms are also increasing in number in areas where there is market access. According to Azage and Alemu (1998), the urban milk system in

Addis Ababa consists of 5167 small, medium and large dairy farms producing 34.65 million litres of milk annually. Of the total urban milk production, 73% is sold, 10% is left for household consumption, 9.4% goes to calves and 7.6% is processed into butter and ayib (cheese). In terms of marketing, 71% of the producers sell milk directly to consumers (Tsehay, 2001).

2.1.1. Dairy marketing systems in Ethiopia

In the African context, markets for agricultural products would normally refer to market-places (open spaces where commodities are traded). Conceptually, however, a market can be visualized as a process in which ownership of goods is transferred from sellers to buyers who may be final consumers or intermediaries. Therefore, markets involve sales, locations, sellers, buyers and transactions (Debrah and Berhanu, 1991).

There are formal and informal marketing systems in the transaction of dairy products. The term 'informal' is often used to describe marketing systems in which governments do not intervene substantially in marketing. Such marketing systems are also referred to as parallel markets. The term 'formal' is thus used to describe government (official) marketing systems (Debrah, 1990). Dependable system has not been developed to market milk and milk products in Ethiopia (Zegeye, 2003). Fresh milk is distributed through the informal and formal marketing systems. In both rural and urban parts of the country, milk is distributed from producers through the informal (traditional) means. This informal market involves direct delivery of fresh milk by producers to consumers in the immediate neighborhoods or to any interested individuals in nearby towns (Debrah and Berhanu, 1991).

Initial intervention to promote formal dairy marketing started with the establishment of a 300 dairy farm and a small milk processing plant under the UN Relief and Rehabilitation Program in 1947 in the premises of the now Dairy Development Enterprise (DDE) (Sintayehu, 2003). The same report stated that in 1959 UNICEF helped establish a processing plant with a processing capacity of 10 thousand litres per day with milk collection and purchasing centres around Addis Ababa. The radius of milk collection was later expanded to 70 km around the capital. Capacity of the processing plant was increased to 30 thousand litres in 1969. In 1979 the DDA (Dairy Development Agency) was transformed to the DDE when processing

capacity was increased to 60 thousand litres/day and the radius of collection expanded to 150 km with donor assistance.

The only organized and formal milk marketing and distribution system comes from the two milk-processing plants which are both located in the capital Addis Ababa (Zegeye, 2003). As reported by many authors, farmers' milk marketing groups and dairy cooperatives play a key role for milk marketing outlets, which as a result encourages farmers to produce more (Zegeye, 2003).

A study of the milk marketing system in Kenya has shown that there are at least eight different marketing channels, with the number of intermediaries ranging from 1 to 4 (FAO 1996). A study in Addis Ababa milk shed revealed that dairy producers sold milk through different principal market channels (Debrah 1990, Mbogoh, 1990), which included:

- Producer–consumer (P–C) channel: direct sales to individual consumers, which accounted for 71% of the total channels.
- Producer–catering institution–consumer (P–CI–C) channel: catering institutions includes/ itinerant traders, small private shops and kiosks, coffee and tea sales, hotels, and supermarkets/, and
- Producer–government institution–consumer (P–GI–C) channel: sales to government institutions such as the armed forces, schools and hospitals

2.1.2. Overview of butter production and marketing in Ethiopia

Butter was known in the classical Mediterranean civilizations. The ancient Greeks and Romans seemed to have considered butter a food fit more for the northern barbarians. The potential butter producer nations in the world are, India (620,000 MT), United States (522,000MT), France (466,000MT), Germany (422,000MT), and New Zealand (307,000MT) respectively (Dalby, 2003).

Butter produced from whole milk is estimated to have 65% fat and is the most widely consumed milk product in Ethiopia, of the total milk produced, around 40 percent is allocated for butter while only 9 % is for cheese (Mohamed *etal,* 2003). In a study conducted in Borena region of Ethiopia, butter was found to be an important source of energy

as food for humans, and is used for cooking and as a cosmetic. The storage stability of butter still makes preferable to other dairy products. This gives butter a distinct advantage over fresh milk in terms of more temporal flexibility for household use and marketing (Layne, 1990).

Efficiency of traditional butter production was measured for 28 instances in which soured milk was churned by women in 20 households of Borena region. Prior to churning, the milk had a temperature of 20.0 ± 0.42^0_C and an acidity of $1.06 \pm 0.03\%$. The milk was churned for 40.0 ± 2.5 minutes and afterwards the temperature of the buttermilk was 23.7 ± 0.32^0_C. The sour milk contained about 46.8 g of fat, compared with 7 g of fat in the buttermilk after churning. Thus some 85% of the butterfat was extracted by churning. Butter yield was 66.9 ± 5.6 g but moisture content of the butter was not determined (Layne *et al*., 1990).

Most of the milk produced in the country is processed by the producers themselves on-farm into butter and soft cheese (*ayib*) for home consumption and sale. Rural producers far away from urban markets usually process surplus milk into butter because of difficulties in selling fresh milk locally and the main butter markets are in the towns and cities (CSA, 2003).

Apart from income, consumer preferences and dietary customs also partly explain relatively low demand for dairy products. Orthodox Christians comprising about 40% of the Ethiopian population abstain from consuming dairy and other animal products for about 200 days in a year. Thus, low demand for dairy products in Ethiopia compared to demand in other low-income countries in Sub-Saharan Africa appears to be a major reason for the slow growth of the dairy sector. The main outlets for cooking butter for rural producers near Addis Ababa were:

(i) Restaurants in Addis Ababa and surrounding areas those serve local foods,
(ii) Itinerant traders, and
(iii) Individual consumers or butter wholesalers in Addis Ababa.

Butter and some dairy products are called yellow fats, which contains a number of products for spreading onto bread or for indirect consumption as ingredients in other foods. There is some debate over product definition, and different systems of classification have distinguished products according to a variety of characteristics: the source of their raw

material (dairy fat, animal fat, and vegetable fat); their total fat content; their polyunsaturated fat content; and whether they are hard or soft (Traill *et al*., 1994). For example, a market research agency used the following definitions: butter (80 percent and over dairy fat); margarine (80 percent and over non-dairy fat); dairy spreads (usually a 75 percent fat blend of dairy and non-dairy fats); low-fat spreads (25 to 40 percent fat); and reduced–fat spreads (60 to 80 percent) (Mintel, 1990).

2.1.3. Common challenges of dairy production and marketing in Ethiopia

Challenges and problems for dairying vary from one production system to another and/or from one location to another. The structure and performance of livestock and its products marketing both for domestic consumption and for export is generally perceived poor in Ethiopia. Underdevelopment and lack of market-oriented production, lack of adequate information on livestock resources, inadequate permanent trade routes and other facilities like feeds, water, holding grounds, lack or non-provision of transport, ineffectiveness and inadequate infrastructural and institutional set-ups, prevalence of diseases, illegal trade and inadequate market information (internal and external) are generally mentioned as some of the major reasons for the poor performance of this sector (Belachew 1998; Belachew and Jemberu 2003; Yacob as cited in Ayele *et al.,* 2003).

In the debate of poverty reduction or small-scale vs. industrial production and in spite of a general consensus on the appropriateness of general recommendations, there seem to be a lack of vision regarding the future structure and roles of the present small-scale producers. Many donors seem ready to protect and preserve the smallholders, but few have a vision of the process requiring 'transforming small-scale subsistence producers into commercial producers supplying a modern, demanding food market' (Kristensen *et al*., 2004).

2.2. Methodological and Conceptual Frameworks

2.2.1. Conceptual frame work of marketing

Market: The choice of market definition depends on the problem to be analyzed. It may be defined by: i) a location (like Alamata market), ii) a product (butter market), iii) a time

(September butter market) and iv) a level (butter retail market). Originally, the term market stood for the place where buyers and sellers gathered to exchange their goods, such as village square. A market is a point, or place or sphere within which price-making force operates and in which exchanges of title tend to be accompanied by the actual movement of the good affected. A market is the set of the actual and potential buyers of a product (Kotler and Armstrong, 2003). These buyers share a particular need or want that can be satisfied through exchange relationships.

The concept market is linked to the degree of communication among buyers and sellers, and the degree of substitutability among goods. A market is thought of as a meeting of buyers and sellers: a place where sellers and buyers meet and exchange takes place, on area where price determining forces (supply and demand) operate, an area where there is a demand for good. However, the term market means not a particular place in which goods are bought and sold. Market means a social institution that performs activities and provides facilities for exchanging commodities between buyers and sellers. Economically interpreted the term market refers not to a place but to a commodity or commodities and buyers and sellers are in free interaction with one another.

Marketing: There is no universally accepted definition of marketing, the usefulness and validity of a definition is associated with its application. Specifically for this study the following definitions used. Kohl (1968), defined marketing in a way that is most applicable to agriculture. Accordingly: ‘Marketing is the performance of all business activities involved in the flow of goods and services from the point of initial agricultural production until they are in the hands of ultimate consumers. Generally marketing is all those business activities associated with the flow of goods and services from production to consumption’. The marketing of agricultural products begins at the farm when the farmer plans his production to meet specific demand and market prospects (Abbott and Makeham, 1981).

Marketing is usually seen as a ‘’system’’ because it comprises several, usually stable, interrelated structures that, along with production, distribution, and consumption, underpin the economic process (Mendoza, 1995). In popular usage, the term "marketing" refers to the promotion of products, especially advertising and branding. However, in professional usage the term has a wider meaning. It can be divided into four sections, often called the "*four Ps*,"

only one of which is promotion. These four elements are often referred to as the marketing mix. A marketer will use these variables to craft a marketing plan. For a marketing plan to be successful, the mix of the four "P's" must reflect the wants and desires of the consumers in the target market. They are:

Product*:* The product management aspect of marketing deals with the specifications of the actual good or service, and how it relates to the end user has needs and wants.
Pricing*:* This refers to the process of setting a price for a product, including discounts.
Promotion: This includes advertising, sales promotion, publicity, and personal selling, and refers to the various methods of promoting the product, brand, or company.
Place or distribution: This refers to how the product gets to the customer; for example, point of sale placement or retailing.

Marketing Channel: The analysis of marketing channel is intended to provide a systematic knowledge of the flow of goods and services from their origin (producer) to their final destination (consumer). This knowledge is acquired by studying the" participants" in the processes, i.e. those who perform physical marketing functions in order to obtain economic benefits. In carrying these functions, marketing agents achieve both personal and social goals. They add value to production and by so doing help satisfy consumer needs. The price pays for the goods) the physical commodities and services (i.e. transportation, bulk breaking, grading) for the services and renders compensated the marketing agents for this effort. This price also serves as a signal to all actors in the marketing channel, i.e. producers, rural assemblers, and transporters, whole sellers and retailers (Mendoza, 1995).

Producers: The first link in the butter supply chain. The producer harvests the products and supplies to the second agent. From the moment he/she decides what to produce, how much to grow and when to grow and sale.
Consumer: The last link in the supply chain. The participants and their respective functions often overlap. The most widespread combinations are traders-whole sellers that collect the commodity and supply it to retailers to consumer.
Rural assembler: Sometimes also known as transporter or trader, he/she is the first link between producer and other middle men

Whole seller: Concentrates the various, intermediate sized loads and puts the product into large, uniform units. These activities all contribute to price formation.

Retailers: Middlemen, which include supper, market another large-scale retailer who divides large shipments of produce and sell it to consumers in small units. The basic function of that they provide is bulk breaking.

Marketable and Marketed Surplus: Marketable surplus is the quantity of the product left out after meeting the farmers' consumption and utilization requirements for kind payment and other obligations such as gifts, donation and charity *etc*. Thus, marketable surplus shows the quantity left out for sale in the market. The marketed surplus shows the quantity actually sold after accounting for losses and retention by the farmers, if any adding the previous stock left out for sale. Thus, marketed surplus may be equal to marketable surplus, it may be less if the entire marketable surplus is not sold out and the farmers retain some stock and if losses are incurred at the farm or during transit (Malik *et al.,* 199l).

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2.2.2. Methodological framework of marketing

2.2.2.1. Approaches to study marketing

Economists take three major approaches to analyzing the marketing sector of the national economy. These include; the functional approach, the system or institutional approach and the individual or commodity approach (Mendoza, 1995; Branson and Norvell, 1983).

The functional approach: In this approach, we took all the basic marketing activities (functions) that have to be performed in the agricultural commodities and at the marketing of inputs in to agricultural production. Physical distribution (i.e. functions) and economic activity (i.e. buying, selling) are two dimensions of marketing carried out by institutions or people. An analysis of these two dimensions of agricultural marketing is intimately linked to the institutions created by law or by corporate standards or simply by established procedure, that have emerged as a result of the social and economic relation between the participants in the marketing process (middlemen, consumers, and producers).

The system (institutional) approach: It is concerned with the number and kind of business firms that perform the marketing task. That means, it covers all market participants (producer, assembler, transporter, wholesaler, retailer and consumer). This approach includes market stabilization agencies boards of foreign trade, supermarket chains, wholesaler or retailer networks, a town's central market, or agreements between producers and millers. The effectiveness of marketing institutions depends on the involvement of the relevant people.

The commodity (individual) approach: This entails an analysis of marketing functions, system, and structure from the viewpoint of an individual product. This approach combines the above two approaches. We can study a list of products. In a commodity subsystem approach, the institutional analysis is based on the identification of the major marketing channels. This approach includes the analysis of marketing costs and margins.

2.2.2.2. Supply chain analysis and Factors affecting market supply

A supply chain is "a network of connected and interdependent organizations mutually and co-operatively working together to control, manage, and improve the flow of materials and information from suppliers to end users" (Christopher, 1998). Kohls and Uhl (1985), define supply as a schedule of different quantities that will be offered for sale at different prices at a given time and place. Many factors can combine to increase or decrease supply. Generally, they may be classified as follows: 1) in the short run, there may be a change in the various factors that would induce sellers to offer available stock of goods at different schedule of prices. 2) In the intermediate and long run periods, there may be a change in the costs of production of the commodity. This may be caused by changes in costs of needed inputs or in the technology of the production of the commodity itself. It may also be caused by changes in the costs of producing other commodities that compete for the same resources (Kohls and Uhl, 1985).

The main factors, which determine market supply, could be divided into economic factors, which include product price, provision of consumer goods, production cost and market supply costs. Political factors, which include the level of government intervention. One of the expected important variables, which influence the behavior of the market supply of producers, is price. If price increases, producers will gain high revenue and would be

motivated to increase the market supply. For high-risk crops, high prices are necessary to call forth a given level of production. Prices also show increased variability because production plans are not always achieved ((Maro, 1986; cited in Wolday, 1994)).

Agricultural commodities are produced by large number of farmers and consumed by large number of households. With the exception of foodstuffs consumed on farm or sold locally, they are bought and sold a number of times between the farm gate and the final consumer or industrial user. Commodities that are exported often change hands many times between the farm gate and points of final sale. While moving between these two points, the commodity is loaded, off loaded transported, stored, cleaned, graded and processed. Typically, each of these activities takes place on several occasions (Westlake, 2005).

In the Ethiopian context, the presence of prohibitively high transaction costs, evidenced by the lack of sufficient market coordination between buyers and sellers, the lack of market information, the lack of trust among market actors, the lack of contract enforcement, and the lack of grades and standards, implies that buyers and sellers operate within narrow market channels, that is, only those channels for which they can obtain information and in which they have a few trusted trading partners. Extensive empirical analyses of Ethiopian market behavior thus reveals that market actors conduct business across short distances, with few partners, in few markets, and with limited storage, implying that opportunities for expanding market activity, otherwise known as arbitrage across space (transporting significant distances to market goods) and across time (storing for significant periods), are limited (Eleni, 2001).

2.2.2.3. Market structure, conduct and performance analysis (S-C-P model)

Market structure: Market structure is defined as characteristics of the organization of a market, which seems to influence strategically the nature of competition by pricing behavior within the market. Structural characteristics may be used as a basis for classifying markets. Markets may be perfectly competitive, monopolistic, or oligopolistic. The four salient aspects of market structures include the degree of seller concentration, the degree of buyer concentration, the degree of product differentiation, and the condition of entry (Scott, 1995).

Market structure indicates all the firms engaged in a particular marketing channel. There are two strategic features. The first is the number and relative size of the firms involved. Do one or two so large firms dominate the others? The business relationship between them, are they interdependent or interlinked in ownership and management? Do formal contracts or informal understanding connect them? How easy is it for new firms to come into the system (Abbott, 1981)? So these and other similar questions will be prepared to know the structure of butter market in the study areas.

Market concentration measures: The common measures of market concentration are:

Concentration Ratio(C):

$$C = \sum_{i=1}^{r} S_i \qquad (1)$$

i =1, 2, 3...r

Where S_i =the percentage market share of i^{th} firm and r =the number of largest firms for which the ratio is going to be calculated. Very recently, the concentration ratio was the numerical index most widely used by industrial organizations for measuring the size of distribution of firms in market. While it is possible, use any economic variable such as employment, total assets or value added, for calculating C, sales or purchase figures have been the most popular basis for the index (Shughart, 1990; cited in Admasu, 1998). Kohls and Uhl (1985), suggested that as a rule of thumb, four largest enterprises concentration ratio of 50 percent or more is an indication of a strongly oligopolistic industry, 33 to 50 percent a weak oligopoly, and less than that, not concentrated industry. The problem associated with this index is the arbitrary selection of r (the number of firms that are taken to calculate the ratio).The ratio does not indicate the size distribution of the r firms.

Hirschman Herfindahl Index (HHI):

$$HHI = \sum_{i=1}^{n} S_i^2 \qquad (2)$$

i =1, 2, 3, ----, n

Where: S_i- is the percentage market share of i^{th} firm, and n, total number of firms. This index takes into account all points on the concentration curve. It also considers the number and size distribution of all firms. In addition, squaring the individual market shares gives more weight

to the shares of the largest firms, which is an advantage over concentration ratio. Avery small index indicates the percentage of many firms of comparable size, whilst an index of one or near one suggest that the number of firms in small and /or that they have very unequal shares in the market. This method is limited in its application for it imposes additional burden in so far as more data must be collected (Scarborough and Kydd, 1992; cited in Admasu, 1998).

Gini-Coefficient: Gini coefficient is an alternative concentration measure that has some similarities to the concentration ratio. It is based on Lorenz curve. To use the Lorenz curve, the firms in an industry are ranked from smallest to largest in terms of their market shares. Then the cumulative percentage of firms is related to their market shares. Gini-coefficient compares the area between the diagonal and Lorenz curve with the area of triangle under the diagonal (Bronfenbrenner, 1971; cited in Admasu, 1998). A simple method to calculate the coefficient is to estimate the area of the trapezoids underneath the Lorenz curve at each quartile, subtracting the total sum from 10,000 and dividing the difference by 10,000. The problem associated with Gini coefficient is that it favors equality of market shares without regard to the number of equalized firms. In other words, the coefficient equals zero. or two firms with 50 percent market share, for three firms with 33.33 percent market share each, and so on. Moreover, the coefficient is sensitive to market errors. The measured degree of inequality in an industry will tend to become larger as relatively small or relatively larger boarder line firms are included (Shughart, 1990; cited in Admassu, 1998).

Market conduct: This refers to the market behavior of firms. In what way do they compute? Are they looking for new technique and do they apply them as practicable? Are they looking for new investment-opportunities or are they disinvesting and transforming funds elsewhere (Abbott and Makeham, 1981).

Market conduct refers to the pattern of behavior that is followed in adapting or adjusting to the market in which they sell or buy (Scott, 1995). Such a definition implies that the analysis of human behavioral pattern that are not readily identifiable, obtainable or quantifiable. Thus in the absence of theoretical framework for market analysis, there is a tendency to treat conduct variables in a descriptive manner or as Ishak (1988), points it out ,as a spill-over in the assessment of market performance.

Bain (1968) names two closely interrelated aspects of market conduct, the manner in which, and the devices and mechanisms by which, the different sellers coordinate. Their intrinsically rivalries decisions and actions, adapted to each other, or succeed in making them mutually consistent as they react to demands for their products in a common market. In addition, "the character of pricing policies and related market policies that the sellers in the industry adopt Assessed in terms of the individual or collective aims or goals that they pursue as they determine their selling prices, their sales promotion outlays, the designs and quantities of their products and so forth." By examining the relationship between the factors of market structure and their price setting practices, it may be possible to make some predictions about the consequence of these behavioral patterns for performance (Scott, 1995).

There are no agreed upon procedures for analyzing the elements of market conduct. Rather, previous researchers' point to some guide lines in the form of questions. These questions provide a systematic way to detect indications of unfair price setting practice and the condition under which such practice are likely to prevail. More specifically, they cover the following topics: the existence of formal and informal marketing groups that perpetuate such practice; formal and informal producer groups that affect bargaining power; the availability of price information and its impact on prevailing price; the distance from the major market and its impact on price; and the feasibility of utilizing alternative market outlets. The questions also provide an indication of the type of data needed and data collection procedures (Scott, 1995).

Market performance: This is an assessment of how well the process of marketing is carried out and how successfully it aims are accomplished. Is produce assembled and delivered on time and without wastage? Is it well packed and present attractively? Is its quality reliable and are contracts kept? Is the consumption of products increasing and are sales in competitive market expanding? There are many such practical indications of how well a certain marketing system is operating (Abbott and Makeham, 1981).

Market performance refers to the impact of structure and conduct as a measured in terms of variables such as prices, costs, and volume of output (Bressler and king, 1970; cited in Scott, 1995). By analyzing the level of marketing margin and their cost components, it is possible to evaluate the impact of the structure and conduct characteristic on market performance (Bain,

1968). For most countries, it is generally acknowledged that a distribution system displaying acceptable performance is one that allows technological progress, has the ability to adapt, innovate and utilize resources efficiently and to transmit prices that reflect costs (OECD, 1982; cited in Scott, 1995). Prices are thus viewed as a stimulus for an efficient allocation of resources. Hence, desirable market performance is directly related to the competitiveness of an industry because distortions thereof tend to impend price efficiency (Scott, 1995).

There are two major indicators of market performance: 1) net return and 2) marketing margin. Estimates of net return and marketing margin provide indication of an exploitative nature when net returns of buyers are much higher than the fair amount, that is including all marketing costs and returns to management and risk, and when marketing margins increase not because of higher real marketing costs but because price paid to producers are lower. The analysis of performance using the industrial organization framework is as follows.

Collusive pricing (market conduct) become possible if

- Market concentration is high (market structure)
- Entry barriers are high (market structure)
- Market information is not available to all participants (market conduct)

This results in net returns and marketing margins that are much higher than the"fair"amount (Scott, 1995). Hence, in this study, structure, conduct and performance (S-C-P) analysis is used to analyze butter market performance at Atsbi, Alamata and Mekelle markets.

2.2.2.4. Market participation

The first and historically richest strand of literature concerns the determinants of small farmer participation in markets in semi-subsistence agrarian economies. This strand has focused primarily on 1) understanding the role of transactions costs and market failure in smallholder decision making and 2) resolving the econometric challenges to testing hypotheses concerning smallholder market participation in the presence of possible selection bias. Landmark theoretical contributions by de Janvry *et al*. (1991) develop formal household models to explain low smallholder supply response in the presence of food or labor market failure. A key conclusion of their work, empirically confirmed in a range of situations by von Braun *et al*. (1989), is that low productivity in food crop production, in the presence of food market failure, is a constraint to participation in cash crop markets. A corollary of this is that

a wide spread between food purchase and sale prices makes cash crops relatively more profitable for net food sellers than net food buyers. Thus if net marketable food surplus is causally related to household endowments of productive assets such as land and labor. Better-endowed households should be more likely than poorer households to participate in cash crop markets because the returns to cash crops are then directly related to household endowments (e.g., land, livestock) that typically have a strong, positive effect on the likelihood of being a net seller of basic staples (Barrett and Dorosh, 1996).

Empirical analysis of the determinants of smallholder market participation has to deal with the econometric hazard of selection bias (Heckman, 1979). The problem arises because households (or individuals) face different types of decisions in relation to market participation – a discrete decision over whether or not to participate in a given market as either a buyer or a seller, and a continuous decision as to how much to buy or sell conditional on market participation. Variables affecting the latter, continuous decision may affect the discrete participation decision while some factors – e.g., fixed costs of market participation due to transport costs or vendor license fees – that affect the discrete participation decision will not; in theory at least, affect the continuous decision. If unobserved preferences (e.g., risk aversion) or characteristics (e.g., liquidity constraints) affect both decisions, then regression estimates of the continuous choice will yield biased estimates absent correction for the first-stage participation choice.

2.2.2.5. Value chain; definition and importance

The value chain describes 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 consumer, and final disposal after use (Kaplinsky, 2001).

For at least twenty years now, there have been systematic attempts in English-, German-, and French-speaking schools of thoughts, to describe and analyze the vertical integration and disintegration of production and distribution processes. A great many terms were used in this connection, in part with identical and in part with varying meanings.

Value chain analysis addresses the nature and determinants of competitiveness, and makes a particular contribution in raising the sights from the individual enterprise to the group of interconnected enterprises. By focusing on all links (actors, enterprises, processes) in the chain and on all activities in each link, value chain analysis helps to identify which activities are subject to increasing returns, and which are subject to declining returns.

Global Commodity Chains (GCC): the term "Global Commodity Chain (GCC)" was introduced in the mid 1990s (Gereffi, 2001). Gereffi is focusing on the power relations in the coordination of globally dispersed, but linked, production systems. He has shown that generally commodity chains are characterized by a leading party or parties that are determining the overall character of the chain. Gereffi differentiates between "producer-driven" and "buyer-driven" global commodity chains. Capital and technology-intensive industries such as automobiles, aircrafts or computers are typical examples for "producer-driven" global commodity chains, while labor-intensive industries such as consumer electronics or food production are examples for "buyer- driven"-chains. For the latter the specifications are supplied by the large retailers or marketers that order the goods. The four core elements of the GCC approach are the international dimension, power or governance, coordination and organizational learning. The main hypothesis of the GCC is linking up with the most significant "lead-firms" in an industry. Lead firms are distinguished from subordinated companies in terms of access to major resources (e.g. product design, brand names or consumer demand).

World Economic Triangle: A concept pointing out that the combination of strong local linkages within global commodity chains might bring upgrading prospects for regions in developing countries; and thus is an approach for showing the importance of linking vertical (chains) and horizontal (clusters) integrations. Other authors (Humphrey *et al.,* 2001) are pointing out that the combination of strong local linkages within global commodity chains might bring upgrading prospects for regions in developing countries. The concept of the "world economic triangle", where actors, governance and regulation systems are determining the scopes of action open to regions in the global commodity chains. He determined six critical aspects in any economic triangle; these are Actor constellations, Interests, Power structures, Situational mindsets, Action orientation and Trust.

3. METHODOLOGY

3.1. Description of the Study Areas

Alamata woreda

Alamata is located in southern zone of Tigray 180km away from, Mekelle, capital of Tigray region on the main road to Addis Ababa. There are 10 peasant association and two-town dwellers association in the District. Agriculture is the main source of income of the population in the district. The total population living in the district is estimated to be 118,557 of which 58,591 were male (CSA, 2007). The total cultivated land is estimated to be 34,503 ha out of which 33,778.8 ha is cultivated through rain-fed while 724.2 ha is through irrigation. From the irrigated land, around 493.6 ha are irrigated through surface irrigation system using perennial rivers and 175 ha using privately owned ponds (shallow wells).

There are also two pilot sprinklers and/or drip irrigation system being implemented in the area with total of 55.6 ha with regard to sprinkler and/or drip irrigation system it is believed to have in the near future 99 deep wells with potential of irrigating 3997 ha of land (REST, 1998). At the moment, 30 deep wells dug out in the district with an estimated potential of irrigating 900 ha of land. Altitude in the area ranges from 1178 to 3148 m and 75% of the district is low land (1500 masl or below and only 25% is found in intermediate high lands (1500 and 3148 masl). The small undulating mountains surrounding the district are very steep and with low vegetation cover. a large area and have a series of dissected gullies which serve as a source of runoff water and alluvial soil to the Alamata valley.

The district is characterized with bimodal rainfall with average annual rainfall of 663 mm. Flood diversion is the most commonly used traditional system of supplementing the erratic rainfall pattern of the area. In eight of the seasonal rivers that pass through the district , it is estimated that around 6621 ha of land can be irrigated using flood coming from high land areas of the district during summer season (REST, 1998). The average annual temperature is $29.7^{o}c$ with the maximum and $14.6^{o}c$ the minimum averaging $22.2^{o}c$.

The dominant crops produced in the district are mostly cereals, pulses and oil seeds of the cereals sorghum, *teff*, and maize takes the largest portion of production. It is estimated the district has livestock population 106,461 of which cattle population 74,853 comprises the major share followed by small ruminants with a population of 24,971. Having this potential the district is suffering from well organized systematized market oriented production system that discourages production and productivity of livestock as required.

Atsbi-Wonberta woreda

Location: Atsbi Wonberta district is found in eastern Zone of Tigray region at about 65 Km from Mekelle regional city. The district is bordered in north by Saese Tsaedaemba district, in the south by Enderta district, in the east by Afar regional state and in the west by Kilteawlaelo district. It has an altitude at Dega (high land),which ranges from 2400 m to 3000 m and at Weynadega (mid land) ranging from 1800 m to 2400 m above sea level. The district has a total area of about 1223 sq Km. Generally the district has 70% and 30% Dega and Weynadega, respectively. The major types of land use are forest 89,185 ha, grazing land 8,742 ha, potential cultivated 35,305 ha, cultivated 13,050.23 ha (ARDO, 2006). There is also bee forage planting practices in the study area such as supplementary feeding which includes sugar, barley flour, peas and beans flour. In both the traditional and modern beehives, supplementary feed is provided. In the study area there is also an extension activity that encourages beekeepers to grow indigenous bee forage such as "*gribiya*" (Hypostus ariculata) and "*tebeb*" (Basium clandiforbium). These plants are herbaceous and contribute high in honey production of the area.

Climate: The climate of Atsbi Wonberta ranges from cool to warm. The average temperature of the area is 18 degree centigrade. Generally, the climate of the area characterized as high land and middle land. Rainfall is usually intense and short duration, with an annual average of about 667.8 mm.

Demographic features: According to the information from district Agricultural and Rural Development Office (2006), Atsbi Wonberta District has a total population of 112,639, of which 55,359 (49.15%) are males and 57,280 (50.85%) are females. Urban and rural population is 9,609 and 103,030 respectively.

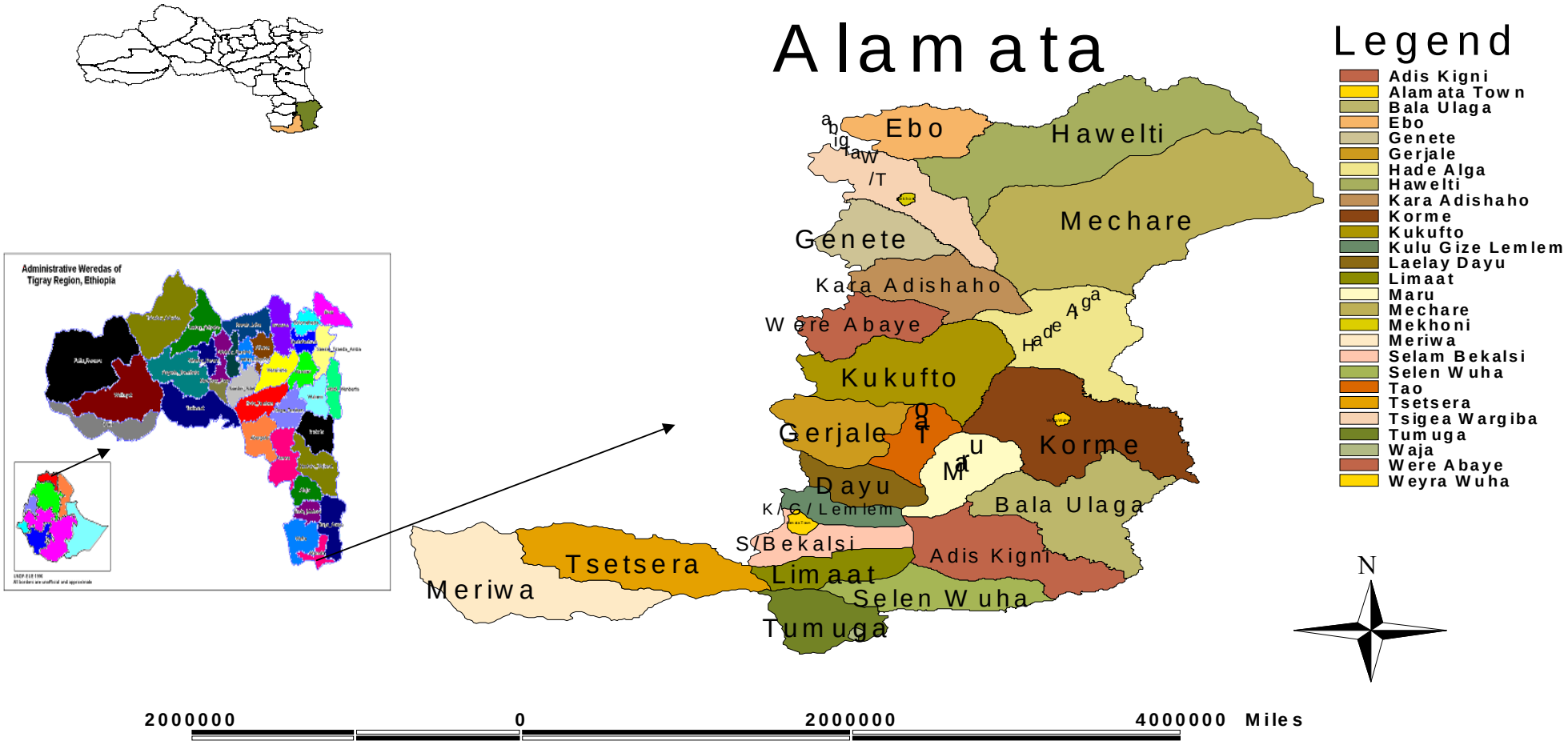

Figure 1. Location of the study area, Alamata woreda

ATSBI-WENBERTA

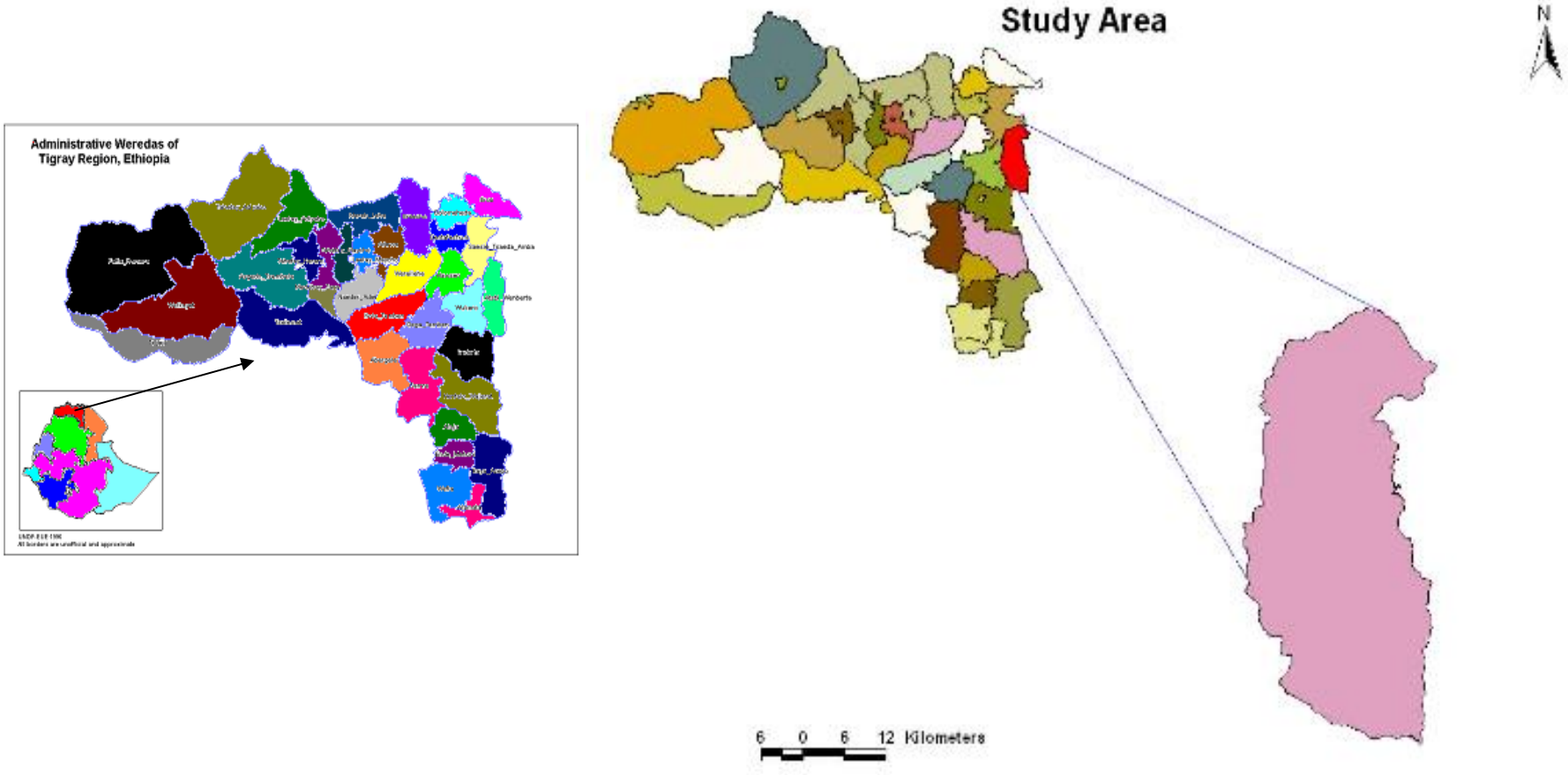

Figure 2: Location of study Area, Atsbi-Wonberta woreda

Crop and livestock Production: According to the information from Atsbi-Wonberta district ARD planning Office (2006), the dominant cereal crops of the area are barley, wheat, teff, maize and sorghum. The important marketable crop commodities in this area are pulses (beans, field pea and lentils, in the order). Despite the large population of livestock, especially sheep, livestock productivity is low as in many other parts of the region. As most of the district is in the highlands, it is suitable for sheep production. Dairy and horticultural crops are also other important marketable commodities in the area. According to the information from Atsbi-Wonberta district ARD planning Office (2006), livestock sources are cattle-52,496, of which 30588 are cows, goat-15431, sheep-82950, poultry-47265, donkey-9416, mule-1333, horse-79, camel-54 found in the District.

Apiculture is another important source of household income in the study area. Studies indicate that, there are farmers who own up to 100 local beehives in the area. There are 16,915 honeybee colonies in the district, out of which about 2000 are modern hives. Currently, in the district, the maximum honey yield obtained per improved box hive and traditional hive is 40 kg and 12 kg respectively, where as the minimum honey production from both beehives is 10 kg and 2 kg, respectively (IPMS, 2004).

3.2. Data Type, Sources, and Methods of Data Collection

3.2.1. Data type and sources

Data on production and marketing of butter, exchange arrangements, system of storage, transport facilities and supporting institutions were collected from sample respondents using questionnaire. Data on quantity of butter marketed, price of butter, price of other dairy products produced in the farm, total volume of butter produced, expenditure on inputs of production, and households socio-economic, demographic and spatial settings was collected from sample informants using questionnaire. In addition to primary data on the above issues, secondary data on number of licensed and unlicensed traders, marketing agents and their role, conversion factors of livestock units, adult equivalent, etc were collected from secondary sources. Sources of primary data are smallholder farmers and marketing intermediaries. Secondary data sources include woreda Office of Agriculture and Rural development,

cooperatives at different levels, Trade and Industry office, Tigray Regional marketing agency, and different publications etc., which have data relevant to the study.

3.2.2. Methods of data collection

The data used for this study was collected both from primary and secondary sources. Secondary data was collected from different institutions, organizations and offices as well as through reviewing documents and publications. Primary data on the production and marketing system was collected from the producing farmer up to the end consumer through structured questionnaires.

3.3. Sample Size and Procedure

The decision involved are partly a function of the information currently known, time and resource available, accessibility to and openness of the marketing participants themselves, as well as the estimated size of trading population. There is no ironclad rule to help one determine the number of interviews required for each stage or segment of the supply chain. The establishment of fixed procedure could prove excessive for same segments of the study and insufficient for others. Sampling by segments without size limits established initially can simplify things as a result prior determination of the number of respondents is set to each category of respondents. By adopting the proportional random selection method, 200 butter producer households from the two woredas and total of 56 traders at different levels were selected from the three markets.

3.3.1. Farmers sampling

As already noted, this study was designed to assess butter supply chain in the specified districts. In addition to this, an attempt was made to assess the production characteristics, profitability and market supply of butter by the households in the study sites. In order to achieve these goals, a two stage sampling procedure was adopted. The first stage involved the random selection of rural *kebelles* in the study sites. Based on the distribution of population, a total of 14 Kebelles from Atsbi-wonberta woreda and seven kebelles from Alamata woreda were selected. These criteria were adopted because they determine largely the behavior of

butter production and marketing characteristics of the districts. The second stage of sampling involved the selection of respondents. Once the list of butter producing household in each selected kebelles was obtained, household heads were selected proportionally using the random selection method. As the number of butter producer households in these woredas is nearly equal, 100 sample producers were selected from each woreda making the total number of sample producers to be 200 from the two woredas.

3.3.2. Wholesalers and assemblers sampling

Similarly, butter traders were selected from three markets (Atsbi-wonberta, Alamata and Mekelle), in which these markets are recipient of the produce from the selected producing areas. Sampling here is the very difficult task due to the opportunistic behavior of the traders. However, to have the possible level of representative prior to formal traders' survey, a rapid market appraisal (RMA) was conducted in order to get the overall picture of butter supply chain in the Districts. The sample size of butter whole sellers and assemblers was determined on the number of traders that were known after the informal market survey.

As the number of the whole sellers and assemblers at each stage was very low, consequently, all of them were interviewed. A total of 8 wholesalers from the region capital city, Mekelle and 16 assemblers from the three markets were sampled in this stage.

3.3.3. Retailers sampling

Selection of retailers in Atsbi-Wonberta, Alamata and Mekelle towns was made based on the size of the markets. A50 percent share for Atsbi-Wonberta and Alamata since they are relatively small markets while Mekelle town had taken a 50 percent share of the samples, total of 32 sample retailers were selected randomly. Data to be collected from retailers was mainly focus on the characteristics of market structure, conduct, and performance of the market.

3.4. Methods of Data Analysis

Both descriptive statistics and econometric methods of data analysis are used.

3.4.1. Structure of production costs and profitability of butter production

To meet the objective all production costs (expenses), farmer's sale (revenue) was identified and collected, based on the economic value of resource used in butter production, the structure of production costs and returns was formulated. By deducting economic costs from total return of butter, net return of butter production was calculated, and this result in turn was used to determine the profitability of butter production in the selected woredas using the following formula.

$$NPV = \frac{\sum_{t=1}^{n} B_t - \sum_{t=1}^{n} C_t}{(1 + r)^n} \quad (3)$$

Where NPV = is net present value

B_t = benefit from one year

C_t = cost incurred in a year

r = interest rate per year

n= number of years

Since the main target of this section is to identify production cost of butter and determine its profitability, production costs were disintegrated to milk, butter, appreciation of cattle (i.e., calves, heifer and young bull) and cow dang and/or manure. This was done by distributing the production costs according to their share of return to the households' income from the dairy enterprise. Therefore, production costs belong to the other dairy out puts based on their income share were identified and deducted out from the profitability analysis.

The procedures employed were:

- The possible outputs from the dairy farm were identified by the farmers and listed as milk, butter, calves, dung, and manure.
- Secondly, the amount of income the farmers earned from these dairy partitions was recorded and computed their proportions from the total dairy income.
- Thirdly, the total production costs were distributed proportional to their income share to the total dairy income.

- Then, total production costs of whole milk were identified neatly off the calves, manure and dung costs.
- Finally, based on the proportion of milk converted to butter, the costs also shared accordingly. In addition to these costs, there are also production costs belong to butter only like labor cost of churning, deprecation of churning and other butter equipments are considered.

3.4.2. Analysis of butter market supply

If two decisions are involved, such as participation and level of supply, Heckman's two-stage estimation is the recommended econometric model. This model allows the producer to choose whether to participate in a particular market, and if so, to choose the level of supply. Thus, a Heckman (1979) two-stage procedure is used in which the inverse Mill's Ratio is calculated from probit estimation of decision to sell and introduced into the supply equation.

Procedures for estimating butter market participation decision and level of supply

Ideally, the OLS is applicable to determining factors that affect the level of participation. However, some households may prefer not to participate in a particular market in favor of others, where as others may be excluded because of market conditions or households resource constraints. If OLS regression is estimated while excluding the non-participating from analysis, a sample selectivity bias is introduced into the model. Such a problem can be overcome by following two-step procedure, as suggested by Heckman (1979). In this study, therefore, the Heckman's two-stage selectivity model is used to investigate the factors that influence the probability of being participated in butter marketing. While secondly estimating the factors affecting the level of supply using OLS.

The first step of Heckman procedure establishes the probability of participation in the output market. For the individual producer, the decision to participate or not to participate in Butter marketing can be formulated as binary choice model that can be analyzed using the probit equation below. The empirical specification of the probit model to be estimated by maximum likelihood estimation is defined as:

$$BMP_i^* = X_i\beta + \varepsilon_i \quad (4)$$

$BMP_i = 1$ If $BMP_i^* > 0$

$BMP_i = 0$ If $BMP_i^* < 0$

Where , X_i = vector of explanatory variables

β = is the vector of parameter coefficients

BMP_i^* = is the estimated market participation probability

ε_i = Random error term for the selection equation

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

The second stage of heckman's two stage procedure for this study is specified as:

$$BMS_j = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 ..... + \beta_n X_n + \eta_n \lambda_n (X_i\beta)_j + \varepsilon_j \quad (5)$$

Where

BMS_j= volume of market supply by the jth producer

X_j = exogenous variables in the second stage

β_j = parameter coefficients

$\lambda_j (X_i\beta)_j$ = the Inverse Mill's Ratio derived from the first stage

ε_j = error term in the second stage

The model parameters were estimated by ordinary least square (OLS) estimates.

3.4.3. Hypothesis and definition of variables

The data covered information necessary to make farm level indices of social, economic, demographic, and spatial. Efficiency indicators comparable across different categories of dairy farm and butter market. In order to investigate the research questions of the study, the following variables are hypothesized to determine butter market supply:

Dependent Variables

Market participation decision (BMP_i^***):** this is a dummy variable that represents the decision of market participation of the household in the Butter market that was estimated in the first stage of the Heckman's two-stage estimation procedure.

Level of butter supplied (BMS_j): It is continuous variable in the second step of the Heckman's selection equation that represents volume of Butter supplied to market.

Independent (Explanatory) Variables

Variables that are assumed to influence Butter market entry decision and level of market supply. Selection of independent variable needs to born in mind that the omission of one or more relevant variables or inclusion of one or more irrelevant variables may result in error of specification which may reduces the capability of the model in exploring the economic phenomena empirically.

Quantity of butter output (TOTBUTP): It is a continuous variable measured in kilograms. The variable is expected to have a positive contribution in smallholder market participation and level of participation. A marginal increase in butter production has obvious and significant effect in motivating market participation. Part of the product may be used for home consumption or sales.

Distance to nearest butter market (DISTMKT): it is a continuous variable measured in kilometers. The closer the market, the lesser would be the transportation charges, reduced trekking time, reduced loss due to spoilage, and reduced other marketing costs, better access

to market information and facilities. This improves return to labor and capital and increase farm gate price and the incentives to participate in economic transaction. Therefore, it is hypothesized that this variable is negatively related to market participation and marketable surplus. A study conducted by Holloway *et al,* (1999) on dairy products market development in the Ethiopia highlands indicates that distance to market causes marketed surplus to decline. Similarly, study conducted by Wolday (1994) on food grain market in Alaba Siraro identified that poor access to market and volume of food grain supplied to market related negatively.

Number of local breed dairy cows (NOLOCBRD): This variable is continuous variable**.** As the number of dairy cows increases, production also increases and the percentage share of consumption declines and sales increases. Some field studies have shown that the policy relevant variables having the greatest impact on farmer participation in Butter markets are cow numbers affects marketable surplus through both total production and marginal cost of production (Holloway *et al,* 1999). Therefore, the variable is assumed to have positive contribution to volume of market supply.

Number of cross breed cows (NOCRSSBRD): Production in turn varies directly with the number of crossbred and local bred lactating dairy cows. It is continuous variable and is expected to have a positive impact on participation of butter market and the level of supply of butter to the market.

Education level of the Household Head (HHEDUCA): Intellectual capital or education, measured in terms of formal schooling of household head, is assumed to have positive effect on the market participation and sale decision. Sometimes, however, because of cultural and socio-economic characteristics, education has opportunity costs in alternative enterprises (Lapar *et al.,* 2002). So it is not possible to have a definite expectation of the effect of education on market participation and sales volume.

Experience in butter production (EXPRIBUT): This variable is measured in terms of the number of years of butter production of the household head; it is expected to have a positive effect on market participation and sale volume.

Age of the household head (AGE): It is a continuous variable and measured in years. Age is a proxy measure of farming experience of household. Aged household are believed to be wise in resource use, and it is expected to have a positive effect on market participation and marketable surplus. However, some studies used variables proxy variable to identify factors affecting marketable surplus. Tshiunza *et al,* (2001) identified age as the major farms' characteristics that significantly affected the proportion of cooking banana planted for market. He found that younger farmers tended to produce and sale more cooking banana than older farmers did.

Sex of the household head (SEX): It is a dummy variable taking one for male headed and zero for female headed households. In mixed farming system, both men and women take part in livestock management. Generally, women contribute more labor input in area of feeding, cleaning of barns, butter and cheese making and sale of Butter and other dairy products. However, obstacles, such as lack of capital, and access to institutional credit, access to extension service, may affect women's participation and efficiency in livestock production (Tanga *et al.,* 2000). Therefore, it is not possible to tell a prior about the likely sign of the coefficient of sex in market participation and sales volume.

Labor in man equivalent (LABOR): It is a continuous variable measured in man equivalent (Stroke *et al,* 1991) i.e. the availability of active labor force in the household, which affects farmer's decision to market participation. Since production is the function of labor, availability of labor assumed to have positive relation with volume of supply.

Family size (FAMSIZ): Although, family size is expected to have positive impact on market participation and volume of sales, but larger family requires larger amount for consumption, which reduces marketable surplus. A study by Singh and Rai (1998) revealed that marketed surplus of buffalo butter to be negatively related to farm family size. However, a study conducted by Wolday (1994) identified that family size has significant positive effect on quantity of teff marketed and negative effect on quantity of maize marketed. From this context, family size is expected to have positive or negative impact on farm decision maker market participation and volume of sale.

Financial income from the non-dairy sources (NONDAIRY): These are originating from other agricultural production, different forms of remittance obtained by household head, spouse and other household members. Through improving liquidity, this income makes the household to expand production and or/ purchase from market. It also strengthens the household position in coping with different forms of risks and enters into economic transactions. However, getting income from non-farming activities is assumed to have direct or inverse relation with market participation and marketable surplus.

Access to credit (CREDIT): It is dummy variable taking one for those who have access to credit, zero otherwise. Debt can be interpreted in two ways: the first way pertains to the fact that increased debt in other activities may lead to lack of free collateral in order to secure loans for market selling activities. In this case, it is assumed to relate negatively with market participation decision of the household. In the second case, the existing debt may be the result of previous borrowing that has occurred for the production and selling decision and may therefore signal greater propensity to sell. In this case, the amount of loan received is assumed to have positive impact on market participation decision and sales volume of the farm households.

Number of extension Visit (EXTNFRQN): The number of visits made by extension agent in the year measures the variable. Number of extension visits improves the household's intellectual capitals, which improves dairy production and divert product resources to market such as different forms of dairy products. Therefore, number of extension visits has direct influence on market participation and sale volume. Studies have shown that visits by extension agent improve participation and volume of dairy sale (Holloway *et al*, 2000).

Market information (MKTINFO): Farmers marketing decisions are based on market price information, and poorly integrated markets may convey inaccurate price information, leading to inefficient product movement. Therefore, it is hypothesized that market information is positively related to market participation and marketable surplus. Study conducted by Goetz (1992) on food marketing behavior identified better information significantly raises the probability of market participation.

Distance to development centers (DISDEV): This is a continuous variable measured in kilometers from the households' residence. This variable is expected to have inverse relationship with both participation decision and level of participation. As farmers become far from the development center, the extension agent may not serve them frequently 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 of extension workers).

Distance to woreda town (DISTWORDA): This is a continuous variable measured in kilometers from farmers' residence to the woreda town. This variable is expected to have inverse relationship with both participation decision and level of participation.

Distance to allweathered road (DISTROD): This is a continuous variable measured in kilometers from farmers' residence to the weathered road. This variable is expected to have inverse relationship with both participation decision and level of participation.

Other livestock in TLU (OTHELIVE): This is the number of live animals measured in tropical livestock unit other than the lactating cows. This variable is expected to have positive impact on both participation and level of participation.

3.4.4. Analysis of production and marketing supporting services

Four production and marketing supporting services are included in this sub section. These are input supply, credit access, extension service and market information access. With regard to input supply, four major inputs were identified in relation to butter production and marketing namely breed supply, feed, veterinary, drug and equipments supply. To analyze this objective both econometric model (probit) and descriptive statistics were used.

3.4.4.1. Input supply

In peri-urban areas of the East African highlands, strong urban demand driven by increasing urbanization and income growth is encouraging the development of smallholder dairying (ILCA, 1995). Several organizations including international and national agricultural research centers, the World Bank, ministries of agriculture, and non-governmental organizations have

developed and promoted the use of improved dairy technologies to help increase farm productivity and smallholder income. Yet, the rates of adoption of these technologies among smallholder farmers remain low (Freeman *et al*., 1998a, b). On the other hand, inputs that are needed for butter production and marketing like type of breeds, feed, veterinary service, equipments and drug are largely in a traditional basis in the study areas. This indicates, as there is a problem of access to these improved inputs and/or the supplying institutions could not able to address all the smallholder producers. Therefore, this section of the study is targeted in identifying socio-economic and demographic factors determining households' access to these improved dairy technologies.

An econometric model probit is used to identify factors determining access to crossbreed cows, feed and access to drug. These three inputs were analyzed separately in relation to households' socio-demographic, economic, intellectual and spatial characteristics. In addition to the model, descriptive statistics was also used to assess the supply and sources of crossbreeds, feed and drug. On the other hand only descriptive statistics such as mean, percentage and ratio supported by test statistics (chi-square and t-test) was applied to analyze the access to veterinary service and equipments supply.

For the individual cases, the probability of getting access to crossbreeds, feed supply, drug supply can be formulated as binary choice model. This model can be analyzed using the probit equation below. The empirical specification of the probit model to be estimated by maximum likelihood estimation is defined as:

$$Y_i = \beta_0 + \sum_{i=1}^{m} \beta_i X_i + \varepsilon_i \qquad (6)$$

Where: i = 1, 2… m

Y_i is a dummy variable indicating the probability of getting access that is related to the equation as $Y_i = 1$ if a farmer have access to the services, $Y_i = 0$, otherwise.

β_i, are the coefficients to be estimated,

x_i' are explanatory variables in the Probit regression model,

ε_i is random error term

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

Hypothesis and definition of variables

The three inputs namely access to; crossbreed cows, feed and drug, were analyzed separately in relation to households' socio-demographic, economic, intellectual and spatial characteristics. The hypothesized explanatory variables and their expected relation to each input type are presented below.

Dependent variables

Access to crossbreeds, access to feed, access to drug: each input were analyzed separately. These dependent variables are dummy variables indicating the probability of getting access that is formulated as $Y_i = 1$ if a farmer have access to the input, $Y_i = 0$, otherwise. Where Y_i is for each inputs, access to crossbreed cows, access to feed, and access to drug separately.

Independent variables

Age of the household head (AGE): No priori sign is expected on this variable because it is both possible that the older farmers with more experience in dairying are more likely to recognize the gains from adoption of improved dairy technologies. On the contrary, being older may meant for more conservative and less likely to adopt improved dairy technologies.

Sex of the household head (SEX): This is a dummy variable representing the sex of the household head. It is assigned zero if the respondent is female and one if the respondent is male. No sign could be expected a priori for this variable. It could take positive or negative signs of coefficients.

Labor supply of the household (LABOR): This is a continuous variable representing the availability of working labor force in the household. This variable is defined to affect crossbreed and feed access only. It is expected to take positive coefficients explaining an in increase in labor force to expand the dairy and therefore might be supported and get access by different institutions. Consequently, this variable is expected to have positive impact for the two inputs.

Education level of the household head (EDUCTN): Intellectual capital or education, measured in terms of formal schooling of household head, is assumed to have positive effect for the three inputs.

Years of experience in butter production (EXPRC): This is a continuous variable indicating the number of years spent in butter production. As this variable increases knowledge and management of dairy inputs, the more he has the experience the higher would be access to crossbreed and feed access, however, this variable is not applied to drug access.

Off farm income (OFFICM): This is also a continuous variable measured in cash income. This variable is expected to influence the access to crossbreed only in such a way that as off-farm income increases, liquidity constraint may minimized and can easily purchase crossbreeds from market or other supplying institutions. It also strengthens the household position in coping with different forms of risks. As a result, it is expected to have direct effect to access of crossbreed cows.

Distance to development center (DEVDIS): This is a continuous variable measured in kilometers from the households' residence to development center. This variable is expected to have inverse relationship with access to crossbreed cows. As farmers become far from the development center, the extension agent may deliver timely information and advice frequently 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 of extension workers).

Distance to woreda town (WORDIS): This is a continuous variable measured in kilometers from farmers' residence to the woreda town. Due to the reason that the offices of most

service delivery institutions is located in woreda towns, households more farther from woreda may not updated to improved technologies and /or service delivery institutions may not address those remote areas due to infrastructure problems. Hence, this variable is expected to affect negatively for crossbreed, feed and drug access.

Credit access (CREDIT): This is a dummy variable, which takes value of one if a farmer has access to credit and zero otherwise. Access to credit can facilitate levels of input use closer to the potential levels of resources and reduces financial constraints to introduce improved inputs. Thus, households whom have access to credit are more likely to have access of crossbreed cows and feed.

Number of extension contact (FRQEXT): The number of visits made by extension agent in the year measures the variable. Number of extension visits improves the household's intellectual capitals, awareness about dairy technologies, which improves also dairy production. Therefore, number of extension visits was expected to have direct influence on crossbreed, feed and drug access.

Participation in extension demonstration (DEMPART): This is also a dummy variable taking value of one if a farmer was participated in extension demonstration regarding dairy and zero otherwise. Farmers can receive training in various aspects of herd management, feeding and feed production strategies and disease control at these sessions. This may an opportunity for the farmers whom participated to get higher priority of access to the inputs. Accordingly, this variable is expected to have positive effect for the two inputs, access to crossbreed and access to drug.

Access to veterinary service (VETACS): This factor is hypothesized to determine access to crossbreed and access to drug and takes value of one if households have access to veterinary service, zero otherwise. For the reason that crossbreed cows are very prone to livestock disease and needs proper management and timely treatment, therefore, farmers whom did not have access to veterinary service might have lower chance to get crossbreed cows than their counter parts. In addition, veterinarians can comment the farmers to use recommended drug sources and type or even can supply themselves to the farmers. On this basis, the variable was expected to have direct effect on breed and drug access.

Access to feed (FEED): It is a dummy variable taking one for those who have access and zero otherwise. As dairy technology package, this variable is proposed to affect farmers' access to crossbreed cows. These breeds need high quantity and quality of feed prior to introduce. Therefore, those farmers whom have sufficient feed and/or access to feed markets can get better opportunity to introduce the crossbreed cows.

Number of lactating cows (COWNBR): This is a continuous variable. It was defined to determine access to crossbreed cows and to drug. No sign could be expected a priori for this variable. It could take positive or negative signs of coefficients.

Number of oxen (OXENUM): This is a continuous variable and was defined to determine access to feed only. This variable is expected to have direct effect with access to feed.

Distance to market (MKTDIS): This is a continuous variable measured in travel kilometers from a households' residence to market center and is supposed to relate negatively with access of feed and drug. Since alternative source of the inputs is from market, households near to the market may have better access to drug and feed.

Land size in hectare (LAND): This is the total cultivated land holding measured in hectares. This variable is expected to have direct effect with access to feed however; no sign can be expected for access to crossbreed cows.

Distance to weathered road (DISROD): This is a continuous variable measured in kilometers from farmers' residence to the weathered road. This variable is expected to have inverse relationship with access to crossbreed cows and access to feed.

3.4.4.2. Access to formal credit

One likely explanation for low adoption rates of improved dairy technologies is that binding capital constraints limit the ability of many smallholder livestock farmers to make the initial investments or finance the variable costs associated with improved dairy technologies (Rey *et al*., 1993). Economic theory suggests that farmers facing binding capital constraints would tend to use lower levels and combinations of inputs than those whose production activities are

not limited by capital constraints. Access to credit can facilitate levels of input use closer to their potential levels when capital is not a constraint.

Therefore, accurate assessment of farmers' credit constraint condition is important in order to understand the circumstances under which credit would have its greatest impact. In this study, a probit regression model is used to determine the factors determining farmers' credit constraint condition for dairy production and marketing. Whereas, credit supply, source and credit evaluation was analyzed using descriptive statistics as used for the input supply.

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

$$Y_i = \beta_0 + \sum_{i=1}^{m} \beta_i X_i + \varepsilon_i \quad (7)$$

Where: i = 1, 2… m

Y_i is a dummy variable indicating the probability that a farmer is credit constrained that is related to the equation as $Y_i = 1$ if a farmer is credit constrained, $Y_i = 0$, otherwise.

β_i, are the coefficients to be estimated,

x_i' are explanatory variables in the Probit regression model,

ε_i is random error term

Hypothesis and definition of variables

Dependent variable

Credit constraint condition (CRCNSTR): It is a dummy variable indicating the probability that a farmer is credit constrained that is defined as CRCNSTR = one if a farmer is credit constrained, CRCNSTR = zero, otherwise.

Independent variables: A set of explanatory variables are expected to determine households' credit constraint condition. These are indicated as follows

Age of the household head (AGE): No priori sign is expected on this variable because it is both possible that the older farmers with more experience in dairying are more likely to recognize the gains from adoption of improved dairy technologies, and then need for credit increases. On the contrary, being older may meant for more conservative and less likely to adopt improved dairy technologies.

Sex of household head (SEX): Collateral and minimum investment requirements as well as information problems restrict access to credit for smallholder livestock producers (Freeman *et al*, 1998b). Accordingly, women are most likely to face with obstacles, such as lack of capital, access to extension service. Thus, thus this variable was supposed to have inverse relation with credit constraint condition.

Labor availability (LABOR): It is a continuous variable measured in man equivalent. Farmers with sufficient labor may have motive to expand their dairy enterprise and their capital need would increase as well. Hence, it is assumed to have positive relation to the dependent variable.

Education level of household head (EDUCTN): It is a categorical variable and expected to have negative effect. This is because educated households are more informed about sources, utilization and rising of financial funds for their dairying, then, less constrained than their counter parts.

Years of experience in butter production (EXPRC): No sign could be expected a priori for this variable. It could take positive or negative signs of coefficients.

Off farm income (OFFICM): It is a cash income from off-farm activities. To this effect, no priori could be assumed here. It may have direct or inverse relation**.**

Distance to development center (DEVDIS): It is a continuous variable measured in kilometers to the development center. As extension advice improves farmers financial and technical management capacity, the farmers nearer to development center may have better opportunity to get advice regarding rising investment capital from development workers, they

can utilize different sources of credit. Therefore, farmers further from the development center are expected to be more likely credit constrained.

Distance to woreda town (WORDIS): It is a continuous variable measured in kilometers from farmers' residence to the woreda town. Due to the reason that the offices of most financing institutions is located in woreda towns, households more farther from woreda may not have required awareness and information about sources and types of credit for dairying. Based on this consensus, the variable is expected to have direct relationship.

Total herd size in TLU (HERD): It is the number of live animals measured in tropical livestock unit. Households with larger herd size are supposed to be less constrained as they can provide their livestock asset as collateral; consequently, negative sign was expected to this factor.

Land size in hectare (LAND): This is the total cultivated land holding measured in hectares. No sign could be expected with regard to this variable it can have either direct or inverse relationship.

Family size (FAMSZ): This is also a continuous variable measured in number of persons of the household have. Larger family requires larger amount for consumption, which reduces saving and liquidity. As a result, family size increases the need of credit for consumption and production. However, the likelihood of getting credit for both consumption and production is very low in smallholder farming system. Thus, farmers with larger family size are more likely to be credit constrained.

Number of extension contact (FRQEXT): It is a continuous variable measured in number of extension contact the farmer was made in a year. More extension contact helps farmers to be informed and awarded of investments and capital sources for investment for dairying. Due to this reason, the variable is supposed to have inverse correlation with credit constraint condition**.**

Participation in extension demonstration (DEMPART): Attendance at livestock training and seminars was hypothesized to be negatively correlated with credit constraint condition.

This is because farmers who had acquired specific dairy production and management training are expected to be better farm managers then can easily rise and utilize finance from alternative sources.

Number of lactating cows (COWNBR): It is a continuous variable. No sign could be expected with regard to this variable. It can take both directions.

The remaining production and marketing supporting services (extension service and market information access) were analyzed by applying relevant descriptive statistics as usual.

3.4.5. Analysis of structure -conduct -performance

Identification of Butter marketing channels, and the role and linkage of marketing agents is the fourth objective of the study; the S-C-P framework was used to meet this objective.

3.4.5.1. Structure of market

Structural characteristics like market concentration, government participation, product differentiation, barriers to entry, and diversification, are some of the basis that was considered. The perfect competition model was used as a standard to study the structure of the market.

Market concentration; this is the number and size distribution of sellers and buyers in the market. The greater the degree of concentration, the greater is the possibility of non-competitive behaviour, such as collusion, existing in the market. The concentration ratio (market ratio) was calculated as

$$MS_i = \frac{V_i}{\sum V_i} \quad (8)$$

Where MS_i - market share of trader i

V_i - amount of product handled by trader i

$\sum V_i$ - Total amount of product traded

$$C = \sum_{i=1}^{r} S_i \quad (9)$$

Where C - concentration ratio

S_i - percentage share of the i^{th} firm

r - Number of largest firms for which the ratio was calculated.

A four largest enterprises concentration ratio of 50 percent or more is an indication of a strongly oligopolistic industry, 33 to 50 percent a weak oligopoly, and less than that (competitive industry). The problem associated with this index is the arbitrary selection of r (the number of firms that were taken to compare the ratio).

Barriers to entry; A barrier to entry is simply any advantage held by existing firms over those firms that might potentially produce in a given market. Potential entry barriers have been investigated based on demand conditions, product differentiation and price elasticity, control over input supplies, legal and institutional factors, scale economies, capital requirement, and technological factors.

3.4.5.2. Market conduct

Here conditions that are believed to express the exploitative relationship between producers and buyers have been analyzed. There are no agreed up on procedures for analyzing the elements of market conduct. Rather, the following few questions were taken into consideration to systematically detect indications of unfair price setting practices and conditions under which such practices are likely to prevail. The following topics shall be taken into consideration:

1. The existence of formal and informal producing and marketing groups that affect the bargaining power
2. The availability of price information and its impact on prevailing prices
3. The feasibility of utilizing alternative market outlets

Analyzing buying and selling practices

1. What is the source of product?
2. Are there formal and informal producer and marketing groups that affect the bargaining power?
3. What buying/selling practices are in place?

4. What distribution channels are used?
5. Are there observed unethical trading?
6. The nature and strength of linkages among different parties in the chain
7. Values to be added at different stages,
8. Nature of rules and practices of the different parties involved

Pricing behavior analysis

1. Who sets prices (one buyer or many buyers)?
2. How prices are set (What is the degree of personal contact among market participants)?
3. What factors are considered in price setting (example, basic supply and demand conditions or artificial price restraint)?
4. What is the basis for price differentiation?
5. Does the physical location of the market (in relation to other markets) affect prices and marketing arrangements?

3.4.5.3. Market performance

Market performance refers to the impact of structure and conduct as measured in terms of variables such as prices, costs, and volume of output (pomeroy and Trinidad, 1995). Analysis of the level of marketing margins and their cost components could help to evaluate the impact of the structure and conduct characteristics on market performance.

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

$$PS = \frac{P_x}{P_r} = 1 - \frac{MM}{P_r} \quad (10)$$

Where: PS = Producers' share

P_x = Producers price of Butter

P_r = Retail price

MM = marketing margin

The above equation tells us that a higher marketing margin diminishes producers' share and vice versa. It also provides an indication of welfare distribution among production and marketing agents.

Calculating the total marketing margin have been done by the following formula

$$TGMM = \frac{\text{Consumer price} - \text{Farmers' price}}{\text{Consumer price}} \times 100 \quad (11)$$

Where TGMM-Total gross marketing margin

$$GMMp = \frac{\text{price paid by the consumer} - \text{marketing gross margin}}{\text{price paid by the consumer}} \times 100 \quad (12)$$

Where GMMp- Producers' participation (farmers' portion)

The marketing margin was compared with marketing service costs and the results are interpreted. Margins at each stage have been calculated and the share was compared.

Net Marketing Margin (NMM) is the percentage over the final price earned by the intermediary as his/her net income once his/her marketing costs were deducted.

$$NMM = \frac{\text{Grossmargine} - \text{Marketing costs}}{\text{Endbuyerprice(Consumersprice)}} \times 100 \quad (13)$$

Where, NMM = Net marketing margin

3.4.6. Major production and marketing problems

This objective was addressed using descriptive statistics like percentages and ratios to identify key Constraints and opportunities in Butter production and marketing in the study area. In addition to this, important problems of butter production and marketing through the supply chain are identified starting from the inputs supply, service provision, production and finally marketing. These problems in combination with the other findings of the study were used to identify strategic areas of intervention point along the chain to improve the dairy enterprise, market performance and to commercialize the existing dairy sector.

4. RESULTS AND DISCUSSION

This chapter presents the results of descriptive and econometric analysis of the study. the descriptive analyses has been done to describe the general characteristics of sample farm households, butter traders characteristics and butter market structure-conduct- performance. The econometric analysis is used to identify factors that affect farm households' decision to participate and level of participation in butter market, factors determining households' access to production and marketing services such as access to dairy inputs and credit constraint condition of farmers.

4.1. Butter Production Characteristics and Households Socio-Demographic Settings

4.1.1. Butter production characteristics

Butter, an important source of food, cosmetics and common marketable form of dairy product in the study areas, constitutes a lifelong production activity. The farm household, also known as small-scale dairy producers, uses too traditional and inefficient technologies for producing and management of butter. The main input used in butter production is milk that households usually get from their own cows, in which their number ranges from a single cow per household up to several cows. About 79% of the milk for butter production comes from cows of local breed in which their average productivity (1.99 liters of milk per cow/day) is very low and limited amount from cross breed cows introduced by BoARD, relief society of Tigray (REST) and market. Even if cross breed cows more productive than the existing local breed cows, they are still small in number in the study districts.

The farmers use their own produce feed, which is straw from cereal crops, hay, green forage and grass of communal grazing. The availability and quality of feed in these woredas was described to be low, less nutrient, and limited supply in markets. 72.5% of the farm households pointed out as they face shortage of feed from year to year and they fill the gap by borrowing from neighbors and purchasing from local markets. Like most smallholder dairy production system of Ethiopia, family members are the only source of labor for any dairying activities in the study area.

Due to selling milk is considered as taboo in the study sites a greater share of the milk produced was converted to butter, as butter is common marketable dairy product. The milk left from butter production was consumed for majority of rural households and sometimes sold especially in the semi-urban dairy producers. Farmers in the study areas produce butter mainly for market and for home consumption mostly on non-fasting periods and holidays.

Table 1. Butter production characteristics

		Woreda		
		Atsbi-	Alamata	Total
Inputs		%N	%N	%N
Lactating cows	Only Cross breed cows	9	2	5.5
	local breed cows only	63	78	70.5
	Both local and cross breed	28	20	24
Butter cash allocation	Household consumption	47	46	46.5
	Educating children	10	12	11
	To buy feed	7	10	8.5
	To buy house furniture	1	2	1.5
	Saved	3	2	2.5
	Clothing expenditure	1	1	1
	Consumption and saved	5	4	4.5
	For feed, food and clothing	7	3	5
Source of labor for butter production	Family	99	100	99.5
	Hired	0	0	0
	Hired and family	1	0	.5
Churning equipment	Pot	99	100	99.5
	Modern churner	1	0	.5

Source: survey result, 2008

As shown in Table 1, 46.5% of the sample households allocate the revenue from butter sale to household consumption expenditure. Similarly, it was found that revenue from butter was not put to saving, as much does not remain after consumption expenditure. Only 2.5% of the respondents, mostly those living around urban areas and own crossbreed cows only, used their butter revenue to save. The producers whom introduced cross breed cows were settlers of small towns and semi-urban areas of the woredas. Therefore, they have the opportunity to sale raw milk to urban consumers, hotels and cafeterias as raw milk transaction is possible in towns.

4.1.2. Socio-demographic characteristics of butter producer households

Of the total interviewed butter producer farm households (N=200) 81.5% are male-headed and the rest 18.5 % were female-headed households. About 51% of the respondents range under age category of 45-64.99 years and 45%, 4% are under the category of 20-44.99 and 65 and above respectively. The average family size, which is a composition of different age groups, was 6.5, and average economically active labor force of the households is 3.8 person-days as measured in man equivalent.

With respect to educational status of the household head, the 40.5% of butter producers of the study areas were literate to read and writes. The overall proportion of illiterate farmers was 38.5% of the total respondents, about 20% and 1% are elementary completed and high school educated households respectively. Un like Atsbi Wonberta woreda, in which religion of the whole sample farmers (N=100) were orthodox Christians, Alamata woreda's sample households religion were 70% and 30% for orthodox Christians and Muslims respectively.

As it is indicated in Table 2, a significant difference was observed between male-headed households and female-headed households with respect to age (at 10%), farming experience (at 5%), experience in butter production (at 5%) and labor availability (at 10%). These variables take larger value for male-headed households. Moreover, male-headed households have larger number of local breed cows than their counter parts at 5% significant t-value.

Sample producers whom use crossbreed cows only for dairying are those residents of small towns and semi-urban parts of the woredas. Based on the results of the survey, farmers whom use only crossbreed cows are wealthier than those farmers use local breed only. The average butter production for crossbreed farms was 101 Kg/household annually, which is significantly larger than local breed farms that was 50 Kg/household annually.

Average distance to the nearest market for local breed farms was found to be 7.25Km. This is significantly larger (at 10% level) than of crossbreed farms that is 3.61Km.

Table 2. Socio-economic and demographic characteristics of butter producer households

	Sex of the household head		Cow breeds used to produce butter		
	Female	Male	Crossbreed cows only	Local breed cows only	Both cross and local breed cows
Age	39.11	47.41*	40.18	47.14	43.46
Family size	5.65	6.72	6.45	6.55	6.46
Labor in man equivalent	3.22	3.94*	3.55	3.86	3.72
Farming experience in years	15.62	23.27**	18.36	23.18	18.75
Experience in butter in years	13.16	20.85**	13.09	20.70	17.13
Physical asset (Wealth) in Birr	27713.38	33812.12	44348.18***[b]	28541.07	42180.21
Annual off-farm income	969.16	875.96	815.45	882.66	941.98
Number of Local breed cows/household	1.97	2.83**	.00	2.90**[ac]	2.35
Number of crossbreed cows/household	.57	.55	1.82*[bc]	0	1.44
Non dairy income	10524.78	13493.90	12334.09	12108.23	15541.42
Distance to the nearest market in Km.	6.31	6.17	3.61	7.25*[ac]	3.68
Distance to development center in Km.	3.52	3.38	1.50	4.02*[ac]	2.06
Distance to woreda town in Km.	12.96	16.97	16.80	18.07**[c]	10.66
Annual farm income	12893.32	17451.88**	16495.91	14809.84	21918.08**[b]
Annual butter production in kg.	63	75	101***[b]	50	133***[b]
Herd size in TLU	4.94	7.60	4.55	7.16	7.57

Source: survey result, 2008 *** significance at 1%, ** at 5% and * at 10%. a= crossbreed only, b=local bread only and c=both *bc= significantly larger than local breed only farms and both local and crossbreed farms. ***b= wealth of crossbreed farms is significantly larger than local breed farms, **ac= local breed farms have largest number of local cows than the other two Each value in the table represents mean of the row variables

Market participation is both a cause and a consequence of economic development. Markets offer households the opportunity to specialize according to comparative advantage and thereby enjoy welfare gains from trade. Recognition of the potential of markets as engines of economic development and structural transformation gave rise to a market-led paradigm of agricultural development during the 1980s (Reardon and Timmer, 2006) that was accompanied by widespread promotion of market liberalization policy agendas in Sub-Saharan Africa (SSA) and other low-income regions.

As to butter market participation, from a total of 200 butter producing sample households 161(80.5%) were participants of butter market as it was known from the survey result, while the rest 39(19.5%) did not. The survey result shows a higher share of male-headed households for both participants and non-participants proportionally, which is 86.3% and 79% respectively. Average family size of the two groups shows no significance difference and the man equivalent active labor found to be 3.89 and 3.47 for participant producers and non-participants respectively. Intellectual capital, which is measured by education level of the household give rise to similarities between the participating and non-participating households, that is the greater portion of these groups fall under the category of read and writes**.**

A significant difference between participants and non-participants households was observed with regard to travel distance from the farmers' residence to the nearest market center. As indicated in Table 3, participant households on average walk about 5 km while non-participants travel about 12 kms to get the nearest market center. The same is true for travel times to the development center, that is 2.68km and 6.41km for market participants and non-participants respectively.

As to the economic activities of the sample respondents, mixed crop-livestock production system is the major economic activity. In the rural parts of the study areas, there is a system of which out puts or products and/or by-products of crop and livestock are inputs for one another. Crop production, in which it covers annual food demand of the households, constitutes a significant households farm income. Income from butter production was allotted to buy feed for cattle, clothing, educational expense, household consumption expenditure (to buy food grains, edible

oil, coffee, sugar, spices and others), and small to medium household furniture. Except in the semi-urban dairy production system, in which they participate by supplying both milk and butter to the markets, selling raw milk is culturally prohibited, and even considered as taboo in the rural part of the study areas. Therefore, for the rural small-scale dairy producer households butter is the sole marketable dairy product.

Table 3. Socio-demographic characteristics of market participants and non-participants

Demographic characteristics		Participants N = 161(%N)	Non participants N = 39(%N)	Test $\chi 2$
Sex	male	82.6	80	0.673
	female	17.4	20	
Education level	illiterate	39.1	35.9	0.802
	Read and write	40.4	41	
	Elementary completed	19.3	23.1	
	High school complete	1.2	0	
Religion	Orthodox Christians	86.3	79.5	1.155
	Muslim	13.7	20.5	
Marital status	married	81.4	76.9	.459
	divorced	7.5	10.3	
	widowed	11.1	12.8	
		Mean (STD)	Mean (standard deviation)	
Age of HH in years		46.27(10.36)	44.2(9.25)	
Family size		6.55(1.900)	6.35(1.67)	
Working labor in man equivalent		3.89(1.34)*	3.47(0.96)	
Experience in farming		22.15(10.74)	20.61(9.94)	
Experience in butter production		19.7(10.74)	18.28(10.48)	
Distance to the nearest market		4.96(4.09)	11.28(6.29)***	
Distance to development center		2.68(2.35)	6.42(4.64)***	
Number of local breed cows/household		2.86(2.36)***	1.53(0.85)	
Number of cross breed cows/household		0.54(0.82)***	0	
Per household milk production		2191.68(1775.26)***	598(371.01)	
Per household butter production		84(58)**	28(15)	
Income from crop production		10367.14(7956.66)*	6392.56(4056)	
Income from livestock production		7591.67(4100.09)**	4641.79(2889)	
Off farm income		903.59(888.53)	850.28(755.68)	
Total livestock in TLU		7.63(4.40)**	4.94(1.83)	
Total land holding in timad		5.74(3.87)*	4.10(2.03)	

Source: survey result, 2008 *** significance at 1%, ** at 5% and * at 10%

As indicated in Table 3, participating households have more lactating cows with a mean of three cows per household, than non-participating households that is 1.53 cows per household. In addition, the average number of cross breed cows for the participant farmers found to be 0.69, on the other hand, none of the non-participant households used crossbreed cows for dairying. As a result, the annual milk and butter production of participant households was significantly at 1% level higher than of non-participants, which is 2191.68lit, 84 kg and 598lit, 28kg respectively. Total livestock holding which is measured in TLU has significantly larger units for butter market participants 7.63 as compared to 4.94 for non-participating farm households.

4.2. Butter Production and Marketing Support Services

Production and marketing support services were identified to be input supply, credit service, extension service and market information access as applied to butter production and marketing in this study.

4.2.1. Input supply

For sustainable agricultural development strategy, establishing an effective input supply system based on market demand will enable the farmer to obtain quality inputs in the required quantity and type, at the place needed, and on time, at a reasonable price. Hence, this will enable the agricultural input utilization to be quite profitable. In general, the strengthening and expansion of market-oriented agricultural development requires the creation of an efficient input delivery system that includes the multiplication of inputs domestically in the quantity and type required.

The survey result shows the input technology used in butter production has been highly traditional in the respective study woredas. The method of butter production is still inefficient and time consuming, that is use of churning pots either pulling on the ground or suspended from the roof of a hut. In addition, the other inputs that are needed for butter production and marketing like type of breeds, feed, veterinary service, equipments and drug are not well developed.

4.2.1.1. Supply of crossbreed cows and factors determining households' access to crossbreed cows

As the very important input for butter production is milk, the amount and quality of milk yield determines quantity and quality of butter as well. Furthermore, the quantity and quality of milk also determined by the type of breed, high yielding and low yield breeds, in this case cross breed and local breed cows. Therefore, the type of breeds households used determines their butter productivity correspondingly. From the total interviewed households about 58% of them respond, as they have no access to improved (cross) breed cows. On the other hand, the rest 42% of the households inform as they have access to improved breed of cows regardless of their adequacy and timelines.

To analyze the factors affecting households' access to crossbreed cows, probit model is used. The variables hypothesized for this problem are households' socio-demographic, economic and spatial characteristics. The dependent variable is access to crossbreed cows which is assigned BREEDACES = one, for households have access, BREEDACES = zero, otherwise. A software known as LIMDEP was used to estimate the parameter coefficients of the probit model. There is no problem of multicollinearity among the regressors as it was tested using VIF for continuous variables and contingency coefficient for categorical variables, see in appendix Tables 4 and 5.

Moreover, explanatory variables such as access to credit, access to feed, access to veterinary service and participation in extension demonstration are likely to be endogenous variables. Consequently, taking these variables their actual value can introduce endogeneity problem, (the endogenous variables could be stochastic and correlated with error term in this equation) and resulting inconsistency in the parameter estimates of the model (even sample size increases definitely the parameter estimates could not converge to their true population parameters). However, it was found a "proxy" for the stochastic explanatory variables such that, they are uncorrelated with the stochastic disturbance term. Such a proxy is also known as an instrumental variable. This is provided by the two-stage least squares (2SLS), developed independently by Henri Theil and Robert Basmann (Green, 2003). As the name indicates, the method involves

two successive applications. The first stage is made by regressing the suspected endogenous variables over the pre-determined or pure exogenous variables to get their predicted values (1st stage). The predicted values of the endogenous variables in the first stage are used to estimate the breed supply equation (2nd stage).

Table 4 presents the results of the probit estimations of factors influencing households' access to crossbreed cows. The model correctly predicted 91% of the observations, with significance chi-squared of 90.609. Four of the hypothesized variables had coefficients that were significantly different from zero. Three of the variables were positively associated with the probability of households having access to improved breed cows. Access to veterinary service, participation in extension demonstration and frequency of extension contact increased the chance of household access to crossbreed cows. Whereas, distance of households' residence from their woreda town affects the probability of access to the breeds negatively.

The results imply that getting veterinary service by experts has a significant marginal effect on increasing the probability of having access to the crossbreeds. This may because of crossbreed cows are vulnerable to livestock disease and needs proper management and timely treatment. Therefore, farmers whom did not have access to veterinary service have lower chance to get crossbreed cows than their counter parts. In addition, households participating in extension demonstration regarding dairying and more extension contact have better knowledge of management of new breeds and motive to expand their dairy enterprise, due to this reason, these households may get high priority to use crossbreed cows. On the contrary, as farmers become far from their woreda town they may not have enough contact and information relating to improved breed cows and it may also difficult for them to get inputs for these breeds, consequently, as farmers residence becomes far and far, the probability of having access to crossbreed cows decreases.

Table 4. Probit estimates of households' access to crossbreed cows

Variables	Coefficients	Marginal effects	T-ratio
CONSTANT	-.69213	-.26800	-.446
	(1.5511)	(.6009)	
HHAGE	.02931	.011352	1.028
	(.02852)	(.0110671)	
HHSEX	-.49946	-.193401	-1.324
	(.37719)	(.14626)	
FAMILYSI	-.266280	-.10310	-.861
	(.30922)	(.11977)	
EXPRIBUT	.03691	.027908	1.47
	(.025035)	(.019707)	
OFFARMIN	.00011	.0000434	.835
	(.0001342)	(.0000520)	
DISTDVLP	-.01526	-.0059073	-.327
	(.046592)	(.018041)	
DISTROD	-.010139	-.00393	-.309
	(.032835)	(.01271)	
DISTWRDA	-.02947**	-.01141**	-2.374
	(.01241)	(.00482)	
LANDHA	.07088	.02744	.200
	(.35530)	(.13761)	
WORKLABR	.40544	.15699	1.100
	(.36865)	(.14284)	
FORMEDUC	-.06325	-.024494	-.220
	(.28739)	(.11127)	
NUMCOWS	-.06302	-.024404	-.722
	(.08729)	(.03386)	
DEMOPAR[a]	1.41624***	.54840***	5.016
	(.28237)	(.11013)	
CREDIT[a]	.39192	.15176	1.241
	(.31586)	(.12224)	
FEED[a]	.41785	.19413	.931
	(.44199)	(.17075)	
EXFREQUEN[a]	.69954*	.27087*	1.853
	(.37761)	(.14626)	
VETACES[a]	.29989**	.11612**	2.91
	(.1035)	(.04038)	
Percentage of correctly predicted	91,	N = 200	
Chi-squared	90.609***,	Log likelihood function = -90.75341	
Restricted log likelihood	-136.0584,	[a] = predicted values	

* = 10% sign level, ** = 5% sign level, *** = 1% sign level (STD errors in brackets)

Crossbreed supply, source and evaluation

For (63% of Atsbi and 78% of Alamata woreda) of the sample farmers, local breed cows are the sole source of milk, then butter. As the survey result indicates, local breed cows are characterized by low productivity, which was (1- 2.5 liters of milk per day/cow), as compared with that of cross breed cows in which they yield (5-10 liters of milk per day/cow) in the study areas. The households using only cross breed cows, mostly residents of semi-urban areas, are (5.5%) out of the total sample and 48 (24%) of the households were used both crossbreed and local breeds to produce milk.

Even if farmers are keen and interested to get crossbred cows for milk production, they could not able to get these breeds. This is because of inadequate supply of cross breeds, unfair price of the crossbreeds and absence of breeding strategy at community level, were some of the reasons as pointed out by the farmers.

Table 5 indicates, out of the total introduced crossbreed cows, 72% were supplied by the woredas office of agriculture (WoARD), in addition 25% and 3% were introduced by relief society of Tigray (REST) and from market respectively.

Table 5. Source of crossbreed cows

Source of cross breed cows	households' woreda		Total %N
	Atsbi Wonberta %N	Alamata %N	
Market	2	4	3
BoARD	70	74	72
REST	28	22	25

Source: survey result, 2008

With respect to timeliness of crossbreeds, 90% of the crossbreed farms and 91% of the both crossbreed and local breed using farmers informed that cross breeds were delayed to be delivered to farmers. Unlike the keen interest of farmers on crossbreeds for dairying, the supply of these cows was found to be insufficient to meet the resulting demand. Consequently, all of the

crossbreed farms and 95.8% of both cross and local breed using households pointed out that the supply of crossbreeds was inadequate in the study areas, as it is already indicated in Table 6.

Table 6. Evaluation of crossbreed cows

Evaluation parameters		Breed of cows used	
		Only crossbreed using producers (N=11) %N	Both cross and local breed using producers (N=48) %N
Quality of crossbreed cows relative to local breeds	High	100	100
	Low	.0	.0
Timeliness of crossbreed cows	On time	9.1	8.3
	Delayed	90.9	91.7
Adequacy of crossbreed cows	Adequate	.0	4.2
	Inadequate	100	95.8
Price of crossbreed cows	Fair	18.2	16.7
	Unfair	81.8	83.3

Source; survey result, 2008

4.2.1.2. Feed supply and factors affecting households' access to feed

As most small-scale dairy production system in the country, the most commonly used feed resources in the study areas include cereal crop residue, hay, green forage and communal grazing. Dairy producers in semi-urban areas mainly used purchased roughage and concentrate feeds along with non-conventional feeds. The dependability of availability and quality of feed up on the seasons of the year resulted to persistent feed shortage from year to year in the woredas. During off-season, some farmers even provide a solution to sell parts of their cattle to reduce the problem of feed and to buy additional feed for the remaining cattle.

The parameter coefficients are estimated by probit model using limdep software. Factor variables were tested for multicollinearity using VIF and contingency coefficient and no severe problem was detected, indicated in appendix Tables 4 and 5.

The access to credit and frequency of extension contact are weak exogenous variables for this equation, consequently their predicted values is taken in this equation as it was made for the breed access econometric model above.

The model correctly predicted 94% of the observations, with significance chi-squared of 84.68. Out of hypothesized variables, four variables found to be significantly affect the probability of households to have access to feed. Three of them, credit access, experience in dairying and labor supply were positively associated with the probability of access to feed. On the other hand, distance to market affects the probability negatively.

The results indicate that as households get access to credit it is more likely to say their probability of access to feed increases. This is mostly because credit can help households to buy feed for their cows or invest on forage production. In addition, as years of experience in dairying increases the chance of producers to get access to feed increases this implies their long time knowledge of management system as well as awareness of feed markets, seasons feed availability, place where more feed can available and their forecasting ability based on last experiences.

Labor supply measured in adult equivalent also has positive and significant relationship. This could resulted from farmers with more labor can easily allocate their labor to search feed, produce feed and transport. Alternatively, they may also simply exchange labor for feed with neighbors. On the contrary, households distance to market has negative and significant relationship as farmers become far and far from markets it is difficult to buy or transport feed, or may less informed about the supply and price of feed in the markets.

Table 7. Probit estimates of factors determining households' access to feed

Variables	Coefficients	Marginal effect	t- ratio
CONSTANT	1.0081	.39894	.972
	(1.0375)	(.41035)	
HHAGE	-.02031	-.01006	-0.83
	(.024195)	(.0173)	
HHSEX	.008529	.00337	.026
	(.33340)	(.13193)	
EXPRIBUT	.041177**	.016294**	2.594
	(.01587)	(.006278)	
OFFARMIN	-.000129	-.000051	-1.009
	(.000128)	(.00005)	
DISTMKT	-.04312**	-.021060**	-2.07
	(.02078)	(.010188)	
DISTROD	-.02931	-.011601	-.829
	(.03535)	(.013993)	
DISTWRDA	.022671	.008972	1.14
	(.019852)	(.007275)	
NUMOXEN	.02153	.008522	.089
	(.24099)	(.09536)	
LANDHA	-.19952	-.07895	-.504
	(.39572)	(.15672)	
FORMEDUC	.29541	.11689	1.048
	(.28184)	(.11157)	
WORKLABR	.60292***	.23858***	6.361
	(.09479)	(.03773)	
NUMCOWS	.03448	.013646	.391
	(.088139)	(.03489)	
OTHELIVTLU	-.10020	-.03965	-1.053
	(.09514)	. (.037660)	
CREDIT[a]	1.0369***	.41033***	3.670
	(.28254)	(.11188)	
EXFREQUEN[a]	.30062	.196034	1.06
	(.28238)	(.1621)	

Percentage of correctly predicted 94, N = 200
Chi-squared 84.68***, Log likelihood function = -95.47713
Restricted log likelihood -137.8183, [a] = predicted values
* = 10% sign level, ** = 5% sign level, *** = 1% sign level (STD errors in brackets)

Supply of feed

Not only shortage of own produced feed, but also supply of feed at local and woreda markets is very low and inconsistent throughout the production year. As most of the households agreed, buying feed from market by credit or in cash found to be a best choice to solve the problem of feed shortage during off seasons.

Table 8. Feed source and evaluation of feed supply

		Sex of household head		
		Male HH (%)	Female HH (%)	Chi-square value($\chi 2$)
Occurrence of feed shortage	Yes	54.7	76.1	10.940**
	No	45.3	23.9	
Source of feed	Market	83.2	90.5	7.794**
	Borrowing	16.8	9.5	
quality of feed	High	15.0	9.1	.010
	Low	85.0	90.9	
timeliness of feed	on time	2	-	
	Delayed	98.0	100.0	
price of feed	Fair	2	-	
	Unfair	98.0	100.0	

Source: survey result, 2008 ** significance at 5% level

Even if water harvesting and integrated forage production has been practiced with the help of BoARD of the woredas and IPMS Ethiopian farmers' project, changes are insignificant as it is at the grass root level to minimize problem of feed. Out of the total interview male-headed households, 54.1% of them respond as they face shortage of feed for their lactating cows from year to year, whereas, 76.7% of female headed samples do face such a problem. As the value of chi-square indicates, female-headed households are more vulnerable to shortage of feed than their counter parts in the study areas.

83.2% and 90.5% of male and female-headed households respectively fills their feed gap from market; the remaining farmers fill their feed gap by borrowing from their neighbors to meet feed requirements of their dairy cows.

4.2.1.3. Equipments supply

Equipments, which are commonly used in the process of butter production and marketing, are milking equipments, milk handling and storing materials, churner and butter handling and storing equipments. These equipments were considered as reference to identify and evaluate the butter production and marketing equipments supply of the study areas.

Like most butter production system of the Ethiopian high lands, clay pot is used as a churning material in the study woredas. A survey of traditional butter making in the Ethiopian highlands has revealed that both the equipment and the methods currently used are inefficient. Traditional churning is time consuming and labor intensive, and results in considerable losses of fat in the buttermilk (F. O'Mahony and Ephraim Bekele, 1985a). A considerable change is observed with regard to milk and butter handling materials as it is shifted from traditional clay pots to relatively improved plastic materials, which are available even at local markets. Except one household in Atsbi-wonberta woreda, who have modern churner gifted from world vision Ethiopia, all of the butter-producing farmers of both woredas use the inefficient and time-consuming churner, clay pot. These pots found at local markets as needed with adequate supply and fair price. The respondents pointed out that there was no modern churner supply at markets, and other production and marketing supporting institutions like BoARD, REST and cooperatives. Not only supply but also information of modern churner is a new issue for the households.

From the total interviewed households (93%) of them evaluated, the quality of local churner is of low performance, on the contrary, the timeliness and adequacy of clay pot is not their problem as they indicated there is on time and adequate supply of the churner at markets.

Table 9. Source and evaluation of butter equipments by household characteristics

Household parameters	Churner type		Churner source			BE. Access		BE. Quality		BE. Adequacy		BE. Price	
	Pot	modern	own pr	Market	WDE	Accessible	Inaccessible	High	Low	Adequate	Inadequate	Fair	Unfair
	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean
No. of churner	2.33	3.00	2.00	2.33	3.00	2.33	-	2.52	2.28	2.33	-	2.33	-
Age	45.86	48.00	51.50	45.81	48.00	45.87	-	44.86	46.16	45.87	-	45.87	-
total family size	6.52	6.00	7.50	6.51	6.00	6.52	-	6.52	6.52	6.52	-	6.52	-
Labor supply	3.81	3.80	3.70	3.81	3.80	3.81	-	3.73	3.83	3.81	-	3.81	-
Butter output(kg)	73	80*	53	73	80	73	-	84	70	73	-	73	-
Milk produced(lit)	1874	3210.0***	1620	1876	3210.00	1881.00	-	2202.61	1790.29	1881.00	-	1881	-
Experience(years)	19	25.00	23	19.36	25.00	19.43	-	18.16	19.78	19.43	-	19.43	-
total wealth in birr	32599	49400***	25625	32670	49400	32683	-	30433	33318	32683.85	-	32683	-
off farm income	888	1850***	1030	886.95	1850.00	893.20	-	851.36	905.00	893.20	-	893.20	-
Local breed cows	2.67	4.00*	4.50	2.65	4.00	2.68	-	2.56	2.71	2.68	-	2.68	-
Crossbreed cows	.55	1.00	.-	.55	1.00	.56	-	.71	.51	.56	-	.56	-
Distance to N.market	6.20	5.00	7.25	6.19	5.00	6.20	-	6.65	6.07	6.20	-	6.20	-
Distance to dev. center	3.42**	.80	7.25	3.38	.80	3.41	-	3.52	3.38	3.41	-	3.41	-
Distance to road	3.95**	.50	6.00	3.93	.50	3.93	-	3.87	3.95	3.93	-	3.93	-

Source: survey result, 2008 *=10% **=5% and ***=1% sign level t-test, BE= better equipments, WDE = world vision Ethiopia

4.2.1.4. Access to veterinary service

Despite the large population of livestock in Atsbi and Alamata woredas, livestock productivity is low. Livestock feed is the major limiting factor for livestock productivity. However, livestock diseases are also an important cause for the low productivity of livestock next to limited feed supply in the woredas. Some of the very important livestock diseases are pastorolosis, anthrax and black leg are main cattle diseases of Atsbi-wonberta. Whereas bovinpastureolosis, liver fluke, anthrax and black leg are important cattle diseases of Alamata woreda. As to the major sheep diseases lambskin disease, mange mites, stryptotrycosis and demodex are the important ones (IPMS, 2004).

For most of the seasons of the year, especially off-season, livestock are left to free graze. As a result, transmission of these diseases among the livestock gets higher probability. Most of the time famers treat their affected cattle traditionally and the probability of recovery found to be very low.

Table 10. Access to and evaluation of veterinary service

		Sex of the household head		
		Female = 39 % N	Male =161 % N	Chi-square value(χ2)
Access of veterinary service	accessible	51	57	.086
	inaccessible	49	43	
Quality of veterinary service	high	80.5	71.8	.318
	low	19.5	28.2	
Timeliness of veterinary service	on time	.-	-	-
	delayed	100	100	
Adequacy of veterinary service	adequate	-	-	-
	inadequate	100	100	

Source: survey result, 2008,

Unlike the households nearer to or live in towns, whom can sometimes get veterinary service from privet specialists, majority of the households get veterinary service from OoARD of the respective woredas. In each woreda there is one veterinary expert assigned by BoARD to serve the whole woredas' households. However, the households respond, as they do not get timely and adequate veterinary service in both the woredas. Out of the sample farmers, 57% and 51% male and female-headed households respectively pointed out as they have access to veterinary service regardless of its timeliness and adequacy.

4.2.1.5. Access to drug

Due to no drug stores available around the farmers' residences and/or nearer markets, the farmers could not able to treat their livestock timely. As a result, dairy producer households pointed out that animal death constrain the productivity potentials of their cattle.

Table 11. Sources, access and evaluation of drug supply

Drug access and evaluation		Households' woreda		Chi-square value($\chi 2$)
		Atsbi Wonberta (%)	Alamata (%)	
Access to drug for cows	accessible	65	57	.202
	inaccessible	35	43	
Quality of drug	high	29	34	.013
	low	71	66	
Timeliness of drug	on time	20	14	.266
	delayed	80	86	
Adequacy of drug	adequate	11	7	.313
	inadequate	89	93	
Source of drug	OoARD	32	23	2.031
	Market	68	77	

Source: survey result, 2008, **=5% significance level

Although the woredas OoARD provide some related drugs to common diseases, the households do not able to utilize it as they have no information for the availability of drugs in the woredas OoARD. As the famers said, they travel a long distance to buy drug from markets, in addition quality and timeliness of the drugs found to be other problem of the producers. Sample households indicated two sources of drugs they frequently used. These are from market and woredas OoARD. 72.5% of the households buy drugs from market, drug stores and the rest (27.5%) informed as they get drug from the woredas OoARD. The main problems of drug supply as indicated in table (11) are adequacy and timelines of the drugs as 83% and 91% of the households of Atsbi and Alamata woredas respond respectively.

Determinants of households access to drug

The households' access to drug supplies is assumed to be influenced by the household demographic characteristics, spatial characteristics, access to institutional services and number of lactating cows.

Parameter coefficients were estimated by probit model using limdep statistical soft ware and independent variables were tested for multicollinearity using VIF and contingency coefficient as usual. As indicated in Table 12, the model is correctly predicted 89% of the observations, with significance chi-squared of 84.0056.

As can be observed from the econometric result of Table 12, among the hypothesized determinants of households' access to drug, three of them found to be significant. Frequency of extension contact and number of lactating cows have positive and significant relation, whereas, distance to the nearest market is associated negatively.

The distance to the nearest market has the second highest negative marginal effect on increasing the probability of getting access to drug. As expected, the result suggests that those households located closer to the nearest town are more likely to have access to cattle drugs in comparison to those living further away.

Table 12. Results of probit model for access to drug

Variables	Coefficients	Marginal effect	t- ratio
CONSTANT	-3.125691571	-1.229416159	-2.529
	(1.2357993)	(.48695582)	
HHAGE	.035455	.021811	.124
	(.028726)	(.01910)	
HHSEX	-.01124	-.00442	-.034
	(.32725)	(.12871)	
FAMILYSI	.18676	.07345	.723
	(.258173)	(.10163)	
EXPRIBUT	.0016552	.000651	.081
	(.020533)	(.00807)	
WORDIST	-.01845	-.007258	-.636
	(.029008)	(.01140)	
DISTDVLP	-.034199	-.013451	-.719
	(.04757)	(.018730)	
DISTMKT	-.043305***	-.017033***	-3.895
	(.01111)	(.004369)	
FORMEDUC	.36876	.13837	1.51
	(.24175)	(.09577)	
WORKLABR	-.38008	-.149495	-1.188
	(.31987)	(.125921)	
NUMCOWS	.14500*	.05703*	1.763
	(.08228)	(.03231)	
DEMOPAR[a]	.19047	.07492	.739
	(.2579)	(.10143)	
EXFREQUEN[a]	.42639**	.08904**	1.954
	(.2186)	(.0494)	
Percentage of correctly predicted	89,	N = 200	
Chi-squared	84.0056***,	Log likelihood function = -95.41416	
Restricted log likelihood	-137.4170,	[a] = predicted values	
* = 10% sign level, ** = 5% sign level, *** = 1% sign level (STD errors in brackets)			

Extension frequency has the highest positive marginal effect on the probability of drug access. This implies, farmers whom get more extension contact may get important information and advice from development agents with regard to availability, quality and type of drug for their cattle. Households with larger number of lactating cows also have better access to drug than households with smaller number of cows. This might be due to the incentive from institutional supporting services or organizations (like BoARD) to expand the dairy enterprise of households;

as a result, producers with larger number of lactating cows can have high priority to get drug for their cows than the others.

4.2.2. Credit supply and households' credit constraint condition

The professed goal of public support for microcredit is to improve the welfare of poor households through better access to small loans. Seemingly, in the study areas, finance was primarily obtained from micro credit institutions, and informal lenders such as farmers and traders. The problem, however, was that the credit system was not well developed, the commercial banks are predominantly state owned and collateral based, private banks are not eager to finance agriculture in general and dairy production in particular because of the associated high risk in dairy production and marketing activity. They find the risk too high and ask for collateral that peasant farmers lack. Therefore, money to finance dairy sector is mostly obtained from micro credit and informal institutions. Credit from relatives and/or friends, bears often no-interest, are also an alternative source of finance.

The credit given to the rural areas in the woreda can classified into two types: Regular credit and household package credit. A farmer cannot get credit of more than one type. The activities for which regular credit is given include the purchase of dairy cows, fertilizer and improved seeds, livestock fattening, poultry production, horticultural production, apiculture, handicraft, and small businesses. All of the sample households described, as they had no access of credit for dairying from commercial bank.

The available sources of formal credit for dairying, as the households pointed out are Dedebit credit and saving institution (DSCI), woreda cooperatives (OoARD). These institutions are serving the farm households credit needs at the same time providing training and workshops with regard to credit utilization for improving agricultural productivity. As the survey result shows, from the total interviewed farmers for their credit need for dairying, 132 (66%) respond yes, out of these farmers only 83 (62.8%) able to get the credit. This is because the limited financial

capacity of the institutions, socio-economic criteria and prioritization of credit demand proposals are some of the reasons.

Factors determining farmers' credit constraint condition

The econometric model used to analyze this problem was the probit maximum likely hood estimation. The dependent variable in the probit equation is farmers' credit constraint condition. This variable takes a value of one if a farmer is credit constrained and zero otherwise. The explanatory variables comprised both the continuous and categorical variables. Parameter coefficients were estimated by probit model using limdep statistical soft ware and independent variables were tested for multicollinearity using VIF and contingency coefficient as usual.

The result shows maximum likelihood estimates of the probit model for dairy producers' credit constraint condition. As indicated in the Table 13, Goodness-of-fit measures indicated that the estimated model fitted the data reasonably well with significance chi-squared of 170.4640. The choice of explanatory variables correctly predicted farmers' credit constraint condition for 93% of the observations. Likelihood ratio tests indicated that the slope coefficients were significantly different from zero at 1% level of significance in the sample.

Marginal effects (for continuous explanatory variables) indicate the effect of one unit change in an exogenous variable on the probability that a farmer was credit constrained. Of the hypothesized explanatory variables, five of them found to be significant factors affecting farmers' credit constraint condition. Three of the significant variables show negative correlation with the credit constraint condition whereas; family size and distance to the development center correlates positively with credit constraint condition of the farmers.

Herd size is significant and negatively related to the farmers' credit constraint condition of the study areas. This result shows credit constrained farmers are more likely to have smaller herd sizes as livestock can be used as collateral to get credit from financial institutions.

Table 13. Results of probit model for farmers credit constraint condition

Variables	Coefficients	Marginal effect	t- ratio
CONSTANT	8.2027	1.4384	2.946
	2.7839	.526623	
HHAGE	-.036778	-.00644	-.76
	.047935	.00837	
HHSEX	.58226	.102107	1.102
	.52816	.08873	
FAMILYSI	.52058**	.09129**	2.201
	.23653	.042303	
EXPRIBUT	.04679	.008205	1.323
	.035375	.00637	
OFFARMIN	-.00039*	-.00006*	-1.951
	.0002004	.00003	
DISTDVLP	.40560***	.07112***	6.63
	.06116	.00107	
DISTROD	.01929	.00338	.424
	.04552	.00798	
DISTWRDA	.01625	.00285	.813
	.01999	.003477	
HERDSIZE	-2.03676***	-.3571***	-4.316
	.471933	.11663	
LANDHA	-.77139	-.13527	-1.190
	.64838	.11654	
FORMEDUC	.38993	.17359	.870
	.4477	.191502	
WORKLABR	-.44875	-.078695	-1.569
	.28601	.05024	
NUMCOWS	.247909	.04347	.866
	.286232	.052285	
DEMOPAR[a]	-.84768	-.14865	-1.559
	.543782	.10351	
EXFREQUEN[a]	-2.0572***	-.36075***	-2.863
	.718490	.12597	
Percentage of correctly predicted	.932,	N = 200	
Chi-squared	170.4640***,	Log likelihood function = -48.95446	
Likelihood ratio	-134.1864,	[a]= predicted value	
* = 10% sign level, ** = 5% sign level, *** = 1% sign level (STD errors in brackets)			

Therefore, farmers with larger herd size have less probability to be credit constrained for dairying than farmers with smaller herd size. The same is true for off farm income, households'

whom have off farm income have less probability to be credit constrained as this income can minimize farmers liquidity problem to repay their loan and requesting other additional loan.

Frequency of extension contact is the other significant factor. This implies frequent extension contact helps farmers to get accurate and valuable information with regard to sources, requirements, utilization and importance of credit for dairying. As a result, farmers with more extension agent contact have relatively better probability to get credit from lending institutions than their counter parts. On the other hand, distance to the development center and family size of the household is positively related to the credit constraint condition of the farmers. The positive relation of family size is because of households with more members have more mouse to feed.

Sources of credit

Dedebit credit and saving institution (DCSI): The Dedebit Credit and Saving Institution (DSCI) is the major supplier of credit and saving services for dairying and other agricultural production in the woredas. Four sub-branch offices provide the service to the rural people in Atsbi-Wonberta woreda and in Alamata town for Alamata woreda. After loan request is approved, disbursement document is prepared. The term of the credit is 1 – 2 years, with interest rate of 18%. The maximum loan in rural areas is Birr 5000. A mandatory saving of 5% of the principal plus Birr 2/month saving is required of borrowers. The savings are now being important sources of loanable fund. However, the households strongly complain the timeliness and adequacy of credit of these institutions. Due to this reason, 87% of the DSCI accessed sample farmers inform that the credit from DCSI was too delayed to get in the required season at it passes through many steps to be approved. The other problem of DCSI as (90.1%) of the sampled farmers pointed out was regarding the interest rate, which is 18% per annum is unfair.

Woreda cooperatives' credit: As the data from OoARD of the woredas indicate, the Household Package Credit is tied to the household package extension program. The office of agriculture (cooperatives department) gives training to the farmers who involved in the household package extension program. Up to five production activities are included in one package. There is no

group formation requirement for the package credit. Farmers take the credit individually. The credit is expected to be repaid over time. Simple interest rate is applied, as opposed to the compounded one. The term of the household package credit is 2 – 4 years, with an interest rate of 9%. On the other hand, 84% and 99% of the households, revealed as the credit was inadequate and too delayed respectively. Cooperative's interest rate, which is 9% per annum, has advantage over DCSI's interest rate by the households since they evaluated as fair interest rate.

4.2.3. Extension service

The woreda office of agriculture, IPMS project and Tigray agricultural research institute provides agricultural extension services in the woredas. The Woreda office of agriculture has three teams: Crop production, livestock production and natural resources management teams. The crop production team also includes the input supply expert, an irrigation expert and home economics agent, in addition to other experts of crop production. The livestock production team includes experts in quality control (hides and skins, and dairy), an apiculture technician, and an AI technician, in addition to other livestock production experts. The natural resources management team includes soil and water conservation experts, a biological soil conservation expert, forestry and agro-forestry expert. Currently each PA has a minimum of three DAs: one each in crop production, livestock production and NRM. Most of the DAs have diplomas and certificates.

There is better understandings of the vital importance of getting farmers adopt technologies and improved practices voluntarily, rather than through intimidation by different means as appears to have been mostly the practice so far. There appears to be a tendency to move towards the strategy of getting farmers to adopt technologies completely voluntarily. It has been reported that DAs and PA administrators (5 of the PA council executives) tour house to house to encourage farmers to join the household package extension program. The subject matter specialists and DAs will then give farmers who opted to join training at the PA farmers training center (FTC).

A number of experts at woreda level and DAs at PA level are distributed to help farm households regarding agricultural production and marketing decision. Even if the introduction and dissemination of improved breed cows is at grass root level, there is a situation that farmers' understanding, willingness and participation in the improved breed cows based dairy production increases from time to time due to continuous trainings and experience sharing at FTC and other model sites.

Table 14. Access to extension service and frequency of DA contact per month

	frequency of extension visit per month			
	0nce	twice	three times	four times
distance to development center	3.39	3.99	3.45	2.84
distance to all weathered road	3.41	4.80	3.26	3.91
distance to the woreda	13.34	16.07	14.07	19.52
number of cross breed lactating cows	.33	.04	.90	.98
number of local breed lactating cows	2.40	2.14	2.53	3.43
years of experience in butter production	18.66	19.69	20.35	18.85

Source: survey result, 2007/8

On the other hand, the frequency of extension agent contact shows a difference among the producers, which is ranging from one to four times contact per month. Model farmers, also known as early adopters, get more contact than other farmers do. Out of the total respondents, 31% of them get DA contact four times per month and 24%, 29%, and 16% of the sample households had three times, twice and once DA contact per month respectively. The type of extension service with regard to dairying was technical advice, input using and credit allocation and/or utilization as applied to dairy production and marketing.

4.2.4. Access to market information

The primary objective of a market information service is to increase the degree of knowledge of market participants (farmers, traders and consumers) about the market. Improved access to

information leads to an improved understanding of the working of the market. Government planners and policy makers should also benefit by the provision of market information in that policies and programmers should be based on an improved understanding of the market (Bridget Poon , 2001). Butter production and marketing is seasonal by its nature in addition, consumption of these products is less during fasting and high at the time of religious festivals like Easter, Christ-mass, *meskel* and others. Because of such fluctuation of production and consumption, the demand and supply changes accordingly. Consequently, price of dairy products goes up and down as well. Regard less of these fluctuations; farmers sell their products at any price without considering the best market, time and price they could get, as they have no enough exposure to timely, reliable and adequate market information.

Although cooperatives department of the woredas OoARD record and report prices weekly through radio, majority of the households are used informal sources of information from neighbor farmers and traders that is believed to be less accurate and inconsistent to make marketing decision. On the other hand, 8% of the farmers respond, as they had no any information, even the informal one, to make a marketing decision. Only 20.7 % of the total sampled households inform that they were used formal information source cooperatives and radio that is broadcasted every Sunday morning representing different commodities and markets of the region.

Table 15. Butter market information sources

Information sources	Market Supply information	Market demand information	Market price information
	%N	%N	%N
Other farmers	31.7	22.4	25.5
Butter traders	24.2	23.1	2.2
Personal observation	3.3	4	43.6
Radio	-	-	14.7
Cooperatives	0.8	1	6
Total	60	60.5	92

Source: survey result, 2008.

Unlike the formality and the source of information, 92% of the sampled households could able to get butter market price information. Information sources of butter supply and demand are very informal source and around 60% of sample farmers could able to get such information regardless of its reliability, adequacy and timeliness. The producers near to small towns and those have radio listening habit have better butter price information relative to those living in remote villages and do not listening radio. About 92% of the respondents has access to nearby market price of butter even the quality of the information varies among the households.

4.3. Structure of Production Costs and Profitability of Butter Production

4.3.1. Structure of butter production costs

The production cost of the dairy farm considered comprises of variable and fixed costs. The variable cost of inputs analyzed included cost of green fodder, dry fodder (hay and straw), labor, medicine and veterinary service and interest on working capital considered as variable cost. Fixed costs included were depreciation costs of cows, building and dairy equipments as well as interest on fixed capital. As it was discussed in the input supply section of the document, the inputs used in dairy production are mostly locally/home produced and less productive ones. From the farmers' point of view, crossbreed cows consume more feed and needs close management than the local breeds. For the lactating cows, feed and labor costs constitute 78.7% of their total variable costs; while crossbreed holder farmers and those live in towns incur cost like water cost, transportation cost and veterinary service costs in addition to the major ones. Transportation costs include disposing wastes, to buy feed from markets and distributing milk and butter to hotels restaurants and cafeterias.

Since the main target of this section is to identify production cost of butter and determine its profitability, production costs were disintegrated to milk, butter, appreciation of cattle (i.e., calves, heifer and young bull) and cow dang and/or manure. This was done by distributing the production costs according to their share of return to the households' income from the dairy

enterprise. Therefore, production costs belong to the other dairy out puts based on their income share were identified and deducted out from the profitability analysis.

The procedures employed were:

- The possible outputs from the dairy farm were identified by the farmers and listed as milk, butter, calves, dung, and manure.
- Secondly, the amount of income the farmers earned from these dairy partitions was recorded and computed their proportions from the total dairy income.
- Thirdly, the total production costs were distributed proportional to their income share of the total dairy income.
- Then, total production costs of whole milk were identified neatly off the calves, manure and dung costs.
- Finally, based on the proportion of milk converted to butter, the costs also shared accordingly. In addition to these costs, there are also production costs belong to butter only like labor cost of churning, deprecation of churning and other butter equipments are considered.

As computed from the survey data, the greater share 68% of dairy income was derived from milk and milk products. Next to milk, return from sale of calves was second important output of the dairy enterprise in the studied areas. Cow dang and manure, which are used as major source of fuel and fertilizer, have considerable importance and their local value was estimated by the farmers considering the opportunity cost principle, as they are non traded out puts and no standard way of pricing them.

The overall average production cost of a butter producer farms was 1838.9 ETB per cow/year. Out of this, variable costs accounted for 83.3% (Birr 1532.4 per cow/year) and fixed cost accounted for 16.7% (Birr 307.5 per cow/year) of total cost of production. The total production costs of butter for crossbreed owning farmers were Birr 2758.9 per cow/year with a average variable cost of (2276 Birr per cow/year) 82.5%, and fixed cost share of 17.5% (482.6) Birr per cow/year. For local breed owning farms, variable cost accounted for 85.9% (Birr 788.8 per cow/year) and fixed cost accounted for 14.1% (Birr 130.1 per cow/year) and average production

cost for local breeds was 918.9 Birr per cow annually. The share of variable and fixed costs was nearly in line with study done by Kalra et al.(1995) on economics of milk production and disposal in rural areas of Haryana, India. They reported that, the share of fixed and variable costs were approximately 85% and 15%, respectively. The findings were also in agreement with similar studies by Alam *et al.* (1995) on the economics of dairy farms in selected areas of Bangladesh. Alam *et al*. (1995) reported that the share of variable and fixed costs were 87% and 13%, respectively.

4.3.2. Returns of butter production

Revenues of butter production were estimated from sold and consumed butter, value of buttermilk (yoghurt) and estimated at their respective market price. Even if buttermilk (yoghurt) selling is not common practice in the rural areas, its value was estimated by the price in which cafeterias do sell in urban areas. The highest share of total returns was from butter in both Atsbi-Wonberta and Alamata woredas, which was 73.1% and the remaining 26.9%, was from buttermilk (yoghurt). The overall average gross revenue from sale of butter was 2016.3Birr per cow/year. The gross revenue of butter from crossbreed cows was 3198.4 Birr per cow/year, which is much greater than gross revenue of local breed cows that was 834.2Birr per cow annually. The value of yoghurt was estimated by using price of yoghurt in cafeterias of surrounding towns, therefore, 1ETB per liter of yoghurt was the average price. According to this, the overall gross revenue derived from yoghurt was 740.9ETB per cow/year with masked difference between crossbreed and local breed cows that was 1183.8ETBper cow/year and 298ETBper cow/year respectively.

Average price of butter was 50.17 ETB per kilogram of butter with a minimum of 40ETB/Kg and maximum price of 65 ETB/Kg. The variability of butter price was resulted from variation in markets place, season (summer, autumn, winter, and spring), fasting and non-fasting periods. Moreover, it was also observed that there was a price difference between the woredas, i.e. Alamata's average price was 47.7ETB/Kg, which is slightly lower than average price in Atsbi-wonberta that is 52.6ETB/Kg.

Table 16. Structure of butter production costs and profitability of butter production

Details	Cross breed Per cow/year	Local breed Per cow/year	Total average Per cow/year
Feed cost	1002.00	465.9	733.95
Labor cost	769.06	174.8	471.93
Water cost	40.42	18.64	29.53
Drug cost	94.63	30.06	62.345
Veterinary service cost	33.33	-	16.665
Interest on loan	194.64	76.35	135.495
Transportation cost	75.6	-	37.8
Variable cost	2209.68	765.7	1487.69
Interest on working capital	66.3	23.01	44.655
Total variable cost	**2276**	**788.8**	**1532.4**
Depreciation of cows shed	19.2	5.3	12.25
Depreciation of lactating cows	412	106	259
Depreciation of milking equipments	10.9	4.6	7.75
Depreciation of butter equipments	26.7	10.4	18.55
Total depreciation cost	468.82	126.3	297.56
Interest on fixed capital	14.06	3.8	8.93
Total fixed cost	482.9	130.1	306.5
Total cost of production	**2758.9**	**918.9**	**1838.9**
Return from sale of butter	3198.4	834.2	2016.3
Return from sale of yoghurt	1183.8	298	740.9
Total returns	4382.2	1132.2	2757.2
Net return/profit	**1623.3**	**213.3**	**918.3**

This may due to more traders from Mekelle, Wukro and adigrat towns were buying from Atsbi-Wonberta and the woreda is nearer than Alamata to the central market, Mekelle. In addition, Alamata woreda had additional supply of butter from Kobo and the demand was low as the number of cafeterias, restaurants and hotels are very few as compared to demands in Mekelle, adigrat and Wukro which are potential markets for Atsbi-wenberta's butter.

The net returns, generated after deducting all financial and opportunity costs of resources used for butter production, found to be 1623ETB per cow/year from crossbreed cows and 213ETB per cow/year from local breed cows with overall average net return of 918.3ETB per cow annually. Based on the figures resulted from the survey, butter production in the studied woredas have been profitable, even if the profit varies between the breed types used for butter production.

4.4. Butter Marketing and Butter Traders' Characteristics

4.4.1. Butter traders' social and intellectual capital

Social capital, defined as a 'stock' of trust resulting from close functional or emotional attachments to a group or society that facilitates the provision of public goods (Fukuyama 1995), helps traders in terms of exchange of market information, on credit purchase and sale, and number of local and distant trade contracts.

Characteristics of traders considered here are age, family size, sex, marital status, religion, education level, experience in butter trading and others. The survey result indicates that the sampled traders were on average 41.3 years old. Family size differs across the markets and the average family size was six per household. As to the sex, female traders dominated butter trading in the study areas, as a result, 78.1% of the interviewed butter traders were female and the remaining 21.9% of them were male. With regard to religion, about 88% of traders were orthodox Christians while the remaining was Muslim accounting to 12%. From sampled traders 30% were divorced and 31% and 39% of them were widowed and married respectively. Out of the total sampled traders, 52.4% were educated to read and write while the remaining 47.6%

were illiterate. The average years of experience in butter trading was found to 8.3 years and the mean distance from residence to the nearest butter market was 1.9 kilometers with a maximum of 5Km, mostly for the Woreda Retailers, and a minimum of 0.2Km. The survey result reveals that traders at the retailer level were 75% females, 56.6% of them speak Tigrigna and Amharic, and 43.4% of the traders speak only Tigrigna. About 78% of traders started up their butter trading business themselves, which is small and personalized. Only one trader indicated that her mothers were involved in butter trade and none of them suggested that their father was in butter trade thus insignificant social capital was derived from family butter trade. As to the occupation before butter trading, 34% sample traders were involved in trading of other agricultural commodities like grain, spices, vegetable and fruits trading. The remaining 66% pointed out, as they were farmers before getting involved in butter trading.

Table 17**.** Socio-demographic characteristics of butter traders by market center

		Market center		
		Atsbi %N	Alamata %N	Mekelle %N
Sex	Male	24.6	13	37
	Female	75.4	87	63
Religion	Orthodox	100	89.1	74
	Muslim	.0	10.9	26
Marital status	Married	51.2	18.7	47
	Divorced	23.8	53.3	14
	Widowed	25	28	39
Education level	Illiterate	68.3	43	31.5
	Read and write	31.7	57	68.5
language	Tigrigna only	100	0	47.5
	Tigrigna and Amharic	0	100	52.5
Pre-butter trade occupation	Trading	18	31	54
	Farming	82	69	46

Source: survey result, 2008

Physical capital: The physical capital, which is related to the traders butter trading business like shop, house, storage, vehicle, balance, desk and mobile telephone, churner and butter handling materials were the major ones. The total values of physical asset of the traders when they start butter trading were found to be 26166ETB for Woreda Retailers, 34174ETB for regional retailers, 22087 and 55162ETB for assemblers and wholesalers' respectively. Butter whole sellers, whom have the largest value of physical asset, were operating at the region's capital, Mekelle market only. As it is shown from Table 18, the total physical asset value was doubled in 2008 year in comparison with the asset values at the beginning that is 33147.50, 41300.00 and 133550ETB for Woreda Retailers, assemblers and whole sellers respectively.

During the survey year, it was found that of the traders, 70% have their own weighing scale (balance) and the rest were borrowed from their friends to sale and/or buy their butter. With regard to telephone, 62.5% and 32.3% of the sample traders were respond as they have mobile and desk telephone respectively. Above all, it was observed a significant difference in physical asset holding between regional retailers and local or woreda traders at 1% significance t-test.

Operating capital: The opportunity cost of working capital indicates how costly it would be for a butter trader to tie up working capital in butter for the period required during the transaction. Butter has better shelf life and opportunity cost of working capital is high. Therefore, much time can be spent during butter marketing or in deliberately speculating higher price while the butter is in storage and the capital is tied.

The majority of traders used small amount of operating capital when they start butter trading. About 41% sample traders operate with working capital of less than 1000 Birr, 53.2% of the traders operate with financial resources between 1000 and 5000 Birr, and the remaining 6.2% operate with working capital between 6000 and 22000 Birr.

Table 18. General characteristics and intellectual, social and financial endowment of butter traders

Characteristics		Age	Family size	Distance to market	Years in butter trading	Starting total fixed asset in birr	total fixed asset in birr in 2008	Starting working capital	working capital in 2008
		Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean
Level of trade	Woreda Retailers	42	6	1.80	6.80	26166.00	33147.50	1390.00	4930.00
	Wholesaler	46	6	1.25	11.00	55162.50	133550.00	4825.00	19500.00
	Rural assembler	37	5	1.65	10.25	22087.50	41300.00	1675.00	10187.50
	Regional retailer	43	5	2.40	7.70	34174.00	67391.00	1910.00	10100.00
Market center	Atsbi	44	7	2.13	8.13	28601.25	32494.38	1325.00	6137.50
	Alamata	36	5	1.24	7.67	21672.22	31324.44	1800.00	7077.78
	Mekelle	44	5	2.13	9.13	38459.33	88540.67	2593.33	13133.33
Sex	male	47	6	1.93	6.57	70644.29	121810.00	4885.71	15428.57
	female	40	5	1.87	9.00	20249.60	40692.60	1260.00	8072.00
Marital status	married	44	6	1.47	6.18	56396.36	91618.18	3845.45	11818.18
	divorced	38	5	1.88	8.38	20649.23	42413.85	1046.15	8946.15
	widowed	44	5	2.44	11.75	13993.75	38850.63	1225.00	7937.50
Education level	illiterate	45	6	2.07	10.64	25606.43	58706.07	950.00	7521.43
	read and write	39	5	1.73	6.78	35681.11	58227.78	2911.11	11361.11
Occupation before butter trading	yes	42	5	1.97	8.37	33081.67	58089.50	2113.33	9593.33
	no	41	4	.60	10.00	4150.00	63650.00	1150.00	11000.00

Source: survey result, 2008

The average working capital was 12400.83ETB ranging from 100 to 22000ETB. Retailers and wholesalers mostly market on credit basis. This was based on long-term established clientele ship. Every week or twice depending on their selling capacity, retailers took any amount they demand. All traders do not involve brokers in buying and selling processes and operate by owners themselves. Sometimes traders take butter from suppliers on credit basis and repayment is made right after the sale. Such traders have high opportunity cost because of inability to look for quality butter and negotiate or haggle over the prices.

The working capital of retailers on average was 7515ETB during the survey year, assemblers and whole sellers' working capital was 10187 and 19500ETB respectively. Based on this result, Whole sellers' working capital was significantly larger than retailers and assemblers. It was also found that there was a significance difference with regard to amount of working capital between regional and woreda level traders.

As to the source of working capital, majority of the trades was respond as they were used their own capital from the time they began butter trading until 2008. Of the total interviewed traders, only 15.6% traders used credit from relief society of Tigray (REST) to run their butter trading business. Moreover, all (100%) traders pointed out that, there are improvements with regard to credit supply for butter trading these days as compared to last four years. Due to the reason that, butter trading could be run with little working capital and access of credit for butter trading was found in the way of improving, working capital does not constrain butter traders in the districts.

4.5. Structure, Conduct and Performance of Butter Markets

This section describes the size and distribution of firms in the market, and their behavior, which are important determinants of how well the markets perform various functions.

4.5.1 Structure of butter markets

Those characteristics of the organization of the market that seem to exercise strategic influence on the nature of competition and pricing within the markets which include degree of sellers concentration, entry barriers, product differentiation and market transparency are discussed.

4.5.1.1. Market concentration

Market concentration refers to the number and relative size of buyers or sellers in a market. Many studies indicate the existence of some degree of positive relationship between market concentration and gross marketing margins. It is generally believed that, higher market concentration implies a non-competitive behavior and thus inefficiency. However, some studies also warn against the interpretation of such relationships in isolation from other determinant factors like barriers to entry and scale economies (Scot, 1995).

Butter markets in the districts were characterized by the prevalence of unconcentrated supplies. Dairy products are supplied by a very large number of producers from different areas, whereby no producer affects the function of other producers. Market in the next level, at buyers' level, is also unconcentrated for the product. Therefore, this market resembles the characteristic of a competitive behavior.

Concentration ratio for butter market was calculated by taking the annually purchased volume of butter by market participants in kilograms. In this study, the degree of market concentration was measured using the common measures of market concentration that is Concentration Ratio ($C_{4)}$.

Following the market structure criteria suggested by Kohls and Uhl (1985) butter market shows competitive nature in Atsbi market that was C_4 of 31%, and weak oligopolistic markets in Alamata and Mekelle markets as the concentration ratio shows to be 39% and 44% respectively.

Table 19. Concentration ratio of four firms for the three markets

Market center	Concentration index of largest Four traders (%)
Atsbi market	0.31
Alamata market	0.39
Mekelle market	0.44

Source: survey result, 2008

4.5.1.2. Barriers to entry

Trade barriers have often laid the groundwork for market imperfection. Whether by intent or not, many regulatory actions by state or local units have the result of restricting freedom to entry and the free flow of goods and services (Kohls and Uhl, 1985). Even though some barriers were intrinsic to certain traders and others were erected by the single or combined actions of the incumbent traders, the major barriers to entry considered in the trade of butter in the study areas included licensing, lack of working capital, experience in butter trading, and risk and policy barriers. These barriers to entry were discussed.

4.5.1.2.1. Licensing

Following the survey result, butter trading in the studied markets does not need a trading license and there are no license barriers with regard to butter trading.

4.5.1.2.2. Lack of capital

The majority of traders and almost all retailers invest very small amount of initial working capital when they start butter trading. About 60% of the sample traders used less than 1500ETB initially to participate in butter trading which is ranging from a minimum of 50ETB to the maximum of 1500Birr. while, 33.8% traders mostly whole sellers and some assemblers start with financial resources between 1501 and 5000 Birr at the beginning, the remaining 6.2% invest working capital of greater than 5000 Birr. Due to the reason that butter trading does not need

more initial working capital and there is credit access for butter trading in the sample markets, working capital was not found as a burrier to participate in butter trading.

4.5.1.2.3. Experience in butter trading

The 44% of traders found in over all markets had 6-10 years of experience and 28% were with experience of 1-5 years. There appears relatively high variation within a sample that it is from 2 to 18 years of experience at the retail and assembling level. This may explain that a trader with experience of 18 years and the other with 2 years experience were operating or running their business at the same time. Therefore, it can be said that, at the retail and assembler level, there is no barrier to entry in butter trading with regard to years of experience. While, it was observed that, at wholesale level of butter trading there is some indication of experience as a burrier to participate in batter trading with average years of experience 11 years. In addition to this, there appears a small variation among the mean, maximum and minimum years of experience at this level of trading. As a result, considerable burrier was observed with respect to years of experience at the wholesale level of butter trading.

Table 20. Years of experience in butter trading

		Retailer	wholesaler	Assembler
Years in butter trading	Mean	7.25	11.00	10.25
	Standard Deviation	3.86	4.69	5.42
	Maximum	15.00	16.00	18.00
	Minimum	2.00	7.00	3.00

Source: survey result, 2008

4.5.1.2.4. Risk barriers

Butter trade in the study areas was subjected to both demand and price risks as butter consumption is seasonal due to orthodox Christian fasting which covers about 60% of the year. Based on the informal market survey, some traders respond that they shift from butter trading at the time of fasting, as there was less demand then lower price during this period. Moreover, spoilage found to be other risk in butter trading due to Perishability nature of the product.

Following to the risk of seasonal variation in demand and price of butter, traders may reserved from participating in butter trading to averse the risk of loss. As a result, the risky nature of the business may impose considerable barrier on butter trade.

4.5.2 Market conduct

Market conduct refers to the patterns of behavior of firms. This implies analysis of human behavioral patterns that are not readily identifiable, obtainable, or quantifiable (Pomeroy and Trinidad, 1995). There are no agreed upon procedures for analyzing the elements of market conduct. Rather, some points are put to detect unfair price setting practices and the conditions under which such practices to prevail. In this study market conduct was analyzed in terms of the existence of formal and informal producer groups, formal and informal marketing groups, buying and selling strategy and the availability of market information and price setting.

4.5.2.1 Existence of formal and informal producer and marketing groups

Farmers only organized in terms cooperatives in Alamata woreda in which milk from individual farmers was collected and processed to butter and sold at the woreda market. As most cooperatives do, it collects temporal and spatial supply and demands of butter in order to set price of butter. Accordingly, the cooperatives said that the prevailing market was their reference to decide their selling and buying price. At market level, there was no such organization or grouping as individual traders operate lonely at any level.

4.5.2.2. Market price information behavior

Accurate and timely market information enhances market performance by improving the knowledge of buyers and sellers concerning prices, price trends, production, supply movements, stocks, and demand conditions at each level of the market (Kohls and Uhl, 1985). Although producers and traders are the direct beneficiaries of the accurate and timely market information, ultimately, there are benefits to the consumers and government, as a result of market efficiency

and enhanced competition. Hence, producers, traders and consumers require information on the most current prices in local and regional markets.

In the study areas, producers had limited market and weak bargaining power partly due to dearth of market information. Moreover, the sources of information are mostly informal, from other farmers, traders and personal observation. These sources are believed to be less accurate, inconsistent and delayed for production and marketing decision. Only 20% of the sample farmers were respond as they get weekly price information through formal sources (radio and woreda cooperatives). Based on the informal market appraisal, traders are more sensitive to every price changes and actively discover the price changes at different markets as their bargaining power highly depends on the information they have. Most of the traders get accurate, timely and consistent price information largely from weekly radio broadcast and other trade partners. About (56%) of the sample traders used radio as their primary source of market price information, 37.5% observe themselves by visiting the markets and the remaining 6.2% traders get from other traders of the same commodity.

Table 21. Traders market information source

Source of information	Supply information	Demand information	Price information
Radio	0	0	56.3%
Other traders	93.7%	90.6%	6.2%
Personal observation	6.3%	9.4%	37.5

Source: survey result, 2008

4.5.2.3. Buying strategy

All of the traders do not involve brokers and commission agents in buying and selling processes and operate by owners themselves. Sometimes traders (mostly between whole sellers and retailers) take butter from suppliers on credit basis and repayment was made right after the sale. About 64% of the sampled traders purchase butter from farmers directly. Traders are more informed than farmers regarding price of butter in local and regional markets. In this study,

respondents were asked to comment on who decided buying price. 96.9% believed negotiation as a tool for price decision

4.5.2.3. Selling strategy

Respondents reported their selling strategy as spontaneous to any buyer. There was no any contract-based marketing. Respondents were asked what issues they took into account to decide for whom to sell. They responded as they offered to anybody as far as he/she offered better price.

With respect to decision on selling price, 56% of the respondents said that the selling price of their butter was set by negotiation between them and the buyer who ever s/he may be. The other 25% of traders set their selling price according the market responses, while 18.8% sample respondents were used their purchase price as a reference to set the selling price of butter and they set the price early at the time of purchasing. Of the total respondents, 53.1% have their own shop to sell their purchase out of these 15.5% used notice board for advertizing.

4.5.3. Performance of butter market

Market performance refers to the impact of structure and conduct as measured in terms of variables such as prices, costs, and volume of output (pomeroy and Trinidad, 1995). The methods employed for analysis of performance were channel comparison and marketing margin. Following to Mendoza (1995), marketing channel is the sequence of intermediaries through which whole butter passes from farmers to consumers. The analysis of marketing channels is intended to provide a systematic knowledge of the flow of the goods and services from their origin (producer) to the final destination (consumer).

The outlet that farmers normally target for their marketable surplus is the local market. The flow of agricultural commodity from the production centers to the consumer end depends on the distance and market proximity, means of transport, availability and quality of infrastructures, the nature of the product, packaging, the need and purchasing power of consumers,

Most farmers sell butter in markets within their vicinity. This can be attributed to the small amount of butter produced and offered for sale, long distances, and to the high demand urban and peri-urban markets is rare because of reduced output levels and consequently the increasing transactions cost. However, of the product, around 28%, passes from producer to consumer. On the other hand, 27.2% of the total sold goes from producers to Woreda Retailers. 36.5% of butter produced sold for village assemblers at vicinity and rural markets. This is mainly because of the transaction costs and opportunity cost of time for farmers to immediate exchange is high since output levels are low. Therefore, village assemblers are involved in accumulating supplies for resale to whole sellers, retailers in regional, rural and urban markets.

Regional retailers purchase butter from farmers, rural assemblers and whole sellers and sold in Mekelle market mostly for consumers and hotels. Whole sellers are mainly found in the regional market, Mekelle while woreda and rural markets are mostly operate at retail and assembling level.

Eleven channels are identified in the process of butter transaction from producers to consumers. As could be observed from the figure the largest producer's share obtained was through a channel when a direct sale from producer to consumers is made. Along this channel, 4586.4kg of the total butter output was delivered. In addition, producer--Woreda Retailers--consumer channel constitutes the second largest share of butter flow in which that can indicate relatively with a better producers share.

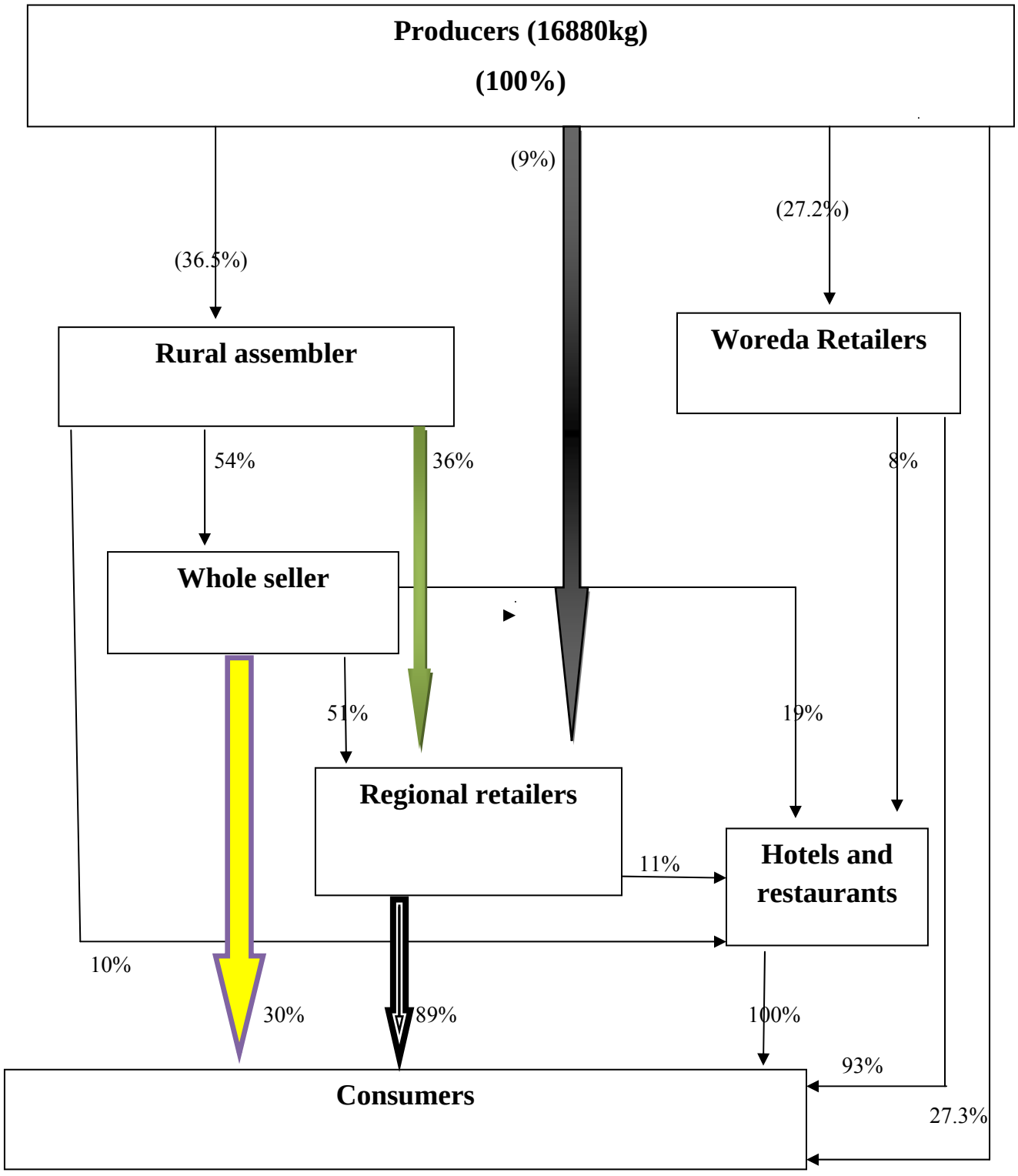

Figure 3. Butter market channels
Source; survey result, 2008

Channel 1: Producer --- consumer = 4586.4kg

Channel 2: Producer -----Woreda Retailers ----consumers = 4249kg

Channel 3: Producer ---- Woreda Retailers –hotels and restaurants –consumers = 2358.9kg

Channel 4: Producer----rural assemblers ---wholesalers –consumers = 1178kg

Channel 5: Producer –rural assemblers – wholesalers –regional retailers –consumer = 1682kg

Channel 6: Producer –rural assemblers – wholesalers –hotels and restaurants–consumers = 746kg

Channel 7: Producer –rural assembler –regional retailers –consumer = 2330kg

Channel 8: Producer–rural assemblers–regional retailers –hotels, restaurants–consumer= 275kg

Channel 9: Producer –rural assemblers –hotels and restaurants –consumer = 274kg

Channel 10: Producer –regional retailers –consumer = 1345kg

Channel 11: Producer –regional retailer –hotels and restaurants –consumer = 166kg

4.5.3.1. Marketing margin

Analysis of the level of marketing margins and their cost components could help to evaluate the impact of the structure and conduct characteristics on market performance.

A common means of measuring market efficiency is to examine marketing margin. This is an attempt to evaluate economic or price efficiency. The overall marketing margin is simply the difference between the farm gate price and the price received at retail sale. It is important to sort out the producers' share in the consumers' price and to know the shares of different actors. Market prices reflect two elements; marketing and transaction cost on one hand and normal profit on the other.

Based on the data on buying, selling, prices and applying the gross marketing margin calculation formulae, the marketing margins for trade participants in the supply chain are shown in Table 22. The producer's share of the consumer's price was found to be the highest along channel-1 followed by channel-2 and channel-4 that was 82.5% and 67.5% respectively.

Table 22. Butter market channels and marketing margin analysis.

Market actors	Marketing measures	Butter market channels										
		CHA-1	CHA-2	CHA-3	CHA-4	CHA-5	CHA-6	CHA-7	CHA-8	CHA-9	CHA-10	CHA-11
Quantity flow (kg)		4586.4	4249	2358	1178	1682	746	2330	275	274	1345	166
Producers'	Price/kg	51.2	51.2	51.2	54	54	54	54	54	54	54	54
Woreda Retailers	Price/kg	-	62.1	65	-	-	-	-	-	-	-	-
	Gross margin/kg	-	10.9	13.8	-	-	-	-	-	-	-	-
	Marketing cost/kg	-	5.814	8.5	-	-	-	-	-	-	-	-
	Net marketing margin/kg		5.086	5.3	-	-	-	-	-	-	-	-
Rural assemblers	Price/kg	-	-	-	72.5	72.5	72.5	77.1	77.1	80		
	Gross margin/kg	-	-	-	18.5	18.5	18.5	23.1	23.1	26	-	-
	Marketing cost/kg	-	-	-	10.8	10.8	10.8	13.4	13.4	15	-	-
	Net marketing margin/kg	-	-	-	7.7	7.7	7.7	9.7	9.7	11	-	-
wholesalers	Price/kg	-	-	-	80	77	80	-	-	-	-	-
	Gross margin/kg	-	-	-	7.5	4.5	7.5	-	-	-	-	-
	Marketing cost/kg	-	-	-	3.7	2.6	3.7	-	-	-	-	-
	Net marketing margin/kg	-	-	-	3.8	1.9	3.8	-	-	-	-	-
Regional retailers	Price/kg	-	-	-	-	86	-	86	86	-	86	86
	Gross margin/kg	-	-	-	-	9	-	8.9	8.9	-	8.9	8.9
	Marketing cost/kg	-	-	-	-	5.8	-	5.8	5.8	-	5.8	5.8
	Net marketing margin/kg	-	-	-	-	3.2	-	3.1	3.1	-	3.1	3.1
Hotels and restaurants	Price/kg	-	-	86	-	-	120	-	120	120	-	120
	Gross margin/kg	-	-	21	-	-	40	-	34	34	-	34
	Marketing cost/kg	-	-	12.8	-	-	22.6		22.6	22.6	-	22.6
	Net marketing margin/kg	-	-	8.3	-	-	17.4	-	11.4	11.4	-	11.4
Total gross marketing margin(complete) %		0	17.5	37	32.5	37	55	37	55	55	37	55
Producers portion (%)		100	82.5	63	67.5	63	45	63	45	45	63	45
Rank of channels by producers' share		1	2	4	3	4	5	4	5	5	4	5

Source: own computation, 2008, CHA = channel

4.6. Analysis of Factors Determining Butter Market Supply

Empirical analysis of the determinants of smallholder market participation has to deal with the econometric hazard of selection bias (Heckman, 1979). The problem arises because households (or individuals) face different types of decisions in relation to market participation, a discrete decision over whether or not to participate in a given market, and a continuous decision as to how much to sell conditional on market participation. Variables affecting the latter, continuous decision may affect the discrete participation decision.

Therefore, the aim of this section is to look at factors that affect market supply of butter. Some households may not prefer to participate in a particular market in favor of another, while others may be excluded by market conditions. Based on the data collected in the survey year, out of 200 butter producer households 39 of them are non-participants while the rest 161 are market participants. As a result, employing OLS to estimate the model may introduce a sample selectivity bias and the parameter estimates may not consistent and efficient. Therefore, following a two-stage procedure as suggested by Heckman (1979) procedures can overcome the problem of sample selection bias.

The first step of the procedure involves establishing the probability of participation in the output market by estimating a probit model. The level or magnitude of sales can be estimated readily by OLS model.

Before running the Heckman selection models, normality of the data, multicollinearity and heteroscedasticity test was carried out. The continuous explanatory variables were checked for multicollinearity using Variance Inflation Factor; while Contingency Coefficients were used to detect the degree of association among the discrete explanatory variables see Appendix Tables 4 and 5. According to the results, significant problems of normality, multicollinearity and heteroscedasticity were not observed. Likewise, endogeneity test was carried out for the explanatory variables and only frequency of extension contact and access to credit were endogenous variables. As a result, their predicted values were used to estimate the model by adopting the instrumental variable method.

4.6.1. Determinants of butter market participation decision

Heckman's model of market participation provides insights into the effect of socio-economic variables and transaction costs related to the market participation and level of participation. These transaction costs affect the marketing process in two ways. Firstly, the fixed transaction costs affect the decision of the households to either participate or not. Secondly, the variable transaction costs affect the level of sales of butter Goetz (1992).

It is represented that choice by the indicator variable BMP, which takes value one if the household enters the market for butter, and zero otherwise. The model of decisions to sell identifies characteristics that stimulate households to sell butter as opposed to those who do not.

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Table 23 presents the results of the probit estimations of factors significantly influencing the decision to sell butter. The model correctly predicted 95% of the observations, with significance chi-squared of 134.089.

Six of the hypothesized variables had coefficients that are significantly different from zero. Three of the variables were positively associated with the probability of selling butter. The quantity of butter produced, frequency of extension agent contact and market price information increased the chance of household selling butter. The other three significant factors were negatively associated with the probability of participating in butter markets. The family size, distance to the nearest market and distance to development center tended to decrease the likelihood of selling butter. All the significant variables had the expected signs.

Table 23. Probit results of butter market participation decision (first stage)

Variables	Coefficients	Marginal effect	t- ratio
CONSTANT	2.7176	.029594	1.285
	(2.1143)	(.03669)	
CREDACES[a]	-.1772	-.0019305	-.366
	(.48461)	(.005788)	
TOTBUTTP	.047962**	.00079**	2.68
	(.017892)	(.00053)	
EXTNFRQN[a]	.42218*	.00459*	1.742
	(.24233)	(.002866)	
HHAGE	-.03929	-.000427	-.629
	(.06247)	(.000920)	
HHSEX	-.194714	-.002120	-.325
	(.598307)	(.006989)	
FAMILYSI	-.59378**	-.004662**	-2.560
	(.23196)	(.001018)	
LABOURMA	.39666	.001586	1.06
	(.39735)	(.00127)	
EXPRIBUT	.003056	.000033	.075
	(.04098)	(.000440)	
NONDAIRY	.000004	.00000004	.082
	(.000051)	(.00000055)	
HHEDUCA	-.13378	-.00145	-.342
	(.39076)	(.005124)	
DISTMKT	-.24516***	-.00266***	-3.684
	(.06654)	(.004126)	
DISTDVLP	-.40316***	-.00439***	-3.659
	(.11017)	(.00672)	
DISTROD	.06625	.00072	.961
	(.06896)	(.001298)	
DISTWRDA	.05058	.00135	1.29
	(.03889)	(.00154)	
MRKTINFO	1.11575*	.01215*	1.987
	(.56153)	(.02106)	
OTHERLIV(TLU)	.17937	.00195	1.272
	(.14106)	(.00362)	
NOLOCBRD	.00047	.000005	.052
	(.00917)	(.000097)	
NOCRSSBR	.00017	.000001	.325
	(.00055)	(.000006)	

Percentage of correctly predicted 0.9547, N = 200
Chi-squared 134.08***, Log likelihood function = -31.63390
Restricted log likelihood -98.67847, [a] = predicted values
* = 10% sign level, ** = 5% sign level, *** = 1% sign level (STD errors in brackets)

4.6.2. Level of butter market participation

With the Heckman two-step approach, the first step is to estimate a Probit model of participation in the relevant market as a function of both those variables that likely also determine butter sales volumes, conditional on market participation, as well as one or more exclusion restriction variables (Wooldridge, 2006). With regard to this study, the exclusion restriction variable was made on market information access. This was done based on the ground that participant households are informed regarding butter markets. Likewise, the farmers are subsistent operators, they sell their product to cover their liquidity constraint, as a result, their decision how much to sell is made independent of the information they have. After they already decide to sell, the level is made irrespective of the market information. Therefore, market information determines whether to participate or not, however, once they decide to sell based the information they have the quantity supply decision is made independent of their market information knowledge. Study conducted by Goetz (1992) on food marketing behavior identified better information significantly raises the probability of market participation.

The second step is an OLS regression of the butter sales volume on the reduced regressors and the inverse Mills ratio (IMR) derived from the first-stage probit regression, which controls for the probability of market participation so that the remaining regressors are explaining sales volumes conditional on a given probability of market participation. As indicated in Table 24, the results of the determinants regarding the level of butter market participation. The R-square and adjusted R-square are respectively, 98% and 97.8%, with the overall significant fit F-value of 508.42. The inverse mills ratio (lambda) for the level of butter sales was significant, implying that a sample selection bias would have resulted if the level of sales in butter market had been estimated without taking into account the decision to participate in the butter markets. Three variables had coefficients significantly different from zero. The distance to the nearest butter market, distance to the nearest development center and quantity of butter output are significantly determining the level of butter sale among the participating households. Quantity produced have positive and highest marginal effect, on the contrary, distance to the market and distance to the development center have negative impact on the level of butter sales.

Table 24. OLS estimates of level of butter market participation

Variables	Coefficients	t- ratio
CONSTANT	-2.2968	-.419
	(5.4774)	
CREDACES[a]	.031115	.018
	(1.7095)	
TOTBUTTP	.95252***	61.470
	(.01549)	
EXTNFRQN[a]	.74102	1.023
	(.724576)	
HHAGE	-.13138	-.906
	(.14505)	
HHSEX	.24503	.129
	(1.8943)	
FAMILYSI	-.14392	-.247
	(.581967)	
LABOURMA	.299511	.323
	(.926815)	
EXPRIBUT	.082577	.725
	(.113970)	
NONDAIRY	.000041	.493
	(.000083)	
HHEDUCA	-.731070	-.672
	(1.08830)	
DISTMKT	-.50218***	-2.770
	(.18129)	
DISTDVLP	-1.13421***	-4.751
	(.23871)	
DISTROD	-.271465	-1.285
	(.21131)	
DISTWRDA	-.032181	-.515
	(.062532)	
OTHELIV(TLU)	.306410	1.143
	(.268291)	
NOLOCBRD	.001426	.354
	(.0040315)	
NOCRSSBR	.001056	.612
	(.0017251)	
IMR	16.4906***	11.013
	(1.49738)	
R-Square 0 .980606,	F-test 508.42***	
AdjR-Square 0 .97868,	N 200	

* = 10% sign level, ** = 5% sign level, *** = 1% significance level (STD errors in brackets)
[a] = predicted values

With respect to distance to the nearest market center, the closer the market, the lesser would be the transportation charges, reduced trekking time, reduced loss due to spoilage, and reduced other marketing costs, better access to market information and facilities. This improves return to labor and capital and increase farm gate price and the incentives to participate in economic transaction. Therefore, as it was hypothesized this variable is negatively and significantly related to market participation and marketed surplus. A study conducted by Holloway *et al.,* (1999) on dairy products market development in the Ethiopia highlands indicates that distance to market causes marketed surplus to decline. Similarly, study conducted by Wolday (1994) on food grain market in Alaba Siraro identified that poor access to market and volume of food grain supplied to market related negatively. This implies that the level of sales would be increased if the variable transaction costs could overcome through urbanization or expansion of market to the vicinity of butter producing households. The variable transaction costs will be reduced if the markets would be located closer to the farmers.

Distance from the village to the development center is again significant with a negative sign, reflecting the lower quality of service provision by institutions in more remote areas (e.g., late delivery of information, equipment, and poor supervision of extension workers).

A marginal increase in butter production also has positive and significant effect in level of butter market participation. Part of the product may be used for home consumption or sales. This indicates, as output of butter increases quantity of butter sale will increase due to output left from consumption or marketable surplus will increase. At the same time, the transaction cost of taking small quantity of butter to market is higher than selling large quantity. Consequently, households producing more found to increase their quantity of butter sale than those whom with lower butter output.

4.7. Production and Marketing Opportunities and Constraints

In this sub section, the constraints and opportunities of butter production and marketing are presented. This was done starting from production input supply throughout the chain and includes the chain actors and their role in the entire butter supply chain.

4.7.1. Butter production and marketing constraints

Butter production and marketing in the studied areas has been constrained by different problems. Consequently, the producers prioritized the major problems and constraints of production and marketing as: availability and quality of feed, shortage of supply of genetically improved dairy cows, low productivity of local breed cows, high disease prevalence, drug problem, shortage of clean water, poor knowledge and skill dairy management, poor animal health service, supply of improved dairying equipments and lack of capital are the most common problems of production of butter in the study areas. As to the marketing constraints of the small-scale producers: seasonal fluctuation of butter price, inconsistency of butter price information, low demand of butter during fasting and transportation facilities to markets found to be the major constraints. The severity and significance of the problems and constraints varies with in the households.

Availability and quality of feed

Inadequate availability and supply of quality feed, the low productivity of the endogenous cattle breeds and low supply of crossbreed cows are the major factors limiting dairy productivity in the study area. Feed, usually based on fodder and grass, are either not available in sufficient quantities due to fluctuating weather conditions or when available are of poor nutritional quality. These constraints result in low milk and then butter yields, high mortality of dairy cows, 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. About 45% of the households rank availability and quality of animal feed as first production constraint as its availability depends on the seasons of the year. About 21% respondents of the studied area specify feed problem as second production constraint. Because of the reason that the major source of feed for livestock is fodder and grass, the availability of feed mostly depends on condition of weather and availability and duration of rainfall. Not only shortage of own produced feed, but also supply of feed at local and woreda markets is very low and inconsistent throughout the production year.

The problem of feed could be minimized through providing alternative sources of feed, other than the existing rainfall dependent feed production, like integrated forage production activities together with water harvesting works. This activity was already established by the woredas OoARD and IPMS project in recent times as promising option to minimize this problem. Exercising cut and carry feeding system and improved nutrition through adoption of sown forage and better crop residue management can substantially raise livestock productivity and minimize feed problem. Lastly, creating processed feed supply at nearby markets found of the solutions to minimize feed problem of the producers.

Table 25. Production and marketing constraints of butter producer households

Problems	Rated as 1st (%N)	rated as 2nd(%N)	rated as 3rd(%N)	rated as 4th(%N)
Production problems				
Feed problem	45	21	1	-
Problem of crossbreeds cows supply	38.5	27	3	-
Drug problem	15	18	6	1.5
Disease problem	5.5	15.5	9.5	-
Shortage of clean water	9	9	8	0.5
Poor knowledge and skill of dairy management	-	-	1	0.5
Poor animal health service	-	5	2.5	-
Equipment problem	-	-	1	0.5
Lack of capital	-	-	0.5	1
Marketing problems of producers				
Seasonality in price and demand of butter	51.5	44.5	4	-
Inconsistency of market information	33.5	31.5	-	-
Transportation problem to markets	-	-	2	-

Source: survey result, 2008

Shortage of crossbreed cows supply

Several researchers have reported that introduction of crossbreed cows enable to achieve rapid breakthrough in milk, butter production, longer lactation period and shorter inter calving period. Moreover, crossbreed cows convert feed in to milk more efficiently than indigenous breeds. In addition, the unit cost of milk production is significantly lower for crossbreeds as compared to the local breed cows. Therefore, the productivity of crossbreed cows is often substantially higher than that of local breeds (Sharma and Singh, 1995). Provide this, inadequate supply of improved breed cows and less availability of AI services found to be important production problems in the woredas, as the endogenous cattle breeds are characterized by low productivity. Out of the total respondents about 39% and 27% farmers list problem of improved breed supply as their first and second production problem respectively. Introducing artificial insemination (AI) with community based breeding strategy and increasing supply cross breed cows are the suggested solutions by the farmers and key informants to minimize it.

Butter marketing problems

The farmers identified seasonality in demand of butter and inconsistent price information as major marketing problems. This results in to weak linkage between producers and consumers of the supply chain. With respect to this consequence, producers were faced to high production cost and lower price in the market. For 51.5% of the producers lower demand during fasting periods and variability of butter price seasonally were their primary marketing problems. In addition to this, inconsistency of butter price information was also suggested as main problem for 33.5% of the sample farmers. For the seasonality in demand for butter, processing technologies and improved storage facilities, which could be extend the shelf life of butter could be a solution. To the producers with inconsistent information and market access, forming butter producers cooperatives to update timely information and creating market access may minimize the marketing problem.

Other problems

high disease prevalence, shortage of clean water, drug problem, poor knowledge and skill of dairy management, poor animal health service, supply of improved dairying equipments, lack of capital and transportation facilities to markets observed as the constraints of butter production and marketing in the study areas next to the former main problems.

4.7.2 Marketing constraints of butter traders

As indicated Table 26, the major problems faced by butter traders include: adulteration, seasonal variability of demand of butter, absence of permanent market place, inconsistent market information, absence of communication Medias to remote markets, Perishability nature of butter, transportation problem with regard to availability and cost are reported as the major problems. Only some of the most important problems are briefly discussed below:

Table 26. Marketing constraints of butter traders

Marketing problems of traders	Prioritization of problems		
	Ranked as 1st	Ranked as 2nd	Ranked as 3rd
Adulteration problem	50%	9.6%	6.3%
Seasonal fluctuation of butter price	31.3%	18.8%	12.5%
Absence of regular market place	18.8%	15.6	
Inconsistent market information		40%	15.7%
Absence of communication medias to remote markets		3.1%	3.1%
Perishability nature of butter			9.6%
Transportation problem		37.5%	6.3%

Source: survey result, 2008

Based on the survey results, for 50% of the butter traders adulteration was the main problem as there was no accurate way of identifying the organic butter from the adulterated one. Due to the prolonged period orthodox Christian fasting, seasonal fluctuation of butter

price found to be a second important problem of the traders, as 31.3% and 18.8% of them ranked as first and second marketing problem respectively.

4.7.3. Butter production and marketing opportunities

In spite of the problems and constraints that may hinder the development of the dairy sector identified in the area, the majority of dairy producers of both the woredas were interest to expand and/or involve in dairying in the future. As the producers said, the production and marketing support services (dairy input supply, extension service, credit access and market information), which are agents of development for the dairy sector, are provided and improved from time to time. In addition, GOs and NGOs like WoARD, Tigray agricultural research institute, IPMS, world vision Ethiopia, and others are promoting as well as actively participating for the development of the dairy enterprise in the study woredas. Moreover, marketing and production opportunities are likely to be improved. Urbanization, increasing number of supermarkets and restaurants in Wukro, Alamata, and Mekelle towns create a high demand for butter in the towns.

The other opportunities of production and marketing in the studied areas are:
Crossbreed cows were introduced and continuously disseminating until each individual farmer could own these breeds.

All farmers have access to extension service related to dairying; regard less of the variation in frequency of DA contact

- There are micro finances, supporting credit for these households dairying activity, like DCSI, cooperatives and others at woreda and PA level.
- integrated modern forage production activities are initiated by OoARD and IPMS project and taken in to action recently
- The rapid urbanization, substantial population growth and change in the living standard by urban societies in the area, increases demand for good quality and quantity of butter.
- The dairy cooperatives, especially in Alamata woreda, could create markets and opportunities to get enough market information, then remunerative prices.

Over all, the study areas are agro ecologically suitable for livestock production generally and dairy production specifically, being dairying is common activity for centuries in the area.

4.8. Identification of Important Constraints and their Possible Intervention Points throughout the Entire Butter Supply Chain

The objective of this sub section is to identify points of the chain with critical problems in the butter business operations. In addition, make problem analysis of the butter value chain and identify intervention areas where by the study could design means of alleviating the main problem and the obstacles that hinder the butter business operation. Finally, apply the means and get rid off the limitations through possible intervention points so as the business activities across the butter value chain would be smoothened.

The major producers of butter in the districts are the smallholders with low-level technologies and remained with poor productivity of the dairy sector. Service providers and processors, like hotels and restaurants, super markets are also using smallholders as major suppliers. For most of the seasons, these stalk holders fail to address the increased demand of butter and could not able to run their activities because of unsustainable supply of the products from farmers who rely on traditional and less efficient method of production.

On the other hand, during fasting periods of Ethiopian Orthodox Church and at the time of high marketable supply, butter producers faced with less demand and/or less remunerative prices for their produce. Such an outcome forces the farmers to squeeze output and sell their produce at the local market for immediate cash need as the price could not cover the transaction cost of taking to zonal or regional markets. This in turn reduces marketable supply, private investors, institutions and other chain actors from the business. Therefore, producers become discouraged to invest additional capital to increase their marketable surplus, at the same time, the market could not fulfill consumers' demand, which results to market inefficiency.

Based on this consensus, it important to identify the root causes of the major problems throughout the supply chain to improve the market efficiency and promote commercialization of the small-scale dairy producers. Hence, the prevailing production and marketing constraints were categorized in three points as production input problems, post harvest and marketing problems.

Input constraints: despite the large number of dairy cattle in the woredas (see appendix table 1), dairy production has not been fully exploited and promoted. This could be partly due to the production inputs used by the households, in which breed of dairy cows, feed, butter equipments and drug and veterinary service are not well developed. Moreover, the producers were pointed out that availability and quality of feed, low supply of crossbreed cows, low productivity of local breed cows and drug supply was their major input constraints. Increasing the supply of crossbreeds or introduction of community based breeding strategy, better feeding and management in the form of modern way of dairy producing and extending the veterinary service coupled with drug supply can improved dairy production and therefore smallholder producer will have remarkable impact in the future prospect of the sub sector.

Post harvest problems: even if butter have better shelf life of the dairy products, it still needs proper storage, processing, packing and handling technique unless otherwise, should be sold within short period after produce to maintain its quality. As subsistence producers, the farmers could not properly store, pack and process their produce using modern technologies rather they sold it immediately at the prevailing market prices. However, seasonality in consumption of the product coupled with market imperfections can reduce the price then profitability. Therefore, processing technologies, improved storage, packing and handling materials could be justified as a means of way out and provides an option to choose the best market and time to sell.

Marketing constraints: The marketing and distribution channels are determined by the supply chain participants such as the farmers, local traders, assemblers, wholesalers, regional retailers and hotels and restaurants. As per the suggestion of these chain actors, Seasonality in demand of butter, inconsistent price information, adulteration and Seasonal fluctuation of butter price were the major marketing problems identified. Therefore, Introduction of processing technologies (to extend shelf life), establishing farmers' cooperatives (to get marketing services and gain from economies of scale) and establishing quality control (to protect adulteration) are the likely intervention points in this sub sector.

The Value Chain Diagram: The butter value chain is the channel of how the business receives raw materials as input to dairy farm to get butter, add value to the product through various processes, and sell processed and packed butter to customers as they demand. It

involves all the process from the market point back to the beginning of activities usually between input supplies to dairy farm and butter marketing as indicated in figure (4).

The possible intervention points of the value chain are:

- Introduction of crossbreed cows or Artificial Insemination (AI) service can help to improve the milk capacity of indigenous livestock of the rural farm community.
- Training farmers on modern feed production, better feeding and management practice can bring change in the scale of production as well as business operations.
- Supplying veterinary service, drug and training on improved health management techniques
- Organizing butter producers and marketing coops
- Setting-up of a quality assurance system for the entire chain and,
- Promotion of butter producer and marketing associations.

Figure 4. Diagrammatic representation of production and marketing constraints and corresponding strategic intervention points in the entire butter supply chain

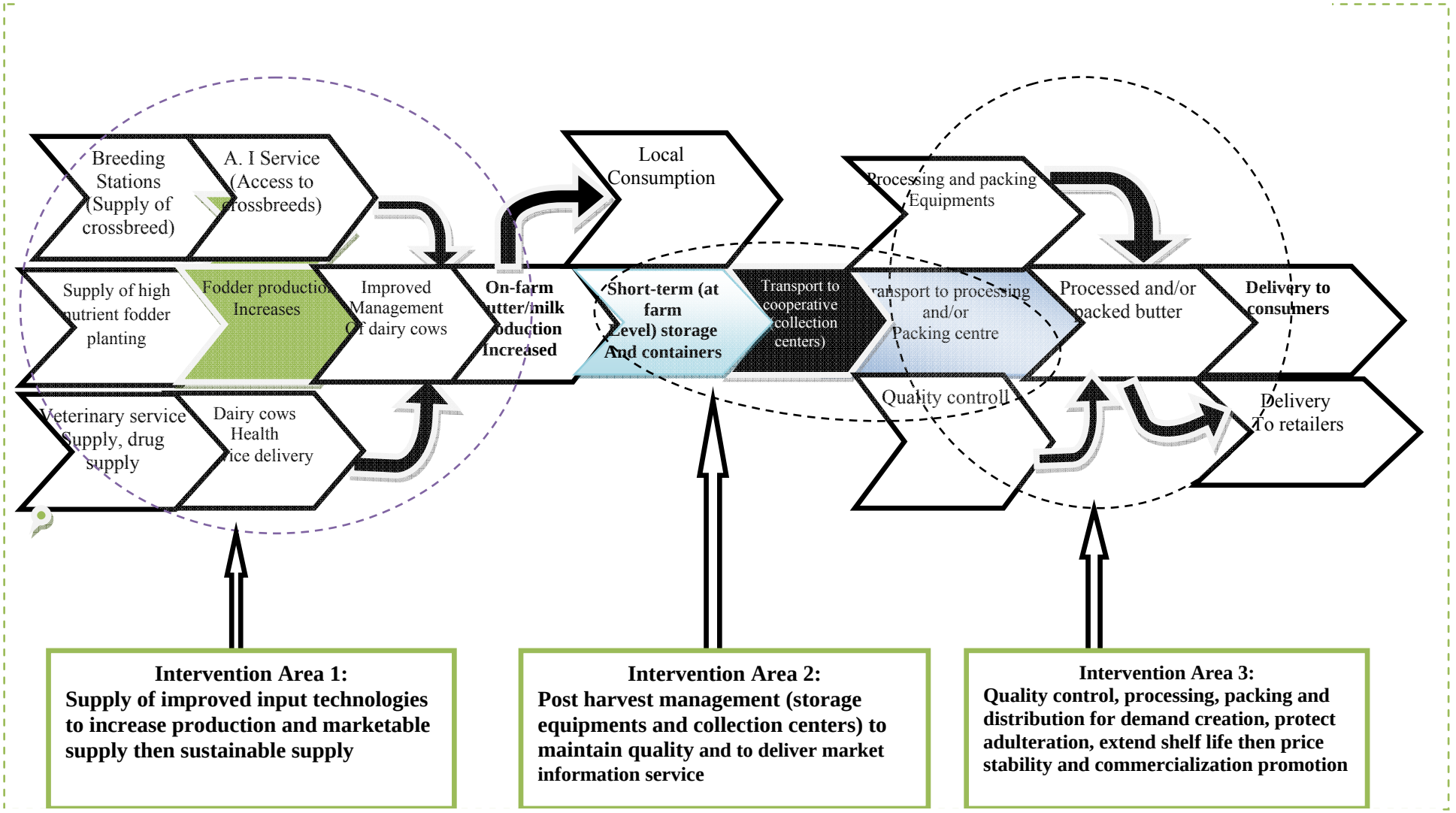

Figure: Butter value chain, the diagram is adopted from (Johannes, 2005)

5. SUMMARY, CONCLUSION AND POLICY IMPLICATIONS

This chapter provides the summary, conclusions and recommendations of the study of butter supply chain conducted in Tigray national regional state with special reference to Atsbi-Wonberta and Alamata woredas. The choice of the commodity (butter) was made with intent based on the ground that butter is the only marketable commodity of the dairy products, as milk transaction is culturally prohibited in the rural households of the study areas.

5.1. Summary

The results of the study that was analyzed using descriptive statistics and econometric models with the help of STATA statistical software are summarized as follows.

Of the 200-interviewed butter-producing households, 81.5% are male-headed and the rest 18.5 % were female-headed households. 51% of the respondents range under age category of 45-64.99 years and 45%, 4% are under the category of 20 - 44.99 and 65 and above respectively. The average family size was 6.5, and average economically active labor force of the households is 3.8 person-days as measured in man equivalent. 40.5% of the farmers were literate to read and writes. The overall proportion of illiterate farmers was 38.5% of the total respondents, about 20% and 1% are elementary completed and high school educated households respectively.

Butter is an important source of food, cosmetics and common marketable form of dairy product in the study areas. The total butter production in the survey year was 18880kg in both the woredas, out of this 87.6% was supplied to market. Households allocate the revenue from butter sale to household consumption expenditure. Only 2.5% of the respondents, mostly those living around urban areas and own crossbreed cows, used their butter revenue to save.

Butter production and marketing supporting services were identified to be input supply, credit service, extension service and market information access in this study. The inputs that are used for butter production like type of breeds, feed, veterinary service, equipments and drug were found to be in a traditional basis.

From the total interviewed households about 58% of them responded that they have no access to improved (cross) breed cows. Out of the total introduced crossbreed cows 72% were supplied by the woredas office of agriculture (BoARD), in addition 25% and 3% were introduced by relief society of Tigray (REST) and from market respectively. The econometric result of factors determining households' access to crossbreed cows indicates frequency of extension agent contact Access to veterinary service and participation in extension demonstration increased the chance of household access to crossbreed cows. Whereas, distance of households' residence from their woreda town affects the probability of access to the breeds negatively.

The dependability of availability and quality of feed up on the seasons of the year resulted to persistent feed shortage from year to year in the woredas. Out of the total interviewed households, 59% of them respond as they face shortage of feed for their lactating cows from year to year. Similarly, the econometric results of access to feed shows credit access, experience in dairying and labor supply, are positively associated with the probability of households' access to feed markets. On the other hand, distance to market shows significant and negative marginal effect on the households' access to feed.

As to the veterinary service, except the households nearer to or live in towns, who can sometimes get veterinary service from privet specialists, all of the households get veterinary service from OoARD of the respective woredas. In each woreda there is one veterinary expert assigned by BoARD to serve the whole woredas' households. However, the households responded that they do not get timely and adequate veterinary service in both the woredas. Of the households with drug access, 72.5% of them buy drugs from market, drug stores and the rest (27.5%) informed as they get drug from the woredas OoARD. With respect to the econometric result, among the hypothesized determinants of households' access to drug, Frequency of extension contact and number of lactating cows have positive and significant relation, whereas, distance to the nearest market has inverse and significant marginal effect.

While investments in additional crossbred dairy cows and other dairy technologies has the greatest potential for smallholder butter production, the full butter production potential from the adoption of improved dairy technologies is not been realized. This is attributed, in part to the fact that the credit provision has not had due attention to butter production on smallholder

dairy farms. Of the hypothesized explanatory variables determining households' credit constraint condition for dairying, five of them found to be significant factors affecting farmers' credit constraint condition. Herd size, off farm income and frequency of extension contact found to be negatively and significantly affecting farmers' credit constraint condition. Whereas, family size and distance to development center shows direct relationship to be credit constrained.

The woreda office of agriculture provides agricultural extension services in the woredas. The frequency of extension agent contact shows a difference among the producers, which is ranging from one to four times contact per month. Out of the total respondents, 31% of them get DA contact four times per month and 24%, 29%, and 16% of the sample households had three times, twice and once DA contact per month respectively. The type of extension service with regard to dairying was technical advice, input using and credit allocation and/or utilization as applied to dairy production and marketing.

Unlike the formality of the source of information, 92% of the sampled households were able to get butter market price information. On the other hand, 8% of the farmers respond, as they had no any information, even the informal one, to make a marketing decision. Only 20.7 % of the total sampled households inform that they used formal information sources from radio and cooperatives.

The major constraints of butter production in the studied areas were inadequate availability and supply of feed, the low productivity of the endogenous cattle breeds and low supply of crossbreed cows. Lower demand of butter during fasting periods and variability of butter price seasonally were also the major marketing problems. In addition to this, adulteration and seasonal fluctuation of butter price due to the prolonged period of Orthodox Christian fasting, was the main problem of butter traders.

The overall average production cost of butter producer farmers was 1838.9 ETB per cow/year. Out of this, variable costs accounted for 83.3% (Birr 1532.4 per cow/year) and fixed cost accounted for 16.7% (Birr 307.5 per cow/year) of total cost of production. The gross revenue of butter from crossbreed cows was 3198.4 Birr per cow/year, which is much greater than gross revenue of local breed cows that is 834.2 Birr per cow/year. The net

returns, generated after deducting all financial and opportunity costs of resources used for butter production, found to be 1623 ETB per cow/year from crossbreed cows and 213 ETB per cow/year from local breed cows with overall average net return of 918.3 ETB per cow annually. Based on the figures resulted from the survey, butter production in the studied woredas have been profitable, even if the profit varies between the breed types of cows used for butter production.

Following the market structure criteria of concentration ratio, butter market shows competitive nature in Atsbi market with C_4 of 31%, and weak oligopolistic nature in Alamata and Mekelle markets as the concentration ratio shows to be 39% and 44% respectively. The lower concentration ratios may be due to small volume of the product was traded and much of the product passes directly from producer to consumer. Butter trading in the studied markets does not need a trading license and due to the reason that butter trading does not need more initial working capital, it was not observed entry barriers in relation to licensing and working capital. However, considerable burrier was observed with respect to years of experience at the wholesale level of butter trading. In addition to this, the risk of seasonal variation in demand and price of butter imposes considerable barrier on butter trade.

As to the conduct of butter market, 93% of the traders get accurate, timely and consistent price information largely from weekly radio broadcast and own observation. All of the traders do not involve brokers and commission agents in buying and selling processes and operate by owners themselves. About 97% of them believe negotiation as a tool for price decision.

The methods employed for analysis of butter market performance were channel comparison and marketing margin analysis along each channel. Eleven channels are identified in the process of butter transaction from producers to consumers. The producer's share of the consumer's price was found to be the highest along channel-1, which is producer--consumer followed by channel-2 and channel-4 that was 82.5% and 67% respectively, moreover, these channels shares the larger volume of the traded butter.

With respect to the first stage (probit model) of Heckman two-step approach, six of the hypothesized variables had coefficients that were significantly different from zero. Three of the variables were positively associated with the probability of selling butter. The quantity of

butter produced, frequency of extension agent contact and market information access increases the chance of household selling butter. The other three significant factors were negatively associated with the probability of participating in butter markets. The family size, distance to the nearest market and distance to development center tended to decrease the likelihood of selling butter.

In the second stage (heckit) the inverse mills ratio (lambda) for the level of butter sales was significant, implying that a sample selection bias would have resulted if the level of sales in butter market had been estimated without taking into account the decision to participate in the butter markets. Three variables had coefficients significantly different from zero. The distance to the nearest butter market, distance to the nearest development center and butter output, are significantly determining the level of butter sale among the participating households.

5.2. Conclusion and Policy Implications

The farmers are generally poor and contribute inadequately to the mainstream market because of a low production and poor access to other options for obtaining a livelihood. It is found, however, that these farmers can survive economically when given a set of opportunities to transform them from subsistence to commercial operators. Based on this consensus and the findings of the study, the following recommendations are suggested to be considered in the future intervention strategies, which are aimed at the development of butter production and marketing in the study area in particular and other areas with similar setting.

The econometric result of heckman's two stages clearly indicates that a marginal increase in butter output increases both market participation and level of supply. This is because farmers' decision to participate in the market and to increase their level of participation is normally driven by the availability of surplus produce. Therefore, policy efforts should give due attention to enhance the production capacity and productivity through the provision of improved production technologies like crossbreed cows, quality feed and proper management techniques.

Similarly, positive and significant relation of frequency of extension contact on participation decision might be on reflection of market extension services rendered to smallholder should be relevant and enough. However, with major thrust of extension agencies on production techniques, marketing extension so far has not received the attention, as it deserves. Moreover, farmers have increasingly begun to perceive marketing rather than production as the major constraint to enhancing farm incomes. Marketing extension was a peripheral issue in the extension scenario so would need to be brought to centre stage and production needs to be significantly dictated by market requirements. Another need is enlightening the producer seller on consumer preferences and to advise them on the proper methods of processing for marketing, storing, packaging, handling and transporting and to improve the quality of the produce to secure a better return.

An implication for negative effect of distance to nearest market might be, the closer the market, the lesser would be the transportation charges and other transaction costs, better access to market information and facilities. This calls for investment in a good physical infrastructure is of the essence if smallholder participation in the markets is to be encouraged. Markets should be brought closer to the farmers in order to address the problem of proximity to markets. This can be done by establishing market infrastructure that includes collection points and/or a transport system. This strategy can cater for the emergence of transport contractors, the opening of road networks, the development of collection points, and investment in road infrastructure.

Furthermore, the negative sign of distance to development center also reflecting the lower quality of service provision by extension institutions in more remote areas (e.g., late delivery of information, equipment, and poor supervision of extension workers). The link between extension services and farmers could be enhanced by improving the farmers' access to and the use of telephone networks and/or road networking coupled with transportation facilities to and from the development center. This could be instrumental for farmers to contact development workers and information centers.

Equivalently, family size also has significant and inverse relationship with participation decision. This shows that typical sample households with many members tend to consume more than they contribute to the sales of the butter. These findings bring to the fore the

importance of a demographic policy which takes into account the composition of the households. For a commercialization process to be successful, it is pertinent to determine the role of different household members in household's market participation. For example, consideration should be made on how to make youth to contribute to production and market participation process (in contrast to being dependent).

The econometric model result of heckman's first stage come up with significant coefficient on market information, the problems associated with market information seem lead to low awareness of butter transaction. Hence, market information is the important component for improving the whole marketing system. The availability of timely information to farmers can increase farmers' bargaining capacity and participation.

Probit model results of access to crossbreed cows suggest availability of veterinary service, participation in extension demonstration, frequency of extension contact and proximity to woreda town determines farmers' probability to have access to such breeds. In response to this, adequate and on time veterinary service, providing training with regard to crossbreed management and treatment can minimize loss of livestock and initiate serving institutions their supply of these breeds. The implication for distance to woreda again suggests the opening of road networks, Marketing institutions and market access in order to provide farmers with options to get crossbreed cows.

Base on the econometric result of farmers' access to feed, the credit access, experience in dairying, labor supply and distance to feed market found to be significant determinants. This in turn calls for well-developed credit service, farmers training on feed production and creation of local and processed feed supplies at nearby markets might eradicate farmers' problem of feed.

As can be referred from Probit estimates of the households' access to drug, frequency of extension contact, number of lactating cows and distance to market determines drug access to butter producers. This finding implies the need for extension agent's advice, information and technical training as applied to source, quality, and relevancy of cattle drug for each cattle disease. Moreover, extending adequate drug supplies to farmers' proximity is also the other implication of the result.

The households' credit constraint condition model estimates indicate, herd size, distance to development center, off farm income and frequency of extension contact are the factors associated with credit constraint condition. The result clearly underlines the need for collateral, liquidity constraint and information regarding credit use affects farmers' credit access. In line with this, financial institutions should not rationed credit service by collateral and/or government or other NGOs should address for the less favored households for their capital constraint in expanding the dairy enterprise.

Information regarding credit access, utilization and allocation in relation to dairy production should be delivered by development agents and the financial institutions. At the same time, livelihood diversification strategies by households could solve their liquidity constraint for credit transaction.

Over all, more attention is needed for investments in development of physical infrastructure, communication and road networks. It is also important develop farmers awareness and decision making capacity through training as well as experience sharing. Institutional arrangements like cooperatives can also be very successful in dealing with both information asymmetries and easily attain competitive edge. They do this through collective action, pooling resources and lowering the unit cost of transactions. In addition, extension agents service should go beyond production technique and therefore should address issues related to marketing, saving and finally, commercialization could be achieved.

Figures of the profitability analysis clearly show the profit that households drive from butter production highly varies between the crossbreed cows and the local ones. This result informs policy measures in relation to dairy development should promote investments in additional crossbred dairy cows and other dairy technologies that provide greatest potential for smallholder butter production. By doing this, the full butter production potential from the adoption of improved dairy technologies can be realized.

Even if the channel and gross margin result of butter market performance reveals as there are alternative channels that producers can get remunerative price and better share for their product, the capability of identifying the best outlet, price and time to sell were found difficult for them. Hence, existing or new co-operatives should be encouraged to provide

marketing services. Local co-operatives could serve as collection points for farmers' product. This can help them to search for best market as well as on time and consistent information of demand, supply and price of butter. This in turn motivates them to produce more and gain from economies of scale.

As per the traders' suggestion, market infrastructures like formal market place, road and communication networks to rural markets are the prevailing problems at retail level. For this reason, butter-trading activity has to be recognized as a formal job for small-scale entrepreneurs of the urban poor; especially most of them are women. Therefore, they need to receive direct and indirect supports from the government and other sectors through training on business, upgrading physical retail market infrastructure and market information. These activities will result in benefit not only the butter traders but also producers, an opportunity to alternative market demand and with competitive price.

Another problem is the perishable nature of the produce and seasonal fluctuation of butter price for both traders and farmers. For this reason, it should be stored until better market conditions exist. In other words, the development of storage facilities or processing technology would make a big difference in the economics of the marketing behavior of these marketing agents. Such developments can provide great opportunities for private sector development in the rural areas and value addition to the product.

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APPENDICES

Appendix table 1. Cow population in Atsbi- Wenberta and Alamata woredas

Atsbi-Wonberta		**Alamata woreda**	
Name of PA	No. of Local breeds	Name of PA	Number of local
Habes	972	Tao	3514
Felegewoyni	1290	Laelay Dayu	3644
Dibab Ahoren	1956	Gerjele	3131
Zarema	1533	Kulgize Lemlem	1071
Michael Emba	2240	Selam Bikalsi	1951
Adi Mesani	1776	Limaat	3506
Ruba Feleg	1780	Timuga	9385
Hayelom	1789	Selen Wuha	7532
Golgol Naele	1620	Tsetsera	9913
Haresaw	1681	Merewa	4960
Kelsha	3634	**Total**	**48607**
Barka Adisebha	1617		
Era	3364		
G/kidan	1704		
Hadnet	1521		
Kalamin	2111		
Total	**30588**		

Source: Atsbi-Wonberta and Alamata woredas office of agriculture, 2008

Appendix table 2. Conversion factors used to compute tropical livestock units.

Livestock type	TLU
Calf	0.20
Weaned Calf	0.34
Heifer	0.75
Cows/oxen	1.00
Sheep/Goat	0.13
Sheep/Goat (Young)	0.06
Camel	1.25

Source: Storck *et a*l., (1991)

Appendix table3. Conversion factors used to compute person-days equivalent (agricultural labor force)

Age group	Male	Female
<10 years	0.00	0.00
10-13 years	0.35	0.35
15-50 years	1.00	0.80
>50 years	0.55	0.50

Source: storck *et al*., 1991

Appendix table 4. Test for Multicollinearity

Continuous independent variables	Collinearity Statistics	
	Tolerance	VIF
Total annual butter production	.697	1.435
Total family size	.317	3.150
Labor supply	.258	3.881
Years of experience in butter production	.653	1.531
Age	.697	1.435
Off farm income	.928	1.078
Frequency of extension contact	.647	2.981
Non dairy financial income	.770	1.298
Distance to the nearest market center	.624	1.602
Distance to the development center	.609	1.643
Distance to the woreda town	.688	1.454
Distance to weathered road	.728	3.510
livestock owned in TLUequivalent	.436	2.292
Number of local breed cows	.287	2.392
Number of crossbreed cows	.510	1.457
Total cultivated land in hectare	.483	2.398
Number of oxen	.612	1.673

Source: own computation

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

Appendix table 5. Contingency coefficient

	SEX	EDU	VETACS	DEMOPAR	MINFO
SEX	1				
EDU	.179	1			
VETACS	.021	.170	1		
DEMOPAR	.113	.212	.014	1	
MINFO	.067	.177	.018	.251	1

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

Appendix table 6. Commitment Level of Export Subsidies on Milk Products (Rs. /Kg)

	1995	1996	1997	1998
		Canada		
Butter	146.23	59.14	62.73	51.20
Skim Milk Powder	24.57	33.70	34.87	33.29
Cheese	-	-	-	-
		European Union		
Butter & Butter Oil	315.58	333.11	232.57	29087
Skim Milk Powder	40.50	74.02	49.41	65.12
Cheese	45.87	46.84	41.69	48.17
		U.S.A.		
Butter & Butter Oil	22.68	78.17	17.82	186.81
Skim Milk Powder	23.94	125.51	32.79	38.86
Cheese	5.41	4.94	4.21	1.48

Source: Chand, Ramesh and Linu Mathew (2001)