Mekelle University

College of Business and Economics

Department of Cooperative Studies

"DETERMINANTS OF PASTORALISTS' LIVESTOCK INCOME IN THE MIDDLE AWASH, SOUTHERN AFAR, ETHIOPIA"

By

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A Thesis

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In

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Advisor:

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This work is dedicated to the late Kalkidan Tamene (1977 – 1997 EC), whom I lost by a car accident. May God place your soul in the Heaven, Amen!

Declaration

This is to certify that this thesis entitled "Determinants of Pastoralists' Livestock Income in the Middle Awash, Southern Afar, Ethiopia" submitted in partial fulfillment of the requirements for the award of the Degree of Master of Arts, in Cooperative Marketing to the Collage of Business and Economics, Mekelle University, through the Department of Cooperative Studies, done by Mr. Derib Woldeyohanes Benti, Id. No. FDA/PS0018/2000 is an authentic work carried out by him under my guidance. The matter embodied in this project work has not been submitted earlier for award of any degree or diploma to the best of my knowledge and belief.

Name of the student: Derib W/Yohanes Benti ***Signature and Date …….....***

Name of the Advisor: Dr. R. Dayanandan ***Signature and Date ……***

Biography

The author, Mr. Derib W/Yohanes was born on June 12, 1980 in Guraghae Zone of Southern Nations Nationalities and Peoples Regional State to his mother Mrs. Alemnesh Endale and his father Mr. W/Yohanes Benti. He attended his elementary and junior secondary education in Kotter Gedra Elementary and Junior Secondary School and secondary education in Emdibir Comprehensive Secondary School, both in Guraghae Zone. Then he joined Alemaya University in 1999/2000 academic year and graduated with Bachelor of Agriculture in Agricultural Extension. Since his graduation in July 2003, he was employed by Ministry of Agriculture and Rural Development as instructor of agricultural extension in Gewane Agricultural Technical and Vocational Training College, Afar region. After five years of services in the college, he has joined School of Graduate Studies at Mekelle University in July 2008 to pursue Master of Arts Degree in Cooperative Marketing in the Department of Cooperative Studies, College of Business and Economics.

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Derib Woldeyohanes

Abbreviations

ALSI …….. Annual Livestock Income

ANRS ……. Afar National Regional State

ATVET …….. Agricultural Technical Vocational and Educational Training

BPARD …….. Bureau of Pastoral Agriculture and Rural Development

CSA …… Central Statistical Agency

EEA …… Ethiopian Economic Association

ETHB ……..….Ethiopian Birr

FAO …….....Food and Agriculture Organization

FDRE ……..Federal Democratic Republic of Ethiopia

FDRECC …….Federal Democratic Republic of Ethiopia Census Commission

GDP ……..…Gross Domestic Product

IFAD ……International Fund for Agricultural Development

LID ……..…. Livestock in Development

MLSI ……Mean Livestock Income

MOA ……Ministry of Agriculture

MOARD …….. Ministry of Agriculture and Rural Development

MOFED ……... Ministry of Finance and Economic Development

NGOs ……...…… Non Governmental Organizations

OLS …….. Ordinary Least Squares

PARDB …… Pastoral Agriculture and Rural Development Bureau

PCDP ……..……. Pastoral Community Development Project

PFE ……..…… Pastoralist Forum Ethiopia

PLI …….…….. Pastoralist Livelihood Initiatives

PRF …….. Population Regression Function

SPSS …… Statistical Package for Social Sciences

TLU ……..……Total Livestock Unit

USAID …… United States Agency for International Development

USD …….……United States Dollar

VIF ……..…….Variance Inflation Factor

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Abstract

Ethiopia is among the first ten nations in the world with respect to the livestock population. However, the benefit obtained from the sector is low compared to other African countries and the world standard. The economic gain for the pastoralists, who predominantly live on rearing livestock for their livelihood, is below the national average. Therefore, identifying the major determinant factors affecting income from livestock is needed to device appropriate development interventions to improve livestock income and thereby living standard of pastoralists.

This study was conducted in Amibara and Gewane woredas of Afar Region with major objective of analyzing determinant factors affecting pastoralists' livestock income. A random sampling procedure is used to select 10 PAs and 100 sample respondents. Primary data are collected from sample respondents and focussed groups through personal interview and discussions using structured interview schedule and checklists, respectively. Data on demographic and socioeconomic characteristics of the sample respondents are presented and discussed using various tools of descriptive statistics. The survey result reveals that 66% of sample respondents receive ALSI below the average livestock income [less than ETHB 10,839.40] in the study area. Among four major sources of household income identified for the study area, livestock income contributes 73.30% of the total household income followed by employment (18.09%), crops cultivation (5.28%) and land rentals (3.33%).

Multiple Regression Model is used to identify variables capable of affecting the livestock income. The model results reveal that among 15 explanatory variables included in the model, 6 are found to be significant at the conventional levels of significance. Those variables which are important determinants of livestock income are a) total livestock holding, b) access to credit, c) availability of grazing land, d) risk of predators, e) livestock breed type and f) livestock mobility. Improving livestock production and productivity, organizing pastoralists into cooperatives, market oriented livestock production, improving pastoralists' access to and participation in the markets, managing associated risks of mobility and proper management and control of the invasive species from grazing lands are the recommendations forwarded.

Derib Woldeyohanes

October, 2010

CHAPTER I

INTRODUCTION

1.1. Background

Ethiopia is among the first ten nations in the world with respect to the livestock population and takes the lead in Africa. The lead is both in terms of number and diversity of livestock, with an estimated 41 million cattle, 26 million sheep, 23 million goats, 41 million chicken, 5.7 million equines and 2.3 million camels (CSA, 2010). Though not proportional to the volume, the livestock sub sector contributes considerably to the country's economy. A study indicated that the livestock sector contributes an estimated 16 percent to the national GDP and over 40 percent to the agricultural GDP (Berhanu G. *et al*., 2007). Its functions take the form of provision of food, cash income, input for crop production and soil fertility management, raw materials for industry, energy/fuel, social values (specially for pastoralists) as well as promotes saving and creates employment opportunities to both highland and lowland inhabitants. More clearly put, the livestock subsector provides wide and year-round employment opportunities for surplus family labour in rural Ethiopia. Cash income from livestock production is especially important for the poor and landless Ethiopian households, particularly women. Income from livestock production is also used for income diversification investment activities. For the average rural farm household with limited investment alternatives, livestock are used as store of wealth and hedge against inflation (CSA, 2010).

The livestock subsector creates livelihood for 65% of the rural population and accounts for about 12–15% of the export earnings of the country in terms of live animals, meat and hides and skins exports (EEA, 2005). Excluding values of draught power and manure for fertilizer, of the total household cash income from crops and livestock, the livestock sector accounts for 37–87% in different parts of the country and the higher the cash income the higher is the share of livestock,

indicating that increased cash income come primarily from livestock, particularly in the pastoral areas (Ayele *et al*., 2003).

As far as the overall contribution of livestock to the economy is concerned, it is concluded that throughout Ethiopia with some regional variations, livestock are valuable (essential in the pastoral areas) in providing food for subsistence, essential in many areas for the cultivation of crops (draught power), essential for the transportation of goods, and in some areas transporting people, the most important source of cash income for the people living in the rural areas, the most significant and widespread form of asset accumulation for the rural residents and used to invest in traditional security systems (Halderman, 2004).

In regard to poverty reduction policies and strategies, the same author states that it is useful to recognize for Ethiopian households, livestock serves as: productive assets that allow households to be self-provisioning; critical safeguards against falling into what is usually unremitting poverty; and springboards that usually enable some households to advance to relative wealth by the standards of contemporary Ethiopia.

However, the benefit obtained from the sector is low compared to other African countries and the world standard. For instance, the 2004 statistical report of FAO (quoted in SOS-Sahel Ethiopia, 2007) revealed that the average beef yield per animal of 108.4kg for Ethiopia is by far less than 121kg for the Sudan, 130kg for Eastern Africa, 146kg for Africa, 163kg for Kenya, and 200kg for the whole world. Low productivity of the sector coupled with poor performance of livestock marketing system and low prices in the market made it so (Ayele *et al*., 2003). Moreover, the study conducted in 9 African countries on values and revenues of livestock showed that Ethiopia derives the least income (USD 383 per household; where for Kenya and Republic of South Africa are 6155 and 18593, respectively) from livestock (Niggol S. Seo *et al.,* 2008).

Table 1.1: Livestock values and incomes of some African countries (in USD)

Country	Value of Livestock (in USD)	Income from Livestock (in USD)
Burkina Faso	3952	2900
Cameroon	4356	3009
Egypt	7483	6731
Ethiopia	2367	383
Ghana	3274	412
Kenya	16095	6155
Senegal	3547	388
South Africa	38986	18593
Zambia	10722	2709

Source: Niggol S. Seo and Mendelsohn R., 2008

Livestock population in Ethiopia is distributed over the highland and lowland areas. Of the total livestock population of the country, pastoralists own about 27% of cattle, 26% of sheep and nearly two-third of the goats' population; and all the camels (SOS-Sahel Ethiopia, 2007); livestock in pastoral regions accounts for an estimated 40% or so of the country's total livestock population (Sara Pantuliano *et al.*, 2008). In terms of distribution across administrative regions, the predominantly pastoral regions of Afar and Somali have the highest densities per capita. In the lowlands of the country where pastoral management system is practiced, livestock are the principal source of subsistence, providing milk and cash income to cover family expenses for food grains and other essential consumer goods and are the main form of financial and social assets (Yakob A. *et al*., 2010).

Pastoral areas in Ethiopia, which cover about 0.7 million sq km, support about 12 - 15% (some 15 – 20 million people) of total population of the country (EEA, 2005; Sara Pantuliano and Mike Wekesa, 2008).

The Afar National Regional State is predominantly pastoral where over 90% of the population relies on livestock for their livelihood. Moreover, the region is characterized by extensive range land, huge livestock resources and pastoralists with best traditional knowledge in extensive livestock production systems. Despite the huge livestock population in the region, pastoralists'

income from livestock is not proportional to the volume (Afar Atlas, 2006). This mainly is attributed to wide ranging problems of underdevelopment and lack of market-oriented production, lack of adequate information on livestock resources, inadequate permanent animal route and other facilities like water and holding grounds, lack or non-provision of transport, ineffective and inadequate infrastructural and institutional set-ups; together with the prevalence of diseases, illegal trade and inadequate market information. Moreover, the wide ranging and complicated social, cultural and economic factors and absence of proper processing and marketing facilities are mentioned contributing to low income from livestock farming in Afar region in particular (Mohamed, 2009). Therefore, improving livestock productivity and their respective marketing activities may improve the sector's contribution to the GDP in general and increase the pastoralists' income and lead better livelihood, in particular.

1.2. Statement of the Problem

The current levels of contributions of the livestock sub sector in Ethiopia, at either the national or regional level is below the potential. The level of foreign exchange earnings from livestock and livestock products are also much lower than would be expected, given the size of population and diversification (Niggol S. Seo *et al.,* 2008).

The level of contribution of livestock production for the pastoralists, who predominantly live on rearing livestock for their livelihood, is below the national average. Pastoralists could not be benefited as expected from the animals they rear. The most food insecure areas in the country are reported to be pastoral; the condition in Afar pastoralists is the worst regardless of its huge livestock resource (PLI, 2008).

Pastoral households depend primarily on livestock to generate their incomes and food consumption needs. The most important and leading income generating activities for the Afar pastoral communities is animal husbandry. Mainly rearing of cattle, camel as well as sheep and goats for cash income and for the daily subsistence need for milk and milk products, meat, hide and skin (Farm Africa, 2009). However, currently there is a dramatic decline in livestock holdings per household associated with shrinkage and degradation in grazing lands and an increase in frequency of recurrent droughts due to which the income sources of pastoral livelihood are adversely affected and the income level from livestock farming is sharply going down; and pastoralists are found to leading impoverished life. Regardless of the huge livestock resources, the household cash income

for the pastoralists from sale of livestock and livestock products is declining and they are becoming more dependants on external assistances (PLI, 2008).

Therefore at this juncture, one may appreciate the paradox (huge livestock resources against absolute poverty and impoverished life) and it is natural and rational thinking to posing questions as "why the contribution of livestock production to the livelihood of pastoralists is not as expected? What has happened to the income from the livestock to move out the pastoralist households from poverty and secure household food needs? Why the pastoralists in Afar are becoming relief dependant and many use imported powdered milk (PLI, 2008)?" These are currently pressing and critical to the region in particular and need to be researched and measures have to be taken to help the innocent pastoralists assume a fair income from the livestock they keep and improve their living standard and ensure that 'pastoralists deserve a fair income from the sale of their animals'. In the severe and widespread drought of 2000, outside observers concluded that, except in extreme pockets of isolation or insecurity, there was no significant problem of food availability, and 'if satisfactory ways could be found of increasing pastoralists' cash income, there would be no separate food crisis' (Sandford *et al.*, 2000 in Sara Pantuliano *et al.*, 2008). Moreover, it is argued that market participation can be an effective route for pastoralists to reduce poverty and increase income (Mohamed, 2009). It is however, widely seen that thousands of pastoral households in Afar Region seem to fail to deserve fair income from participation in livestock markets which is attributed to controllable and uncontrollable factors. Therefore, it demands that the social, cultural, institutional and other factors that determine the level of income from livestock for the pastoralists have to be identified and analyzed to devise solutions for the aforementioned questions.

1.3. Objectives of the Study

1.3.1. General Objective

The overall objective of this study is to explore those factors most closely associated with pastoralists' household income from livestock in the Middle Awash area, Afar Region and to draw recommendations that will help to improve pastoralists' livestock income.

1.3.2. Specific Objectives

The specific objectives of the study are:

1. To explore the different sources of household income for the pastoralists in the study area;
2. To assess the share of livestock income for the pastoralists in the study area;
3. To analyze the determining factors of livestock income in the study area;
4. To recommend strategies for improving pastoralists' household income from livestock in the study area

1.4. Hypothesis

There is no significant relationship between the livestock income and the determining factors.

1.5. Scope of the Study

This study principally concerns identifying the major socio-economic factors that significantly affect the sample pastoralist households' livestock income. To analyze the determining factors of livestock income, the study focused only on the gross annual income from cattle, camels, sheep and goats for the year preceding the survey (Feb. 2009 – Jan. 2010). The livestock income in this study is confined to income from the sale of animals and animals' products, milk production in monetary term and the value of slaughtered animals. In the study area milk is the major component of household food consumption. Milk and milk products, therefore, are the only animal products valuated in terms of money and included in livestock income. Other animal products (like hides and skins) and services (like transportation) from animals and social values were not valuated and excluded from the computation of income of the household. The same applies for by-products, like manure. However, the value of slaughtered animals for home consumption was considered in the calculation of livestock income. The study was confined in Amibara and Gewane woredas of Gebi-Resu Zone, Afar National Regional State.

1.6. Significance of the Study

It is anticipated that the output of this study will be useful to the regional BPARD as well as the rural pastoralists in the operational area. It is also believed that the results of the research are important to provide valuable information to prepare alternative livelihood development programs

that will serve as a guideline for interventions to improve pastoralists' household income. This research project is also significant in creating baseline information that may be extrapolated to other woredas and zones of the region. Moreover, the findings of the study will pave the way for other researchers who want to conduct a detailed research on the issue.

1.7. Limitations of the study

Due to constraints arising from poor infrastructure, security problems, harsh climatic conditions and other logistics related problems, the researcher couldn't cover all woredas of the zone. Hence, the research results are primarily based on data collected from randomly selected sample of 100 respondents (livestock owner household heads) from ten pastoral associations in two woredas. For the study, gross annual livestock income was used because of biased expenditure information obtained from herders. Moreover, gross annual livestock income is limited to income from sale of livestock and livestock products, milk production in monetary term and value of slaughtered animals for consumption, due to difficulty of valuating other livestock products, byproducts, services and social values. However, recommendations and policy implications drawn out of this study could be used in other locations in Gebi-Resu zone of Afar National Regional State.

1.8. Organization of the thesis

The report of the study has been spread over five chapters. The first chapter deals with the introduction, background of the study, statement of the problem, objectives of the study, research questions, hypothesis of the study, scope of the study, significance of the study, limitations of the study and organization of the thesis. The second chapter covers review of theoretical and empirical literatures related to the investigation. This is followed by the methodology used in the research in chapter three. The fourth chapter presents the results and discussion part of the study. In the fifth chapter, the conclusion and recommendations are given.

CHAPTER II

LITERATURE REVIEW

2.1. Theoretical Background

2.1.1. Concepts and Definitions

In this part definitions and concepts related to livestock, livestock production, pastoralists, pastoralism, household income and livestock income are explained.

2.1.1.1. Livestock

Livestock usually represent domesticated animals, including cattle, sheep and goats, horses, mules, camels, donkeys, pigs and others, which are often used to help cultivate fields, harvest crops, and transport farm products to buyers and provide protein to human beings. Animal husbandry not only refers to the breeding and raising of animals for meat or to harvest animal products (like milk, eggs, or wool) on a continual basis, but also to the breeding and care of species for work and companionship (Wikipedia, the free encyclopaedia).

2.1.1.2. Livestock Production Systems

Livestock production systems can be defined based on feed sources, as grassland - based, mixed, and landless. Grassland based livestock production system relies upon plant material such as shrub land, rangeland, and pastures for feeding ruminant animals. Outside nutrient inputs may be used, however manure is returned directly to the grassland as a major nutrient source. This system is particularly important in areas where crop production is not feasible due to climate or soil, representing 30-40 million pastoralists. Mixed production systems use grassland, fodder crops and grain feed crops as feed for ruminant and mono-gastric (one stomach; mainly chickens and pigs) livestock. Manure is typically recycled in mixed systems as a fertilizer for food crops. Landless

systems rely upon feed from outside the farm, representing the de-linking of crop and livestock production (Wikipedia, the free encyclopaedia).

2.1.1.3. Livestock Marketing Features and Structures

A market is the set of or an aggregate of people who, as individuals or as organizations, have a need for certain products and the ability, willingness and authority to purchase such products (Kotler *et al.*, 2004). It can be described as simple arrangements to facilitate exchange of one thing for another. The most observable features of a market are its pricing and exchange processes. This investigation adopts the product definition of market. A market is also defined to include people, money and willingness to buy. In this context, market is another name for demand.

Marketing projects different impressions to different groups of people in a society, like farmers, traders and consumers. According to the American Marketing Association in McDaniel C., *et al*., (2006), marketing is an organizational function and a set of processes for creating, communicating and delivering value to customers and for managing customer relationships in ways that benefit the organization and its stakeholders. On the other hand, Kotler and Armstrong point out that marketing should not be understood in the old sense of making a sale, but in the new sense of satisfying customer needs. Accordingly, they define marketing as a social and managerial process whereby individuals and groups obtain what they need and want through creating and exchanging products and value with others (Kotler et al., 2004). Kohls and Uhl (1985) described agricultural marketing as the performance of all business activities involved in the flow of food products and services from the point of initial agricultural production until they are in the hands of consumers.

Unlike other agricultural products, marketing of livestock and livestock products involves risks and high maintenance and transport costs. In moving animals from place of origin to marketplaces and from one market to another and end users, the animals will lose weight, could be sources of disease transmissions or could be exposed to diseases, and could pollute environments. Livestock also requires special market facilities, including market places, water and feed supply, shades, health posts, etc. Under strict movement controls, there is a need for movement permits, which incurs costs and consumes time in search of veterinary officers. In cases of export, stringent health requirements are also another burden on livestock marketing (PFE, 2004). Marketing of animals by pastoralists is basically a function of their basic needs, such as food grains, clothing, health care and fallback during periods of drought.

Livestock markets in Ethiopia function at three levels consisting of primary, secondary; and terminal markets. Some also include a nominal forth tier at the farm gate level, which could hardly be considered to function as a market (Ayele *et al*., 2003). Primary markets have been identified as village level markets with a supply of less than 500 head of cattle/week where primary producers (farmers and pastoralists) sell small number of animals to small traders, other farmers (replacement animals), farmer or pastoralist-traders and in some cases to consumers and local butchers. Such markets are not fenced, have no scales, and no feeds and watering facilities. Purchasing is done through 'eye ball' negotiations. A good majority of the livestock markets in Ethiopia belong to this group.

Secondary markets are trader and to some extent butcher dominated markets, with an average volume of 500 – 1,000 heads per week consisting of finished, breeding and draught stocks and located mainly in regional capitals. Secondary markets serve the local consumers to some extent but mainly feed the terminal markets. These markets also supply live animals to exporters and meat processors.

The terminal markets are located in large urban centres. Medium to large-scale traders and butchers dominate these markets. Average volume of cattle brought to these markets may exceed over a 1,000 heads/week.

The decision to sell animals by the primary producers (both farmers and pastoralists) is usually based on urgent cash requirements (Ayele *et al*., 2003; PFE, 2004). Producers come to the markets with no information beforehand on the going price of the day and farmers may take back their animal(s) if the price offered is too low to try their luck next time in the same or in another market nearby. Pastoralists take the same measure if the market happens to be close to where they graze their animals. But, if the market is of some considerable distance from where they reside, then they will be forced to sell their animals, however low the price is on the day, as they cannot afford to return empty handed without buying grain and other necessities for their families. Profit becomes a motive for sale only at farmer-trader level and above (PFE, 2004).

Table 2.1: Typical Ethiopian livestock market structure

Variables	Market structures			
	Farm-gate sales	**Local/Primary markets**	**Secondary markets**	**Terminal markets**
Players	Farmers/pastoralists and rural traders	Farmers and rural traders	Small traders and farmers (sellers); Bigger traders and butchers (buyers)	Big traders (sellers); Butchers (buyers)
Animals	Cattle, sheep and goats	Heifers, young bulls, replacement for breeding and draft; Minimal local consumption	Slaughter, breeding and draft stock	Slaughter types; culled for age, oxen and barren cows
Volume	Usually 1-2	<500heads/week	500-1000 heads/week	>1000 heads/week
Location	Farms and rangelands	Market centers in rural areas	Regional towns	Principal cities

Source: Ayele *et al.*, 2003

2.1.1.4. Livestock and Pastoralists

According to Antonio R. *et al*. (2009), pastoralists are people who derive more than 50 per cent of their incomes from livestock and livestock products. Pastoralists are people who live mostly in dry, remote areas, whose livelihoods depend on their intimate knowledge of the surrounding ecosystem and on the wellbeing of their livestock.

Pastoral systems take many forms, adapted to particular natural, political and economic environments. The types of livestock kept by pastoralists vary according to climate, environment, water and other natural resources, and geographical area, and may include camels, goats, sheep, yaks, horses, llamas, alpacas, reindeer and vicunas (Antonio R. *et al*., 2009).

Mobility is a key feature qualifying pastoralism. Pastoralism is a cultural and economic system that incorporates and defines social structure, resource management, productivity, trade, and social and welfare mechanisms in communities founded on livestock rearing as the primary economic activity (PLI, 2008). The term nomadic is used when mobility is high and in irregular patterns; transhumant when there are regular back and-forth movements between relatively fixed locations and sedentary for the rest.

Pastoralists inhabit zones where the potential for crop cultivation is limited due to low and highly variable rainfall conditions, steep terrain or extreme temperatures. Within this unpredictable, vulnerable and dynamic environment, they have developed successful mechanisms of adaptation to maintain an ecological balance between themselves and the natural environment. According to International Fund for Agricultural Development IFAD, 2004, today there are nearly 200 million pastoralists in the world generating income where conventional farming is limited or not possible. However, pastoral communities are marginalized and generally not given due consideration in wider socio-political analysis.

Pastoralists constitute 12-15% of the population of Ethiopia and occupy about 60% of the total landmass of the country. They highly depend on livestock for their living. They live in arid and semi-arid, peripheral areas of the country. In Ethiopia, pastoralists are victims of unusually large number of myths and misconceptions contributing immensely to the generation of inadequate, often hostile, development policies and interventions which in turn, create major barriers for sustainable pastoral development. According to the Pastoralist Forum Ethiopia (2004), the most notable myths and the barriers they engender are the following:

- Mobility is inherently backward, outdated, chaotic and disruptive;
- Provision of services for mobile pastoral community is impossible;
- Pastoralists cannot be trusted enough for provision of financial services;
- Poor access to services (veterinary services, credit, markets, training and inputs), technologies and innovations.

Moreover, this livelihood is highly vulnerable to drought, animal disease outbreaks or other shocks.

In pastoral areas livestock are considered as a means of wealth accumulation and as indicators of status in the societal hierarchy. Thus, livestock sales decision-making usually depends on family needs for cash income, which is used to buy food grains and other essential commodities, such as

clothing, and to cover social expenses, including weddings, funerals; human and animal health care, etc. Occasionally, seasonal shortage of rainfall, due to its impact on feed availability, forces higher supply to the market. This forced supply is constrained by the inability of the pastoralists to plan sales in accordance with market needs (Belachew and Jamberu, 2002).

2.1.1.5. Role of Livestock

As far as role of livestock to the livelihood of livestock keepers is concerned, it is viewed as a form of financial, social and natural capital (McLeod et al., 2001 in IFAD, 2004). Furthermore, livestock can enhance human capital and play a critical role in reducing malnutrition.

Livestock is first and foremost financial capital. For many poor households, livestock is the primary form of savings. As an investment, few other resources can match livestock as a means of capital growth. Animal sales may allow poor households to generate cash quickly during times of need.

Livestock is also social capital. Livestock is important in supporting social relationships. Loans and gifts of livestock contribute to bonding, bridging and linking in social capital relationships, and livestock is one means by which family and household social capital may be measured, (Woodcock *et al.*, 2000 in IFAD, 2004). In many poor households, livestock is shared or loaned among relatives and friends or reared for absentee owners (Heffernan *et al*., 2000 in IFAD, 2004). These arrangements can vary widely, from straightforward rental agreements to more complex loan arrangements in which the duration of the payback may be intergenerational. Animals may also be given as gifts, and, in this manner, livestock can help cement social networks and community-level obligations among households. From own experiences in most rural parts of Ethiopia, most livestock credit-in-kind systems are based on a commercial principle of giving one or more animal offspring to other members of the community.

In Eastern Africa pastoralist societies, livestock loans are generally less common than livestock gifts. Moreover, both loans and gifts tend to be less commercially oriented and more dependent on social capital arrangements. As such, gifts and loans are transacted both formally and informally. For example, in many societies, dowry and bride wealth are paid in livestock, and livestock is often given in direct response to the emergency needs of friends and neighbours (Heffernan *et al.*, 2000 in IFAD, 2004).

However, the use of livestock as social capital may become less frequent as the role of livestock slowly becomes a more productive-oriented and commercial one, common practice in many parts of Ethiopia today. In a study among pastoralists in Kenya, for example, Heffernan *et al.,* (2000) in IFAD (2004) found that the formal role of livestock in inheritance, bride wealth and other ceremonies is now much more important than the informal role in gift giving.

Livestock can help maintain natural capital. The integration of livestock in crop production can enhance the sustainability of farming systems because the use of livestock provides draught power and transport, improves soil fertility and increases the productivity and income opportunities for poor households, while helping households finance the purchase of farm inputs. Recent studies report examples in which the integration of livestock and crop production has improved farm productivity and income by from 50 to over 100% (IFAD, 2004).

Livestock production can enhance human capital in several ways. In a study of the impact of a smallholder livestock development project in Bangladesh, it is found that all participating women had increased their incomes. The extra income was used to buy more food, send children to school and augment assets such as land. The women also enhanced their participation in decision-making at the household level (Nielsen, 1996 in IFAD, 2004).

Livestock can also improve the nutritional status of poor families. Malnutrition often results from a combination of a lack of access to food, a lack of nutritional knowledge and inequality in the distribution of resources within families. The extra regular income derived from livestock production therefore has the potential to increase access to food within the family. At the same time, enhanced knowledge and status among women significantly reduce malnutrition among the women and their children.

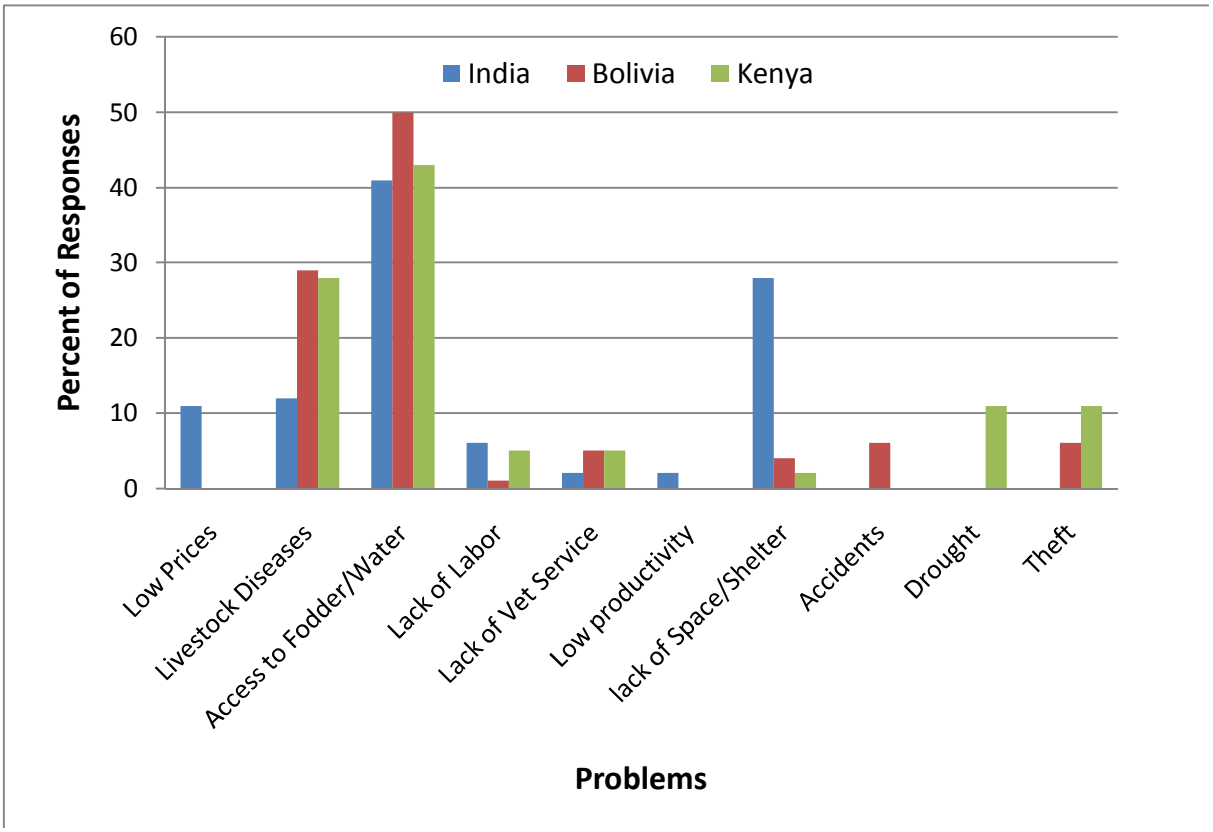
2.1.1.6. Constraints for Sustainable Livestock Production

The livestock keepers face a variety of constraints to sustainable livestock production, which in turn affect the income they derive from the livestock. LID (1999) classifies the problems of the poor livestock keepers into three basic categories: herd and infrastructure acquisition; herd and flock maintenance and marketing of livestock products. Herd and infrastructure acquisition require that households have access to capital and credit facilities so that they can purchase the livestock and pay for the infrastructure. Herd maintenance requires that households maintain the health of their animals and have access to animal production services. To market their livestock and

livestock products, they need to have access to reliable markets for off-take; where in all cases challenging to pastoralists. These needs are also recognized in Heffernan *et al*. (2002) in IFAD (2004), who carried out an open-ended ranking exercise among over 1,700 households in Bolivia, India and Kenya. The study illustrated that the majority of households ranked a lack of access to fodder and water as their most serious problem in the maintenance of livestock. Livestock diseases were the most significant problem for approximately 20% of the producers.

However, aside from these major constraints, the other problems identified differed widely among the countries and the districts involved in the study. For example, theft was considered a serious problem among pastoralist communities in Kenya. Urban producers in India were concerned about access to sufficient space to keep livestock and the low production levels, whereas accidents – mainly involving cattle becoming snared in barbed wire – ranked quite high in Bolivia. Additionally, a number of participants believed that their knowledge of animal husbandry and health was insufficient (Heffernan *et al*., 2002 in IFAD, 2004).

Figure 2.1: Main livestock problems of selected three countries



Source: Adapted from Heffernan *et al*. (2002) in IFAD (2004)

2.1.1.7. Definition of income and its classification

A variety of definitions of income have been advanced in the literature. Many of the definitions spring from the Haig-Simons-Hicks concept of income; where it defines income as the maximum amount that can be consumed in a given period while keeping real wealth unchanged (Eisner, 1989 in John R. *et al*., 2004).

There has been a long history of debate on the boundaries to be set for the definition of income. According to the Canberra Group, much of the debate has centered on whether: income should include only receipts that are recurrent (that is, exclude large and unexpected, typically one-time, receipts); income should only include those components which contribute to current economic well-being, or extend also to those which contribute to future well-being; and whether the measure of income should allow for the maintenance of the value of net worth (Canberra Group, 2001).

As income is defined as the output of activities it measures both cash and in-kind contributions. All the goods and services produced in activities are valued at market producer prices regardless of their use. So, all own-farm products are valued at the same price as if they were sold (Ellis, 2000).

In the literature there has been a wide range of different systems in classifying sources of income. Terms like off-farm and non-farm income are used in an at first glance synonymous way, but with slightly different definitions. Ellis, (2000) defines off-farm income as income originating from wage labour on other farms whereas Barrett *et al*., (2001) in Stefan Schwarze, (2004) refer to off-farm income as all activities away from the farmer's own property. Following this, it is classified according to sectors (agriculture and non-agriculture) and functions (wage and self-employment). Table 2.2 illustrates the concept and the classification of the different income sources.

Table 2.2: Concept and classification of income

Function	Sector	
	Agriculture	Non-agriculture
Self-employment	Annual crops	Enterprises
	Perennial crops	Rentals
	Livestock	
	Forrest products	
Wage employment	Agricultural wage labour	Non-agricultural wage labour

Source: Barrett *et al*., 2001 in Stefan Schwarze, 2004

A household income survey conducted in rural Egypt by André Croppenstedt (2006) states that household incomes are disaggregated into six categories:

- Wage income, both formal and informal, origination in either the non-agricultural or the agricultural sector;
- Crop and livestock income includes revenues from crops and livestock (sale of live animals, sale of animals for slaughter, sale of animal products) production as well as rental income from ploughing and machinery services;
- Household enterprise income, includes enterprises in the agricultural and non-agricultural sector;
- Financial income, includes returns on financial assets;
- Transfer income, includes remittances and transfers sent to the household as well as income from pensions, and;
- Real estate income, includes rent from agricultural (and other) land as well as rent from household dwelling (renting out part of own dwelling) and rent from other assets.

Another study made in Mozambique states household income defined to include food retained for own consumption, all crop and livestock sales, livestock slaughter, cash and in-kind payments received off the farm, and remittances, net of cash and in-kind payments made to hired labor, (1992).

2.1.1.8. Sources of Household Income and Share of Livestock Income

A household baseline survey conducted by Farm Africa (2009) in Afar region found that the major source of household income for pastoralists is sale of animals. The study adds that the livelihood of inhabitants is predominantly pastoralism, although agro-pastoralism is practiced. Furthermore, charcoal production, petty-trade and employment in local government and NGOs also constitute the means of living mainly for urban dwellers. The entire community livelihood in the rural areas is based on livestock production. Livestock represents the most important economic activity in the area and the sector provides a significant proportion of the overall livelihoods asset base and activities of the inhabitants.

The livelihood survey by Farm Africa (2009) showed that 89% of the households in Gewane woreda of administrative zone III of Afar region rely on livestock and livestock-products as their main source of income followed by non-farm employment (wages, salary, business etc); and crop and fruit cultivation. According to the survey result of Farm Africa, natural resource based activities, mainly, production and sell of charcoal and fuel wood were found to be the least important means of income. Accordingly, livestock income receives the highest share of the household income.

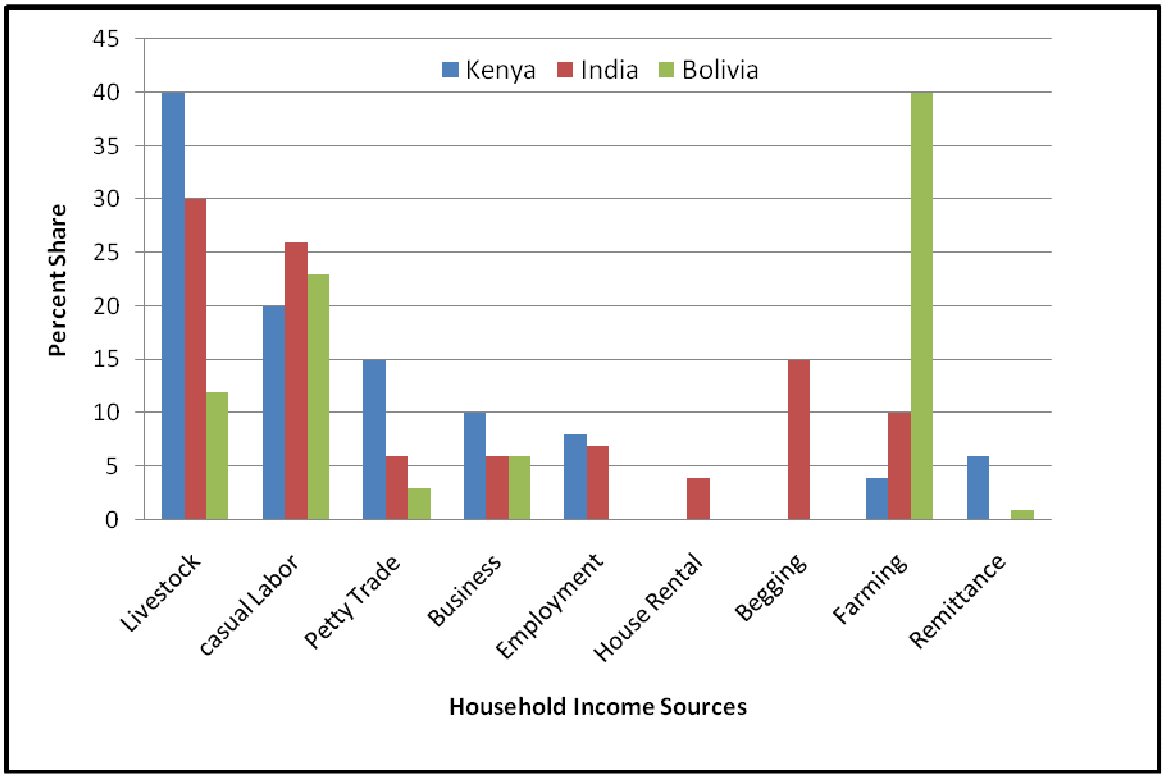
Other countries' experiences on household income sources revealed that livestock is first and foremost important financial capital for the household. For many poor households, livestock is the primary form of savings. As an investment, few other resources can match livestock as a means of capital growth. Animal sales may allow poor households to generate cash quickly during times of need. Moreover, livestock by-product, including manure, is often a key source of income. In a comparative study of poor livestock keepers in Bolivia, India and Kenya, Heffernan, Nielsen and Misturelli, (2001) in IFAD, (2004) found that livestock outranked the other means in the responses in all the three countries (Figure 2.2). As can be seen from the figure 2.2 below, livestock ranked first in terms of household income among the majority of households in India and Kenya.

However, despite the benefits, livestock rearing is also risky for the poor. Because poor households have limited disposable incomes for the purchase of inputs, the production risks are greater among poorer producers, especially because they are unable to control mortality. Furthermore, some livestock-related income has seasonal peaks, which may negatively affect the poor. Poorer

households have year-round needs and must generate income for food and other basic requirements, and they therefore, may not be able to benefit from seasonal produce and price increases.

Another survey done in the year 1999 in five countries (Ethiopia, Egypt, Kenya, Pakistan and Philippines) showed that livestock contribute the highest share to the household income of the poor (Delgado *et al*., 1999 in IFAD, 2004). According to the study, in Ethiopia, livestock income constitutes 24% of the household income of the poor.

Figure 2.2: Ranks of household income sources in selected three countries



Source: Adapted from Heffernan *et al*., 2001 in IFAD, 2004

Table 2.3: Place of livestock in income of the rich and poor in different countries

Country	Poverty indicator	Stratum	HH income from Livestock (%)
Ethiopia	Household income	Very poor	6
		Poor	24
Egypt	Landholdings	Landless	63
		Largest landholdings	14
Kenya	Household income	Lowest 1/5	63
	from dairy business	Highest 1/5	38
Pakistan	Household income	Lowest 1/5	25
		Highest 1/5	9
Philippines	Household income	Lowest 1/5	23
		Highest 1/5	10

Source: Adapted from Delgado *et al*., 1999 in IFAD, 2004

Another study done in pastoral areas of Eritrea indicate that sources of household income items included sales from livestock and livestock products (animals, milk and milk products, hides and skins), agro- forestry products (crops, wood, and charcoal), small-scale trading and wage labor, and other cash inflows (remittance), while expenditures consisted of food, medical care, clothing, transport, livestock and livestock inputs, and other cash outflows such as loan payments. According to the study, livestock constituted an important source of cash income for both the nomadic and transhumance pastoralists in the study areas, though its contribution varied depending on the conditions of aridity. During the normal period households obtain about 30 per cent of their income from the livestock (Woldetensae Kahsaye, 2002).

2.2. Empirical Studies on Determinants of Household Income

Under this section, summary results of previously done studies on factors affecting household and/or farm household income in different countries are summarized.

Permanent household income for a given household is a factor of many variables. Despite the huge livestock population in the Afar region (Afar Atlas, 2006), pastoralists' income from livestock is not proportional to the volume. This mainly is attributed to wide ranging problems of underdevelopment and lack of market-oriented production, lack of adequate information on livestock resources, inadequate permanent animal route and other facilities like water and holding grounds, lack or non-provision of transport, ineffective and inadequate infrastructural and institutional set-ups; together with the prevalence of diseases, illegal trade and inadequate market information (Mohamed, 2009; Tesfaye, 2008).

According to the survey result made in rural Ethiopia, the determining factors affecting the household income and consumption include the following: household size, farming systems, sex of household head, education level of household head, age of the household head, land size, livestock number, dependency ratio, wage employment, and access to credit (Alemayehu Reda *et al*., 2006). Another study conducted in pastoral areas of Oromia region by PCDP also shares the same idea with the above study result in that some continuous and dummy variables determine the rural household income negatively or positively. The study found that the continuous variables that influence livestock income are livestock holding, family size, and age of head of the household; and dummy variables refer to pastoral system such as mobility, nature of housing, involvement in farming and trade, sex of the household head (PCDP, 2005).

Study conducted in Yemen showed that incomes of farmers were found to be influenced by education, area of land, livestock holding, family size, and whether coffee is grown, but not farmer's age (Mohammed S, 2007).

A study conducted in selected rural districts of Malawi show that household income is influenced positively by whether the household involves in growing rain fed food crops, cultivating tobacco and groundnut, whether the household is a member of farmers club (cooperative), has access to farm loans and uses irrigation schemes. There are significant positive correlations between

agricultural income and rain fed food crops, groundnuts, tobacco, farmers' club, loan access and with two exceptions the variables show a strong positive relationship which means that districts with a high share of households involved in these productions and institutions have a higher income (Andreas Bohne, 2008).

Another study done in Indonesia revealed that access to physical and human capital has a significant influence on total household income. The area owned by the family, the value of other assets possessed, as well as the number of livestock and family labourers positively influence household income. The physical capital endowment turned out to be an important determinant of total household income. An additional hectare of land owned raises income by 8% and an additional livestock unit by 16%. The value of other assets owned also has a positive and statistically significant, but very small influence on income. The dependency ratio, which measures the ratio of children and elderly household members to adults, has a statistically significant negative influence. This means that the more children and elderly in relation to adults are members of a household the less the household income. An increase in the ratio by one unit increases income by 25%. The influence of education is weak and not statistically significant. An additional year spent in school by the head of the household increases average income by 1%. Although not statistically significant, ethnicity and participation in formal credit markets have a strong influence on total household income. Belonging to a non-indigenous ethnicity increases total income by 24% and borrowing from formal sources increased income by 33% (Stefan Schwarze, 2004).

According to a study conducted in Mozambique the factors explaining variations in farm and off–farm income are described as household characteristics such as gender, household size and age, education**;** assets (land, machinery, livestock); and remittances; community and regional factors such as market access and infrastructure development; institutional factors such as access to credit, government policy, extension; bio-physical factors such as climatic, diseases; and economic factors such as markets, inputs (Thomas Walker *et al*., 2004). This study also analyzed determinants of income by sources. Accordingly, the livestock income is found to be significantly influenced by gender of the household head, age (age groups of 15 – 64 deserve higher livestock income), land size, number of traction animals; belong to association, drought risk, and number of family members wage employed.

Still another study result shows that the household economic status (which is measured in terms of level of income of the household) is influenced by some household characteristics. Accordingly,

the explanatory variables that are statistically significant are level of education of the household head, age of household head, occupation, and techniques of farms management practices. Each explanatory variable is associated with family economic status (level of income) (Mehdi Yadollahi, *et al*., 2009).

A study was done in two coastal villages of Tanzania on determinants of total household income. In the study the determinants of total income at household level in order to understand the factors responsible for total income variation among households were analyzed. Accordingly, entitlements to fishing assets such as possession and/or access to fishing gears, fishing boats and social capital, agricultural land ownership, and the age of adult members of household were important determinants of total household income (Sesabo J. K. *et al*., 2005).

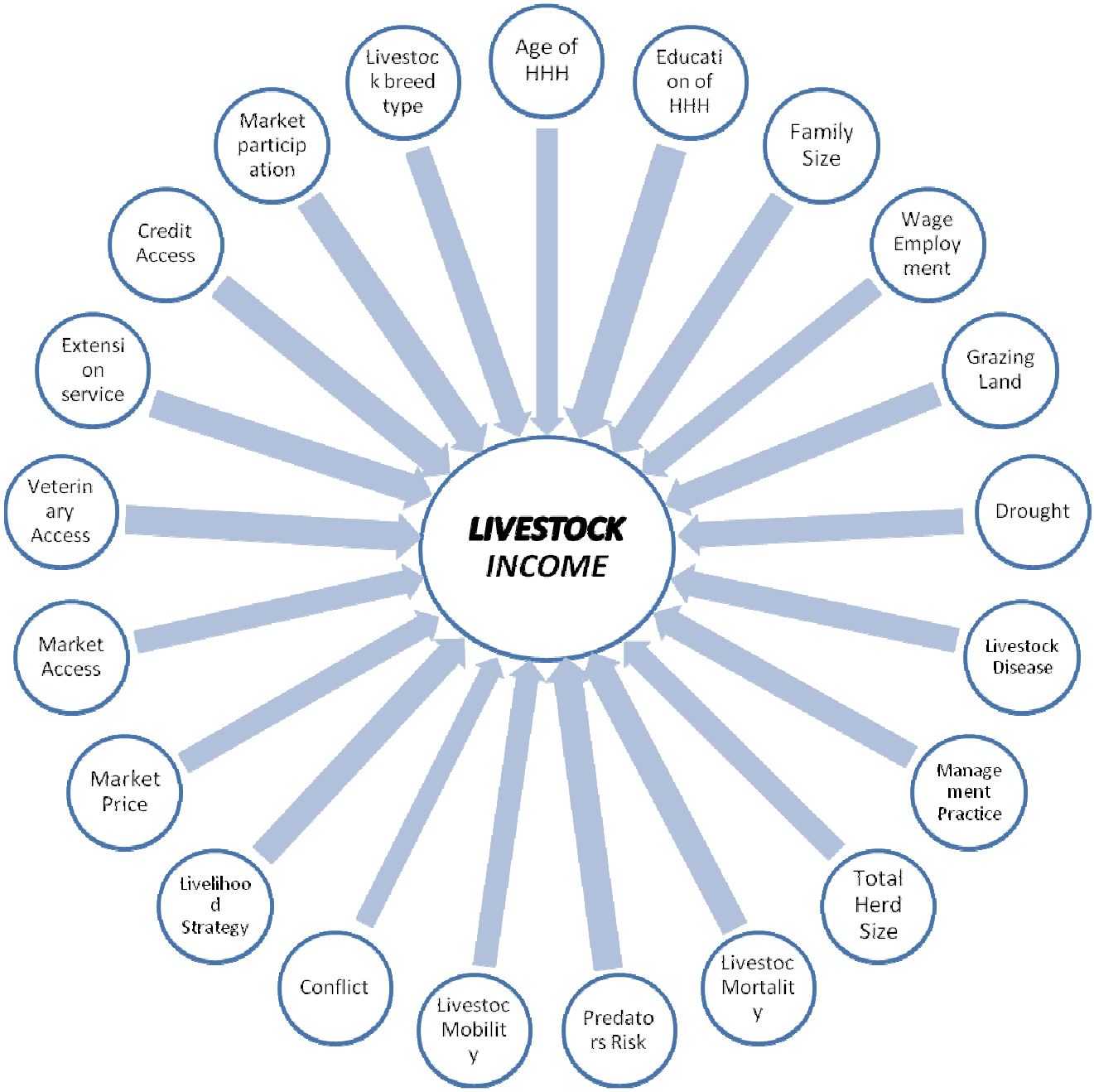
Another study conducted in Northern Kenyan agro-pastoral area on livelihood choices among the agro-pastoralists puts forward the determinants of household income. Based on the results of the analysis of the factors influencing overall income levels the results of the best performing OLS model with natural log of annual net income as the dependent variable, herd size (TLU) was the principal factor explaining variation in levels of annual net income. Moreover, Education of the household head and diversification of household income sources, measured as the number of income earning activities pursued, significantly influence income level. Only two spatial factors (distance to the nearest livestock market town and pasture potential) showed up as significant in terms of explaining variation in net incomes across households (Radeny M. *et al*., 2006).
In the same study, similar regressions on livestock incomes were ran to see if the driving factors differed significantly. The results show that herd size (in TLU) alone is able to explain over half (52%) of the variation in livestock income. Households with larger herds earn significantly more than households with smaller herds of livestock. The results suggest that a 10% increase in TLU per household would increase livestock returns by 7.5 percent. Of the spatial variables, distance to the nearest permanent water source was marginally significant ($p<0.1$) and negatively correlated with livestock returns, implying households located closer to water points earn more from livestock than those living farther from permanent water sources (Radeny M. *et al*., 2006).

According to the study conducted on livelihoods diversification patterns among households in Kenya, it is likely that there is a linkage between the types of livelihood diversification patterns and income level through differences in economic returns of livelihood components. Therefore, effects of particular livelihood diversification portfolios along with variables representing household and homestead characteristics on the total gross income through ordinary least squares (OLS) estimation was estimated. The significant variables are age and education years of the head, participation years in farmers group, adult equivalent, and specialisation in casual off-farm activities (Miyuki Iiyama, 2006).

2.3. Conceptual Framework

After exploring literatures, independent variables for the study were identified. For the sake of simplicity, a conceptual frame work of some 21 factors (variables) was depicted (Figure 2.3). However, these are not the only factors affecting livestock income; nor it is affected by a single factor but combinations of factors exert impact either positively or negatively.

Figure 2.3: Conceptual framework



CHAPTER III

MATERIALS AND METHODS

3.1. Description of the Study Area

The Afar National Regional State is situated in the North Eastern part of Ethiopia. It is geographically located between 39^0 34'and 42^0 28' East Longitude; and 8^0 49' and 14^0 30' North Latitude. The region is bordered to the north-west by Tigray region, to the south-west by the Amhara region, to the south by Oromia and to the south-east by Somali region and to the north-east by Djibouti and Eritrea. The 2008 housing and census report of the Federal Democratic Republic of Ethiopia Census Commission reveals that the estimated total population of the region is 1,411,092 and with population growth rate of 2.2 per cent (FDRECC, 2008). The Region covers an area of 195,238sq.km and administratively divided in to five zones, 32 woredas; and 358 peasant associations and 28 towns (ANRS, 2005). The zonal population distribution of the region is 421,790 (29.89 per cent) in zone I; 352,431 (24.90 per cent) in zone II; 198,628 (14.08 per cent) in zone III; 255, 542 (18.11 per cent) in zone IV and 183, 701 (13.02 percent) in zone V (FDRECC, 2008).

Table 3.1: Population distribution of Afar region by place of residence and sex

Total Population	Place of Residence				Sex			
	Urban		Rural		Male		Female	
1,411,092	No.	%	No.	%	No.	%	No.	%
	188,973	13.4	1,222,119	86.6	786,338	55.7	624,754	44.3

Source: FDRECC, 2008

In terms of land use patterns, about 14.8% of the total land area of the region is covered by grass land; 31.5 % shrub land, 1.7% wood land and 0.11 % forest land. Whereas water bodies and wet

land together account for 1.37% of the total land, the vast area of the region, 49.6%, is an exposed soil, sand or rock. 7% of the region's land is also estimated to be cultivable.

As far as the livelihood system of the region is concerned, pastoralism and agro-pastoralism are the two dominant modes of livelihood systems. Approximately, 90 per cent of the people depend on subsistence pastoral production system while the remaining 10 per cent pursue agro-pastoralism (CARE, 2007). The woredas where agro-pastoralism is common are located along the Awash valley in zone I and III and those woredas located adjacent to Oromia, Amhara and Tigray regions, which include Argoba special, Afambo, Assayita, and parts of Aba'ala, Megale and Koneb woredas. The inhabitants also involve in some other off-farm activities such as charcoal making for income.

The Afar Region is both the hottest and driest part of the country. The major part of the region falls within the arid agro ecological zone below 500masl.The mean annual temperature of the region as a whole is 35^{O}C. Rainfall is rather sparse and erratic. The mean annual rainfall varies from 500mm in the south-west to less than 200mm in the north-eastern part of the region. The coolest and wettest parts of the region are those in the root hills of escarpment on the banks of the rivers.

The major livestock species raised by the Afar pastoralists are cattle, camel, sheep and goats. Large number of donkeys and relatively small number of mules and horses are also kept. According to the regional bureau of finance and economic development (regional atlas) in general, there are about 3.4 million TLU of livestock in the region; of which about 1.6 million TLU of cattle, 0.25 million TLU of sheep, 0.43 million TLU of goats, and 1.1 million TLU of camels, with zonal variation (Afar Atlas, 2006).

The existence of high temperature and low rainfall creates high evapotranspiration in the region. This situation removes the limited water from the soil. In addition to this, low soil fertility, rocky and sandy nature of the land, crop production and land covered by crop is very limited. The major crops cultivated in the region are cotton, maize, sorghum, fruits, vegetables and date palm. Most of the region's investment is in the agriculture sector, mainly in cotton production. According to the investment office data, the regional investment activity is concentrated in 6 woredas; namely Amibara, Gewane, Assayita, Dubti, Mile and Awash Fentale. There are abundant and diverse man-made and natural tourism resources in the region, and could probably rank among the top most tourist attracting regional states in the country. These comprise very astonishing and contrasting landforms, wildlife, vegetation, historical and archaeological sites, mountains, rivers, lakes and hot

springs, etc. In the study area some remarkably mentioned tourist attraction sites are available: part of Awash National Park, Yangudi Rasa Wildlife Reserve, Meteka hot springs and mount Azelo can be mentioned.

Since the livelihood of the region is based mainly on livestock development and crops production is minimal, the pastoralists are subjected to sell their livestock to buy food grains and other industrial products. Due to lack of market in nearby, the pastoralists are forced to trek their livestock to neighboring woredas in search of market. This condition creates significant impact on the body weight of the animals and results in low price of animals in the market. Most of the woredas of the region have no livestock market centers.

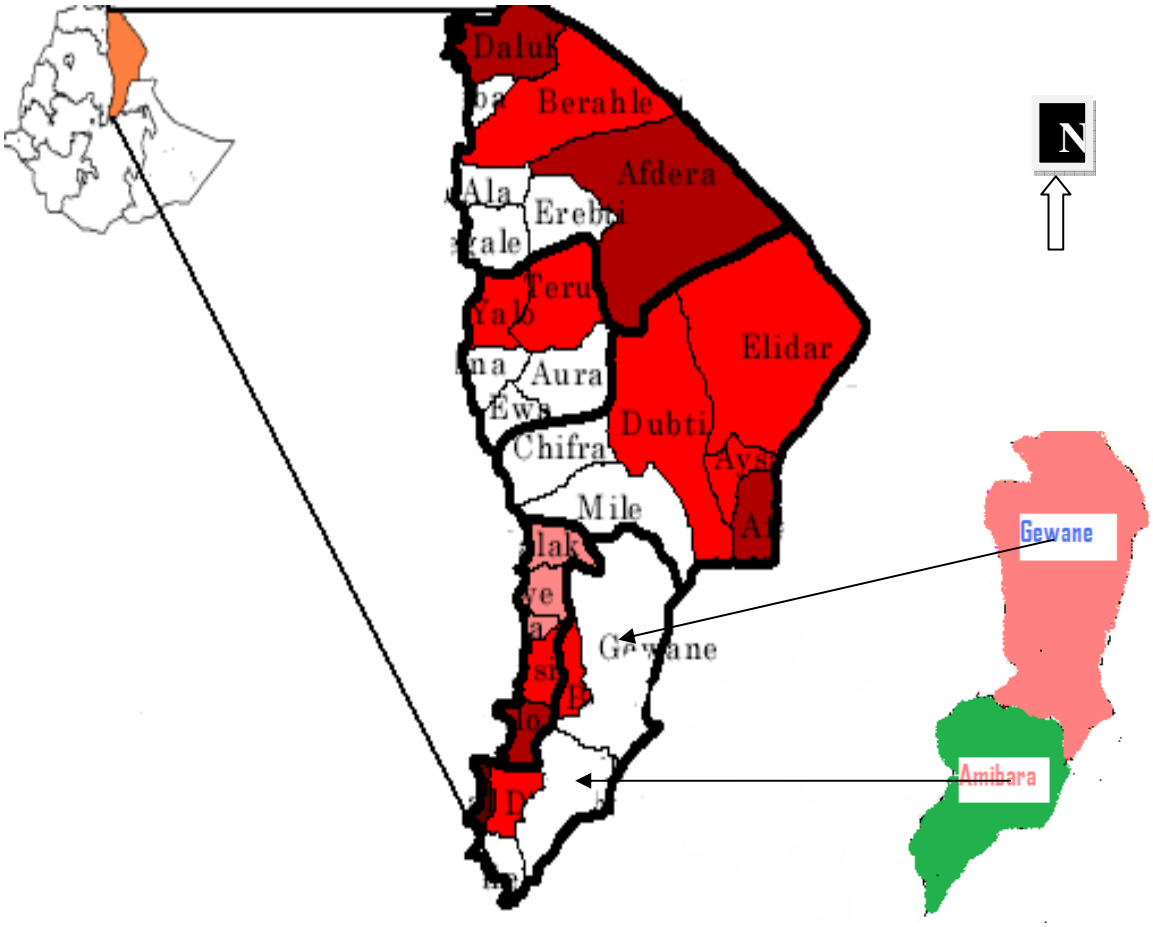
The major market centers in the region are Dubti, Asaiyta, Yalo, Chifra, Berhale, Dulecha, Melka Werer, Dibino, Kuneba, Logiya and Shehet. Amhara, Tigray, Oromiya and Djibouti towns are also big market centers for the region.

3.1.1. Overview of Gebi-Resu Zone and the Sample Woredas

The study was conducted in Administrative zone III (Middle Awash), otherwise known as Gebi-Resu zone of Afar National Regional State which is found in between Upper and Lower Awash River basins. Its altitude ranges from 500 to 820 meters above sea level and it is located between 9^{0} 30' and 10^{0} 20'N and 40^{0} 30' and 40^{0} 50'E. The main stays of local people to the region are pastoral and agro-pastoral. It is administratively divided between six woredas namely Awash-Fentale, Gewane, Dulecha, Amibara, Buremudaytu, and Argoba special. With regard to the topography, the zone can generally be described as plain.

Based on CSA population and census result in 2008, this zone has an estimated total population of 198,628. It is bordered on the south by Oromia region, on the southwest by Amhara region, on the west by administrative zone V of Afar region, on the north by administrative zone I of Afar region, and on the east by the Somali region. Accordingly, it has three national boundaries with Oromia, Amhara and Somali regions of Ethiopia and no international boundary. Based on the information obtained from regional atlas, the zone had 806,189.1 TLU of livestock in 2005 (Afar Atlas, 2006).

Figure 3.1: Map of Afar National Regional State and location of the study area



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Source: Afar Atlas, 2008

Table 3.2: Population distribution of woredas of Gebi-Resu zone of Afar Region

Woreda	Population	Urban	Rural
Amibara	63,280	32,086	31,194
Awash	29,775	16,844	12,931
Buremudaytu	31,786	-	31,786
Gewane	31,313	5,982	25,331
Dulecha	20,683	1,189	19,494
Argoba special	21,791	2,166	19,625
Zone total		**168,628**	

Source: CSA, 2008

3.1.1.1. Description of Gewane Woreda

Gewane is one of the six woredas of the Gebi-Resu zone. The wereda is bordered on the south by Amibara, on the west by Buremudaytu wereda, on the north-west by administrative zone V, on the north by the administrative zone I, on the east by the Somali Region and on the south-east by the Oromia Region. The Awash River defines parts of the boundary with Administrative Zones III and V.

The woreda consists of 9 pastoral Associations of which two urban and seven rural (five pastoral and two agro-pastoral). It covers a total area of 59,640 ha. Based on the CSA report of 2008, in Gewane woreda 31,313 people reside; of which 5,982 are urban and 25,331 are rural dwellers. Therefore, more than 80% of the population of the wereda lives in rural areas.

The wereda is generally semi-arid with a temperature level that falls between 28 and 42^0c, with an average temperature of 35^0c. Seasonal variations reveal that the temperature is moderate in the months between September and November and also in the months of December through January. The highest temperature is in the months between March and May. It is generally low from June through August. The wereda receives an average annual rainfall of 320mm. Most of the rain is concentrated in the months of July and August. The land use pattern shows that out of the total area coverage of the woreda according to information from the livelihood survey result of Farm

Africa, 35.0% used for grazing, 6.6% is covered with crops, 15% is arable land, 25.4 % covered with shrubs and the rest 18.36% either, barren or rocky and for settlement (Farm Africa, 2009).

Concerning livestock composition it has a total livestock population (cattle, shoat and camels) of 194,818.2 TLU (Farm Africa, 2009). The woreda has no livestock market place other than small daily village markets for only small ruminants.

Gewane Agricultural Technical Vocational Training College is found in this wereda. Furthermore, there are 33 cooperatives currently functioning in the woreda.

3.1.1.2. Description of Amibara Woreda

Amibara is one of the six woredas included in administrative zone-III of the Afar region. It is bordered on the south by Awash Fentale Wereda, on the west by the Awash River which separates it from Dulecha to the south-west then on the north-west by the administrative zone V, on the north by Gewane wereda, and on the east by Oromia region; and administratively, it is structured into 18 PAs.

Based on the CSA report of 2008, in Amibara woreda 63,280 people reside; of which 32,086 are urban and 31,194 are rural dwellers. As can be seen from the previous table, unlike the low level of urbanization in the Afar region, 51% of the population in Amibara is urban dwellers.

Agro-ecologically the weather condition of the wereda is generally semi-arid with a temperature level that falls between 25 and 35^0c, with an average temperature of 30^0c. The altitude of the wereda ranges between 720 and 1100masl. Seasonal variations reveal that the temperature is moderate in the months between September and January while it is the highest in the months of February and May. Temperature is generally low in the months of July and August. The wereda receives an average annual rainfall of 360mm.

The livelihood of inhabitants in Amibara wereda is predominantly pastoralism, although agro-pastoralism is also practiced. Furthermore, charcoal production, petty-trade and employment in local government and NGOs also constitute the means of living mainly for urban dwellers. In general, the main sources of food in the wereda are own livestock production, and some crop production, and also purchase of cereals from the market.

3.2. Methodology

3.2.1. Sampling and Data Collection Procedures

Taking all the necessary cares while using the different techniques of sampling into consideration, in this study, probability sampling techniques had been applied.

3.2.1.1. Sampling Design and Sampling Size

The study was conducted in two woredas (Gewane and Amibara) of Gebi-Resu zone of Afar Region. For the study, Middle Awash (Administrative Zone III) is randomly selected.

From six woredas in Administrative Zone III (Gewane, Buremudaytu, Amibara, Awash-Fentale, Dulecha, and Argoba Special), Gewane and Amibara are selected randomly for the study. For the purpose of data collection from the randomly selected two woredas, livestock owners are taken as the main targets. A total of ten Pastoral Associations are selected at random. The number of PAs for each woreda is proportional to total number they have. Accordingly, from 9 PAs of Gewane wereda, 4 (Beeda, Biriforo, Urafita and Yigle); and from 18 PAs of Amibara wereda, 6 (Andido, Angelele, Badulale, Serkamo, Sidihafaghe and Kelatburi) are selected randomly. Then, by taking into account the infrastructural availability, financial capacity, time availability and other logistics requirements, ten households are selected randomly from each sample PAs for the study, totaling 100 households. Therefore, the sample size used in the study is 100.

Table 3.3: Sample size

Wereda	Total no of PAs	Sample size of PAs	Sample size of Livestock owners	Name of Sample PA
Gewane	9	4	40	BEEDA BIRIFORO URAFITA YIGLE
Amibara	18	6	60	ANDIDO ANGELELE BADULALE KELATBURI SERKAMO SIDIHAFAGHE
Total	27	10	100	

3.2.2. Method of Data Collection

As explained above, the survey covered a total of 100 sample households from the targeted PAs to generate quantitative and qualitative data on the issue in concern to achieve the stated objectives. Pretested interview schedule was performed to collect the primary data for the purpose. The questionnaire had different parts: household data (family size, education level and occupation), household assets, livestock and land, income (from livestock, land and non- farm), and others. Led by the structured questionnaires, the sampled respondents were interviewed. For the interviewing purpose, rural and pastoral development workers were used as translators.

3.2.2.1. Focus Group Discussions

In addition to targeting and interviewing pastoral households for the purpose of collecting the required information, focus group discussions had also been conducted with woreda pastoral agriculture and rural development experts, and extension agents in both woredas. Accordingly, from each selected woreda five experts (one from each department of pastoral agriculture and rural

development); and one pastoral extension worker from each selected PA were selected for the purpose. Therefore, in the discussions a total of 20 individuals were involved.

3.2.3. Data Analysis

In order to achieve the stated objectives of the study the survey data were first debugged (sorted-out), edited, and coded, organized, summarized and analyzed using statistical package for social sciences (SPSS version 15.0). Both descriptive statistics and econometrics model had been employed to address the specific objectives of the study. Using descriptive statistics, specifically, statistical tools like percentages, mean, standard deviation, correlation coefficient and cross-tabulation were employed during analysis and interpretation of the household quantitative characteristics. Besides, statistical tests such as tests of significance and correlation were used for interpretation of data and drawing conclusions.

3.2.3.1. Descriptive Analysis

In this study, the first two objectives (to identify sources of household income and to compute share of livestock income) were analyzed using descriptive analysis; and econometric model was employed to analyze the socio-economic factors affecting livestock income of sampled respondents. The descriptive analysis was made using frequencies, means, and maximum and minimum values of some important variables. Econometric model was used to estimate the relationship between the variables of our concern and the hypothesis regarding these variables was tested.

3.2.3.2. Econometric Model Selection and Specification

The core objective of this study is to identify the major socio-economic factors that have a positive or negative impact on the level of the pastoralists' livestock annual income in the study area and critically analyzing level of impact of the factors on livestock income. It is hypothesized that livestock income of a given household is determined by a wide variety of factors; economic, social or cultural. In this study, following the conceptual framework some 21 independent variables hypothesized to affect livestock income were analyzed statistically.

To select a proper model of statistical analysis basically follows, among other criteria to consider, the nature of the dependent and independent variables. In this case the dependent variable, the

livestock income, obviously is a continuous variable measured in Ethiopian Birr (ETHB). However, it can also be made discrete (classifying as very low, low, medium, high and very high using some references as income quintiles or deciles); or even it can be made dummy variable specifying as high or low income groups for the analysis purpose (European Journal of Comparative Economics, 2007). Following this, either multiple regression model or logit models can be applied. On the other hand, the nature of the regressors (independent/explanatory) variables also dictates the type of statistical model for analysis. In this study some continuous and some dummy variables were included. Models in which the dependent variable, or regressand, *Y* depends on two or more explanatory variables, or regressors are referred to as multiple regression models. Following Gujarati, regressors containing both quantitative and qualitative variables are called analysis of covariance models (Gujarati, 2004).

Thus, the income analysis in this study has been done following the regression technique in linear form; and the following multiple regression model was employed to estimate the determinants of household livestock income.

$$Y_i = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \ldots + \beta_n x_{ni} + u_i \ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

Where;

Y_i = is the annual household income in monetary term from livestock;

$X_1, X_2, \ldots, X_n$ = are the explanatory (or the regressors) variables containing both quantitative and dummies,

β_0 = is the intercept gives the mean or average effect on *Y* of all the variables excluded from the model;

$\beta_1, \beta_2, \ldots \beta_n$ = are the partial regression coefficients of parameters; and

i = the i^{th} observation

U_i = is the stochastic disturbance or the error term

Or more expressively, the following multiple regression model can be specified for we have both quantitative and qualitative (dummies) explanatory variables, (Gujarati, 2004). This model is more expressive in that it clearly shows the continuous explanatory variables and the dummies.

$$Y_i = \beta_0 + \beta_1 A x_i + \beta_2 (FS) x_i + \beta_3 (TLU) x_i + \beta_4 (ED) x_i + \beta_5 D_5 x_i + \beta_6 D_6 x_i + \ldots + \beta_n D_n x_{ni} + u_i \ldots (2)$$

Where;

A = is age of the household head;

FS = is family size of the household;

TLU = is the total herd size of the household in TLU;

ED = is the educational status of the household head;

$D_5, D_6, \ldots, D_n$ = are dummies where 1 = existence and 0 = otherwise

Eventually, it is statistically desirable to sort out problem of multicollinearity among the continuous variables and check the association among discrete variables before estimating a model. The term multicollinearity refers to a situation where two or more explanatory variables can be highly linearly related.

If multicollinearity is perfect, the regression coefficients of the *X* variables are indeterminate and their standard errors are infinite. If multicollinearity is less than perfect, the regression coefficients, although determinate, possess large standard errors (in relation to the coefficients themselves), which means the coefficients cannot be estimated with great precision or accuracy (Gujarati, 2004).

Multicollinearity is essentially a sample (regression) phenomenon in the sense that even if the X variables are not linearly related in the population (i.e., population regression function), they can be so related in particular sample. When we postulate the population regression function (PRF), we believe that all X variables included in the model have a separate or independent effect on the dependent variable Y. But it can happen that in any given sample that is used to estimate the Population Regression Function some or all X variables are so highly collinear that we cannot isolate their individual influences on Y.

Some authors use the variance inflating factor (VIF) – which defines the speed with which variances and co-variances increase - as an indicator of multicollinearity. The larger the value of VIF, the more collinear the explanatory variables will be. As a rule of thumb**,** if the VIF of a variable exceeds 10, which will happen if (R^2) exceeds 0.90, that variable is said be highly collinear (Adem Kedir, 2009).

Therefore, in this study the contingency coefficients (C) and a variance inflating factor techniques were employed to detect the problem of multicollinearity. VIF shows how the variance of an estimator is inflated by the presence of multicollinearity. As R^2 approaches 1, the VIF approaches infinity. That is, as the extent of collinearity increases, the variance of an estimator increases, and in the limit it can become infinite. If there is no collinearity between the explanatory variables, VIF will be 1.

For this, in the case of the variance inflating factor technique, each selected explanatory (X_i) variable was regressed on all other explanatory variables, the coefficient of determination (R^2) constructed in each case was evaluated to detect whether multicollinearity is a serious problem.

VIF (β_i) is defined as follows:

$$VIF = \frac{1}{1-R^2} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \quad (3)$$

Where, R^2 is the squared multiple correlation coefficient between X_i and the other explanatory variables. A VIF value greater than 10 is used as a signal for a strong multicollinearity (Adem Kedir, 2009; Gujarati, 2004).

Likewise, there may also be interaction between two qualitative variables, which can lead to the problem of multicollinearity or association. To detect this problem, coefficients of contingency were computed from the survey household data. The contingency coefficients are computed as follows:

$$C = \sqrt{\frac{x^2}{N + x^2}} \quad \text{...} \quad (4)$$

Where;

C = is the contingency coefficient;

χ^2 = is chi-square random variable; and

N = is total sample size

3.3. Operational Definition of Variables

3.3.1. The Dependent variable

Livestock Income (INC_LS): The level of income that the pastoralists derive from livestock is the dependent variable. Income by its very nature is a continuous variable. The annual households' livestock income is considered to be a function of numerable socio-economic variables. Based on the experiences, the respondents in the study area found to keep mainly cattle, shoat and camels. The income from different types of livestock may be affected by different socio-economic factors differently; however, assuming that the overall effect of the variables on the overall livestock income likely to be similar, it is dealt for livestock income as a whole (aggregate effect on livestock income).

Livestock income for this research purpose refers to the gross monetary income that the pastoral households derive from the animals they keep mainly from cattle, small ruminants (sheep and goats) and camel during the year before the survey. This income is equivalent to the income earned from sale of animals, sale of animal products, and food for home consumption from the animals mainly milk which is valuated to monetary form based on the current milk price in the study area. Moreover, the value of slaughtered animals for home consumption was considered in the calculation of livestock income. Pastoral households in the study area used to slaughter animals only occasionally; i.e. especially in times of holydays, wedding ceremonies, when the spouse gives

birth, and when family member gets sick (especially when shot and wounded during conflicts). The value of slaughtered animals for different purposes during the year before the survey was valuated using the 2010 livestock price indices for the study area (CSA, 2010). Other animal products (like hides and skins) and services (like transportation) from animals and social values were not valuated and excluded from the computation of income of the household; because any other animal products, other than milk and milk products are not used in terms of money in the study area. The same applies for by-products, like manure. Following this, income from livestock is expressed as:

$$INC\_LS = INC\_SA + INC\_SAP + INC\_MV + INC\_VSA \ldots\ldots\ldots\ldots\ldots (5)$$

Where;
INC_LS = is annual income from livestock;
INC_SA = is income from sale of animals;
INC_SAP = is income from sale of animal products; and
INC_MV = is income from annual milk production valuated to ETHB
INC_VSA = is value of slaughtered animals in terms of ETHB

3.3.2. The Independent Variables

Based on the review of literature, the researcher's personal experience of working in the pastoral areas and consultation with experts, totally 21 independent variables were identified. As to the scale of measurement of the variables, most of them are classified as categorical and few as continuous in nature.

- **Age of the Household Head (AGE_H):** Age refers to the number of years from the birth of the respondent to the time of the interview. Age by its nature is a continuous variable. Age of the household head is assumed to have a direct relation with experience of keeping livestock, in which case young aged respondents are hypothesized to be disadvantaged. On

the other hand, livestock production needs physical strength. In the pastoral areas livestock owners are expected to travel long distances in search of grazing pasture and water for their animals. Moreover, the herder needs to be strong enough to fight against predators and the competing clans in times of conflict over resources. In these cases, old aged respondents are hypothesized to be disadvantaged against income they earned from livestock. So the effect of age on income is two directional. In both cases, mid aged (25 - 45) heads are assumed to be advantageous, for they have average physical strength and experience of livestock production. Therefore, it is hypothesized that mid aged (25 - 45) heads have a positive impact on livestock income of the household.

- **Educational Status of the Household Head (EDU_H):** Education refers to the level of schooling but a discrete number of years. Therefore, it is treated as discrete variable where score “1" represents illiterates, "2" represents read and write “3” represents primary education and "4" represents above primary education. It was hypothesized that education to have a positive impact on the level of income from livestock for the household.

- **Family Size (FAM_SIZ):** It is a continuous variable, defined in terms of adult equivalences, the availability of active labour force in the household, which affects livestock owners’ income from livestock. Since production is the function of labour, availability of labour is assumed to have positive relation with income. Therefore, family size is expected to have a positive impact on annual livestock income. On the other hand, the more dependant (children and old age) family members are in the household the more will be the consumption in which case family size influences livestock income negatively.

- **Total Livestock Holding (TLSH_TLU):** It is a continuous independent variable measured in terms of tropical livestock unit (TLU). Total livestock holding by the respective household is referred to as the number of livestock species (in this case, cattle, shoats, and camels) owned per household during the survey period. Ownership of more number of livestock is expected to have positive relationship with pastoralist households’ annual livestock income.

- **Mobility (LS_MOB):** It is a dummy variable where value '1' is assigned to those respondents who move their animals in search of feed and water, and '0' otherwise. It refers to the movement of the pastoralists with their livestock to distant areas far away from their residences in search of grazing pasture and water for their animals; in which case risks of animals theft by conflicting clans and risk of animals being eaten by predators is high, which in turn decreases the total herd size, thereby affecting the income from livestock. Therefore, it is hypothesized that mobility has a negative impact on the annual livestock income.

- **Risk of Predators (PRD_RISK):** It is a dummy variable taking a value of '1' for responding 'yes' to the risk of occurrence of loss of animals through predators, and '0' otherwise. It refers to likelihood of animals eaten by beasts in times of herding. It was assumed to have a negative effect on the total TLU of livestock and thereby on the total annual livestock income.

- **Drought (DR_RISK):** It is a dummy variable '1' for affected by drought, and '0', otherwise. It is assumed that the possibility of a danger which results in lack or shortage of grazing, water and other related resources due to the absence of rainfall. It is directly related to the lack of grazing pasture and water for livestock. In times of drought loss of stock is high due to death of animals for hunger. Animals lose body weight resulting in lower price in the market for the herders. Pastoralists are forced to sell their livestock at low price because they have no chance of keeping for next good time and waiting for fair price. Therefore, it is hypothesized that occurrence of drought has a negative impact on livestock income.

- **Livestock price in the market (PR_LS);** It is measured as a dummy variable which takes the value "1" if the pastoral household head receives fair price for the sale of his livestock and ''0'' otherwise. It is assumed that livestock price in the market has a positive effect on the livestock income.

- **Livestock Mortality (MOR_LS);** Mortality is a dummy variable where it takes a value of '1' for the respondents responding 'yes' for losing animals through mortality in any case during the year preceding the survey and '0', otherwise. Herders usually lose animals due to varying reasons including lack of feed and water during the times of drought, infected by different diseases, injury by thorns of *Prosopis Juliflora* and etc. Mortality results in small herds from which fewer animals would be available for sale and minimum income derived from animals. It is hypothesized that the higher the rate of mortality the lower will be the annual household income derived from livestock.

- **Access to credit (CRDT_AC):** It is measured as dummy variable taking a value "1" if the pastoralist household responded for having access to credit, and "0", otherwise. Pastoralists will pass the bad times if they have access to credit. They will have bargaining power to wait for good times and receiving good prices for their animals. Moreover, access to credit for the herders helps them to purchase concentrates (alternative feed) for their animals. Herders can improve the livestock production and productivity by adopting different production technologies. Credit access eases access and use of all these production inputs. It is hypothesized that access to farm credits affects livestock income positively.

- **Access to Veterinary Services (VET_AC):** It is a dummy variable assigned "1" for having access to veterinary services and "0", otherwise. It refers to the availability of animal health centers and adequate animal health services near the residences of respondents. Animal health extension workers assist herders to have continuous animal health care which prevents their animals die of easily curable diseases. It is expected to affect livestock income positively.

- **Market Participation (PPT_MKT):** Market participation refers to the involvement of the respondents in selling their livestock (cattle, shoats, camels) in the market once or more times in the year preceding the survey. It is measured as a dummy variable in which "1" representing the respondents' participation and "0", otherwise. It is expected that market participation affects annual livestock income positively.

- **Conflict (CON_RE):** It is measured as a dummy variable takes the value "1" if replied yes for involving in any type of conflict over resources resulting in loss of livestock and "0", otherwise. It refers to the clashes among competent clans over resources. Occurrence of conflict in pastoral areas causes loss of life of herders and animals, which in turn results in decrease in the labor force, an input to livestock production and decrease in the total TLU of livestock. Consequently, it is expected to influence livestock income negatively.

- **Choice of Livelihood Strategy (LH_STGY):** It is a dummy variable referring to whether the respondent lives on pastoralism or agro-pastoralism; in which case the value "1" represents involving in food crops cultivation (agro-pastoral way of livelihood) and "0", otherwise. Involvement of the respondents in crops farming may serve as an input for livestock farming by using the crop residues as livestock feed; on the other hand, it may compete for resources like labor and land. Therefore, it is difficult to hypothesize the effect of choice of livelihood between pastoralism and agro-pastoralism.

- **Employment (EMPT_WAGE):** It is measured as a dummy variable which assumes a value "1" for respondents' involvement in any paid work and "0", otherwise. It refers to the engagement of the respondents in any form of paid labor or skill activities such as working as civil servant or work for investors. Employment may add capital on the livestock production and thereby improvement in the production system where the effect is positive or may compete for labor resource in which case affects negatively. It is impossible to make a priori assumption about the effect of wage employment on the annual livestock income.

- **Grazing Land Availability (AV_GL):** It refers to the availability of grazing land in required quantity and quality in nearby areas. It is measured as a dummy variable which takes a value "0" for those respondents having problem of grazing land and "1", otherwise. Grazing pasture and water are the major inputs for healthy livestock production. Livestock produced with sufficient grazing land will be more productive and cost well in the market resulting in boost in output (production). It is expected to influence livestock income positively.

- **Livestock Disease (LS_DIS):** It is dummy variable taking "0" for livestock disease risk and "1", otherwise. It is defined as the occurrence of any form of livestock diseases during the production year preceding the survey. Livestock diseases are the likely causes of animals' death. It is hypothesized that occurrence of livestock disease outbreak has a negative impact on the annual livestock income.

- **Livestock Breed Type (LS_BRT):** It is measured as a dummy variable, "1" representing for the respondents adopting improved livestock breed types and "0", otherwise. Breed type here refers to the adoption of improved livestock breed types by the households. Improved breeds are more productive and bringing additional incomes to the household. On the other hand, from years of adaptation, the existing breed type may be tolerant to the harsh environment and some endemic diseases than the cross breeds. It is unlikely to make priori assumption whether the effect of livestock breed type on livestock income is positive or negative.

- **Access to Livestock Market (ACC_LSM):** It refers to the availability of livestock market center in the vicinity area to the livestock owners. It is a dummy variable where "1" represents for access to livestock market and "0" otherwise. Generally, those respondents with least walking hours to market are advantageous as they are more likely to cover production and marketing costs. Access to livestock market is expected to influence livestock income positively.

- **Livestock Management Practice (MGT_LS):** It is measured as a dummy variable, "1" representing for the respondents adopting modern management practices in their livestock production systems and "0", otherwise. It refers to carrying out of all activities in livestock production tradition in a way so as to receive maximum possible output. Improved/modern livestock management practice is likely to boost production. It is hypothesized that pastoralists' involvement in modern management practice has a positive impact on livestock income.

- **Access to extension services (ACC_EXT):** It is a dummy variable taking a value of "1" if the pastoral household has access to extension service and "0" otherwise. The provision of extension services to the pastoralists directly affects their knowledge, productivity and income; mainly because they have a tendency of using production technologies and learn to practice modern production techniques and are prone to change. It is expected to influence livestock income positively.

Table 3.4: Summary of definitions and measurements of variables used in the model

Variables	Definitions	Units of Measurement	Expected signs
AGE_H	Age of the household head	Number of Years	
EDU_H	Educational status of household head	Discrete	+
FAM_SIZ	Family size	Number	+
TLSH_TLU	Total livestock holding	TLU	+
LS_MOB	Livestock mobility	Dummy	+
PRD_RISK	Risk of predators	Dummy	_
DR_RISK	Drought	Dummy	_
PR_LS	Price of livestock in the market	Dummy	+
MOR_LS	Livestock mortality	Dummy	_
CRDT_AC	Access to credit	Dummy	+
VET_AC	Access to veterinary service	Dummy	+
PPT_MKT	Market participation	Dummy	+
CON_RE	Conflict	Dummy	_
LH_STGY	Choice of Livelihood strategy	Dummy	
EMPT_WAGE	Wage employment	Dummy	
AV_GL	Availability of grazing land	Dummy	+
LS_DIS	Livestock disease	Dummy	_
LS_BRT	Livestock breed type	Dummy	+
ACC_LSM	Access to livestock market	Dummy	+
MGT_LS	Livestock management practice	Dummy	+
ACC_EXT	Access to extension service	Dummy	+

CHAPTER IV

RESULTS AND DISCUSSIONS

This part consists of the overall findings of the study presented under different sections. The first section presents the results of descriptive statistics followed by econometric analysis results of the study. The descriptive analyses are done to describe the socio-economic characteristics of sample livestock owners. The econometric analysis delivers factors that affect livestock owners' (Pastoralists) annual livestock income.

4.1. Descriptive Statistics Results

This section presents the findings from descriptive statistical analysis. The description is made using percentages, mean, minimum as well as maximum values and standard deviations. In addition, mean difference for continuous variables and frequencies of discrete variables are tested using T-test and chi-square test, respectively.

4.1.1. Income Derived from Livestock by the Respondents

The process of collecting information on the herders' income is complicated for several reasons. It needs relying on the memory of the respondents, resulting in some degree of error during reporting; and the respondents most often underestimated their cash income, thinking about the relief aid they receive. With regard to this, Woldetensae agrees that these are typical problems faced by researchers working among the pastoral groups on their income in East Africa (Woldetensae, 2002). Usually herders receive cash income from sale of animals and animal products (milk and milk products, hides and skins). However, respondents may not sell animals or animal products for the whole season before the survey which may result in zero livestock income for some respondents. Therefore in this particular study, livestock products used for home consumption (milk and meat) are valuated to ETHB and included in the livestock income data other than the cash income received from sale of animals and animal products.

The nature of the livestock income data revealed that there is large variability in the annual livestock income among the respondents. The minimum annual income as ETHB 375.00 and the maximum is 51,686.00. The average annual income derived by the respondents from livestock is 10,839.40. Moreover, the respondents are arranged in to five livestock income groups to better recognize the livestock income level of respondents. The percentage computation of respondents revealed that the highest percentage of respondents (49%) found to lie in the lowest livestock income group (less than 10,000). It is followed by the [10,000 – 20,000] livestock income category which corresponds to 24% of respondents. Appreciably the result shows that as the livestock income group grows from the lowest (up to 10,000) to the highest (above 50,000) the percentage of respondents gets lower and implying that livestock herders in the study area derive low income from their livestock resources.

Table 4.1: Distribution of Respondents by Livestock Income

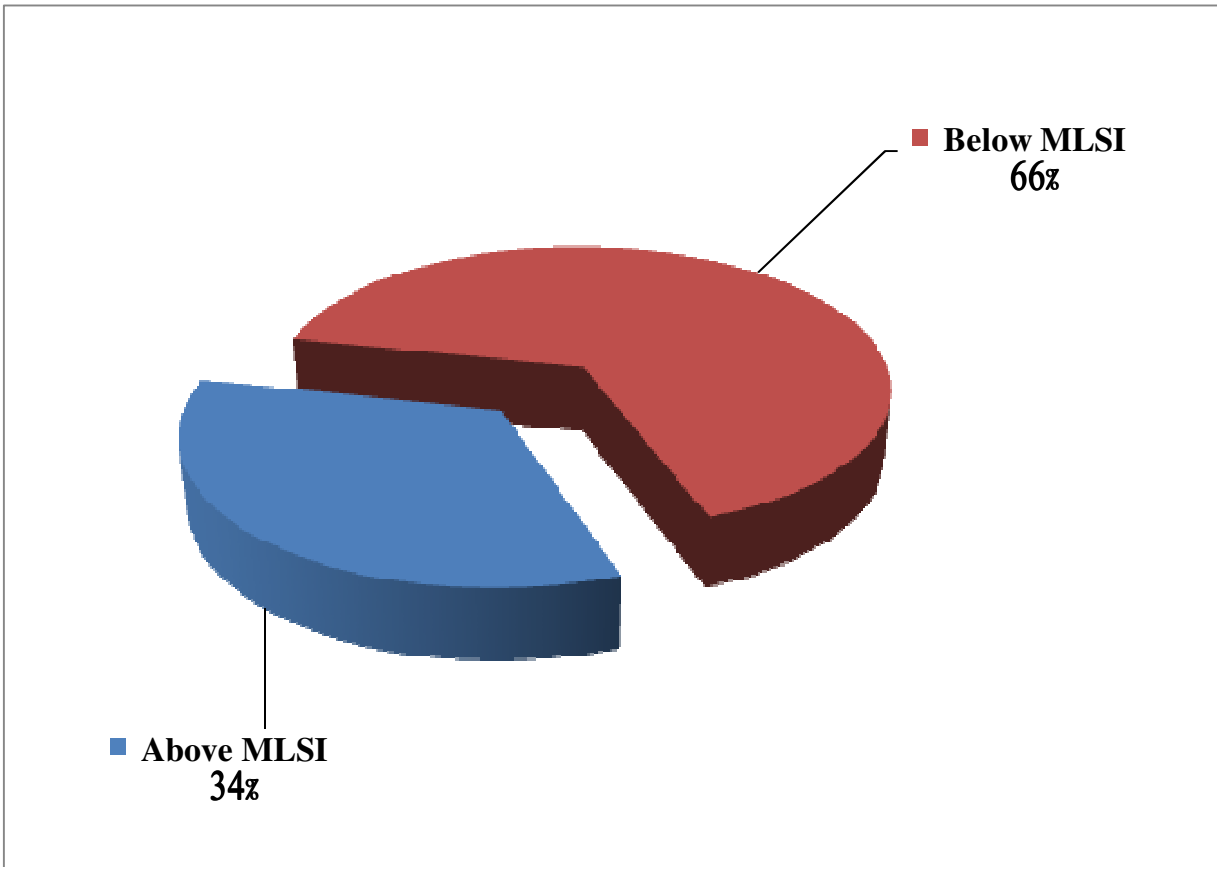
Income Groups (in ETHB)	**Percentage of Respondents**	**Mean Income**	**Standard Deviation**	**Maximum**	**Minimum**
Up to 10,000	49	**10,839.40**	**10,735.42**	**51,686.00**	**375.00**
10,000 - 20,000	24				
20,000 - 30,000	11				
30,000 - 40,000	8				
40,000 - 50,000	3				
50,000 - 60,000	5				

Source: Own Field Survey, 2010

Though income by its very nature is a continuous variable, it can be made categorical grouping it into different income groups (European Journal of Comparative Economics, 2007). Different criteria may be used such as income quintiles, deciles, means, and etc, depending on the nature of data collected for the specific purpose; but no rule of thumb. The collected livestock income values seem to have two extremes, extremely high [ETHB 51,686.00] and extremely low [ETHB 375.00]. Therefore, using the mean income value as a reference, the respondents are divided into two livestock income groups (those who lied above and those who lied below the average [ETHB 10,839.40] livestock income for the respondents).

As per the survey results, large numbers of sampled pastoralist households in the study area found to earn annual livestock income below average [ETHB 10,839.40] livestock income; this corresponds 66 per cent of the respondents in the study area. From this it can be concluded that majority of livestock owners receive low income [below ETHB 10,839.40] from their livestock resources, which is attributed to many social, economic and cultural factors. These factors are well identified, analyzed and dealt with in the preceding sessions of the discussion.

Figure 4.1: Distributions of respondents by livestock income categories



Source: Own Field Survey, 2010

4.1.2. Sources of Income for Households

Household income may come from different sources. According to the Canberra Group Report (2001), total household income is an aggregate which is composed of income from employment, rentals, transfers, livestock, crop, remittance. In this research, four major sources of household income are identified in the study area; livestock, wage employment, crop and rentals. The result of descriptive analysis shows that majority of pastoralists' household income in the study area is

from livestock. Almost all (98%) of the respondents use livestock as a source of household income. 61 per cent of the respondents depend on income from employment in combination with income from livestock. Whereas, 22% of the respondents found to use crops, 7% use land rent and 6% use other sources like remittances and petty trade (mainly charcoal make and trade) as a source of household income to support the livestock income. The shares of each sources of household income are computed. Accordingly, livestock income contributes 73.30% of the total household income in the study area followed by employment (18.09%) and crops cultivation (5.28%).

Table 4.2: Distribution of Respondents by Household income Sources

Sources of Income	Mean Income	Per cent of Households	Maximum	Minimum	Share in per cent
Livestock	10,839.40	98	51,686.00	375.00	73.30
Employment	2,676.40	61	10,800.00	-	18.09
Crop	781.00	22	10,000.00	-	5.28
Rentals	475.20	7	10,720.00	-	3.21
Others*	19.36	6	1,636.00	-	0.13

Source: Own Field survey, 2010

*Note: Include petty trade, remittances

4.1.3. Demographic and Socio-economic Profiles of Respondents

4.1.3.1. Age:

The average age of the sampled pastoralists' household head is computed to be 40.60 years, with 11.9, 20 and 80 years standard deviation, minimum and maximum ages, respectively.

As described in the previous section, the respondents are grouped in to above and below mean livestock income groups, those who receive annual livestock income (in ETHB) above the average annual livestock income of [ETHB 10,839.40] and those who receive below average livestock income groups. Accordingly, the average age is computable for the two livestock income groups as 42.06 and 37.76 years for below and above average income groups, respectively. The descriptive statistics result implies that as the age of the household head increases the income derived from the livestock declines. The independent samples t-test revealed that there is highly significant

relationship between livestock income and age of the household head at less than 1% level of significance.

Table 4.3: Age distribution of respondents by livestock income group

Variable	Below Mean LSI [10,839.40] N = 66	Above Mean LSI [10,839.40] N = 34	t-value	Total N = 100
Mean Age	42.06	37.76		40.60
Standard Deviation	11.86	11.72	- 10.077*	11.93
Maximum	80	61		80.00
Minimum	20	20		20.00

Source: Own Survey data, 2010

* Significant at 1% level of significance

* *Significant at 5% level of significance

* **Significant at 10% level of significance

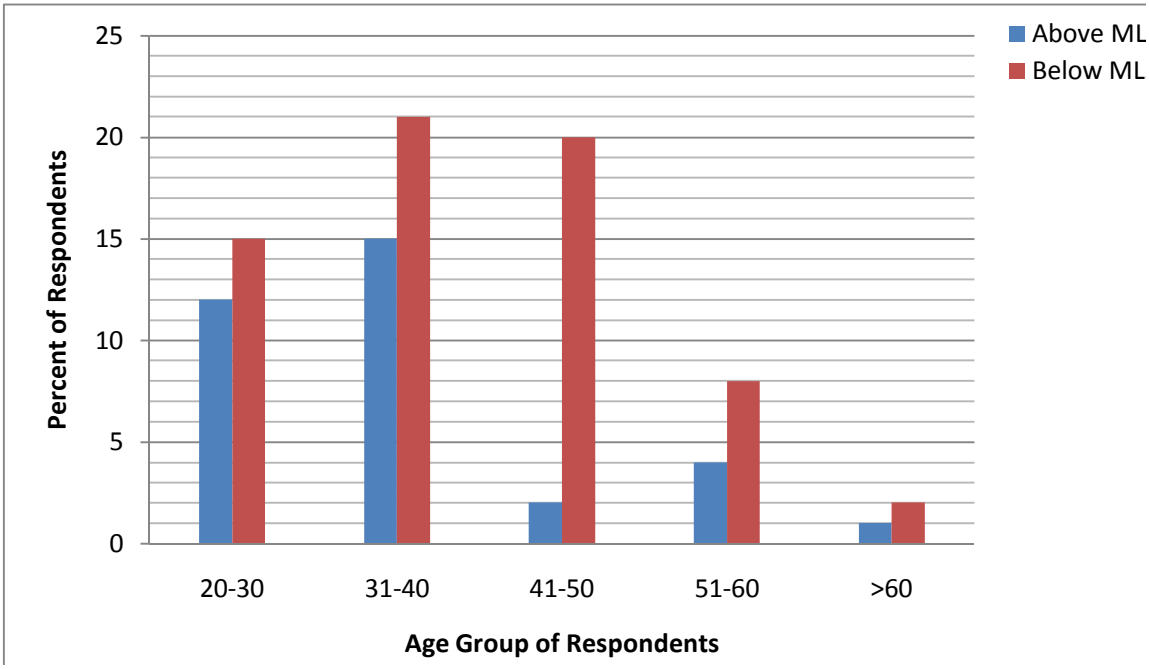
However, mean, maximum and minimum age values do not help to tell which age group is correlated to what level of livestock income, but to make statistical inference. Therefore, to more expressively see the relationship between livestock income and age of respondents; dividing respondents into age groups (age between 21 and 30, between 31 and 40, between 41 and 50, between 51 and 60 and above 60) is worthwhile. Accordingly, it is observed that 44.44 per cent of the respondents who lied in the age group of between 20 and 30 found to assume annual livestock income of above mean livestock income [ETHB 10,839.40]. Whereas per cents of respondents assuming annual livestock income of above mean livestock income in the age groups between 31 and 40, 41 and 50, 51 and 60 and above 60 are 41.67, 9.09, 33.33 and 33.33 per cent, respectively; implying that as age increases per cent of respondents in the above livestock income group decreases. Moreover, 27 respondents [about 80% of above MLSI groups] found to lie in the age groups of 20-40; against only 7 respondents [about 20% of above MLSI groups] lied in age groups of 41 and above.

Table 4.4: Age distribution of respondents

Age group	No. of Respondents	Per cent of Respondents	Cumulative Per cent
20-30	27	27.0	27.0
31-40	36	36.0	63.0
41-50	22	22.0	85.0
51-60	12	12.0	97.0
>60	3	3.0	100.0
Total	100	100.0	

Source: Own Field survey, 2010

Figure 4.2: Distribution of respondents by age group and livestock income group



Source: Own Field survey, 2010

4.1.3.2. Family size:

As can be seen from table 4.5 below, the average family size of the sampled households in the study area is 7.00 persons, with 2 and 16 being the minimum and the maximum family size, respectively. The standard deviation is computed to be 2.81. Family size is analyzed for the above

and below mean annual livestock income [ETHB 10,839.40] categories of the respondents with average family sizes of 6.95 and 7.01 persons for below and above mean livestock incomes, respectively. The independent samples t-test shows that statistically there is significant relationship between livestock income level and number of persons in the household at less than 10% level of significance. The result shows that as the number of persons in the household increases the income that the household derives from the livestock slightly increases. This can be justifiable as the income increment is as a result of more labour input contributed from more number of family members; as livestock income is a function of labour force.

Table 4.5: Family Size distribution of respondents

Variable	Below Mean LSI [10,839.40] N = 66	Above Mean LSI [10,839.40] N = 34	t-value	Total N = 100
Mean family size	6.95	7.01		7.00
Standard Deviation	2.57	3.29	10.094***	2.81
Maximum	-	-		16
Minimum	-	-		2

Source: Own Field survey, 2010

* Significant at 1% level of significance

* *Significant at 5% level of significance

* **Significant at 10% level of significance

4.1.3.3. Level of Education, Health and Marital Status:

The survey result shows that from the total of sampled pastoralist household heads, 92 percent were illiterate, 1% can read and write, 3% had primary education and the remaining 4% had attended above primary education. To see if level of education has impact on the income that the pastoral household earns from the livestock, computing and comparing level of education for the two livestock income categories (above and below ETHB 10,839.40) is worthwhile. The computation reveals that from above mean livestock income category, 94.1% are illiterate, 5.9% attended primary cycle education and none attended above primary cycle education. However,

from the below ETHB 10,839.40 livestock income category 90.9% are illiterate, 1.5% can read and write, 1.5% attended primary and 6.1% above primary cycle education. The result of computation shows that more than 94 per cent of the above mean livestock income categories are illiterate while 90.9 per cent of the below mean livestock income categories are found illiterate implying that the more illiterate the household head is, the more is the probability to earn high income from livestock. This seems illogical. Contrary to the fact, the χ^2 test revealed that statistically there is a positive significant relationship between level of income and level of education, the more the head is educated the more is the probability to earn high income from livestock. Undeniably, education has a positive impact on the overall household income. Educated families will have a high tendency of using different technologies as an input which helps increase income. They will also tend to diversify their sources of income and improve their income. On the other hand, educated household head may shift from one livelihood strategy to another; say from livestock farming to crop cultivation, resulting in decrease in livestock income paying more attention to crops cultivation. Therefore, in both cases the result makes sense.

Table 4.6: Distribution of Level of education, marital and health status of respondents

Variable	Above Mean LSI [10,839.40] N = 34		Below Mean LSI [10,839.40] N = 66		Total		χ^2-value
	No	%	No	%	No	%	
Illiterate	32	94.1	60	90.9	92	92	10.240***
Read and write	2	5.9	1	1.5	1	1	
Primary cycle	-	-	1	1.5	3	3	
Above primary	-	-	4	6.1	4	4	
Total	34	100	66	100	100	100	
Married					93	93	
Unmarried					5	5	
Divorced					2	2	
Healthy					97	97	
Disabled					3	3	

Source: Own Field Survey, 2010

*Significant at 1% level of significance
**Significant at 5% level of significance
***Significant at 10% level of significance

With regard to marital status, most of the sampled pastoral respondents (93.0%) are married. 5% were not yet married (single) and the remaining 2% are divorced.

As far as the health status of the sampled respondents is concerned, almost all (97%) are found physically healthy and fit to the existing situation. Though health status has impact on the income level of the household, with the exiting analysis result it is unlikely to see the effect of the health condition of respondents on their livestock income. In the same manner, all (100%) the respondents are male and here sex, just like health status could not be taken as factor affecting income, even though it has effect on income.

4.1.3.4. Total Livestock Holding

Total herd size is measured in a standard unit called Tropical Livestock Unit (TLU), where 1 TLU is equivalent to 250kg of livestock. In this study, total size of cattle, shoat and camel were computed into TLU using factors 0.7, 0.1 and 1.25, respectively, (International Livestock Centre for Africa, 1990).

It is observed from the analysis that the average TLU that the sampled respondents in the study area have is 15.57. The standard deviation is 17.82. The value of standard deviation clearly implied that there is a large variation in the herd size of the sampled respondents, in turn, implying that there is high wealth difference and income inequalities, as income is a function of total TLU in pastoral areas. In pastoral areas total TLU holding is used as a measure of wealth and used to indicate income level. However, measuring income inequality and wealth difference is not the objective of this research.

Average TLU is also computed for the two livestock income categories which help to see if there is any significant relationship between the two income categories and TLU. Accordingly, the mean, maximum and minimum TLU of the respondents who earn above mean annual livestock income are computed as 30.60, 108 and 7, respectively; whereas for those who earn below mean annual livestock income categories are 7.82, 21.9 and 0, respectively. The standard deviations for the high and low livestock income groups are 23.42 and 5.10, respectively. From the result it can be concluded that the higher TLU the household owns, the higher will be the livestock income. The t-test statistic also revealed that significantly there is a high significant relationship between the two group means and livestock income.

Table 4.7: Livestock ownership of respondents (in TLU)

Variable	Below Mean LSI [10,839.40] N = 66	Above Mean LSI [10,839.40] N = 34	t-value	Total N = 100
Mean TLU	7.82	30.60	10.097*	15.57
Standard Deviation	5.10	23.42		17.82
Maximum	21.90	108.00		108.00
Minimum	-	7.00		-

Source: Own Field Survey, 2010

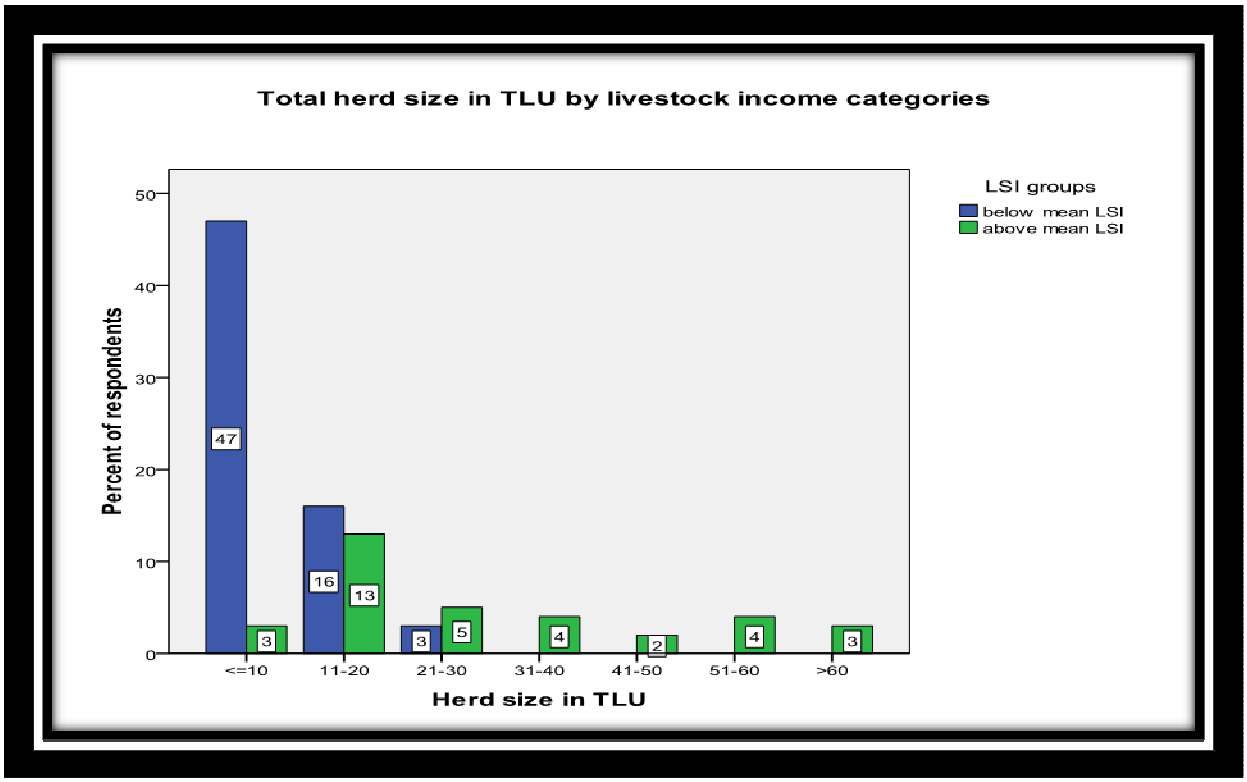
*Significant at 1% level of significance

**Significant at 5% level of significance

***Significant at 10% level of significance

To more expressively see the relationship between livestock income and total herd size, dividing respondents into 7 categories (TLU of less than or equal to 10, between 11 and 20, between 21 and 30, between 31 and 40, between 41 and 50, between 51 and 60 and above 60) with respect to livestock holding in TLU is worthwhile. From the figure 4.4 below, it is also observed that 47 per cent of the respondents found to hold total herd size of less than 10 TLU, which is 71.21% of the low income level groups; whereas only 3 (8% of high income level groups) of the respondents had total herd size below 10 TLU. On the other hand, 13 of the respondents (38.24% of the high income groups of respondents) owned more than 31 TLU of livestock at the time of the study; where none of the low income grouped respondents owned greater than 31 TLU. This confirmed the proposition that the less number of TLU that the pastoral household owns the higher is the probability that the household earns lesser livestock income.

Figure 4.3: Herd size by livestock income groups



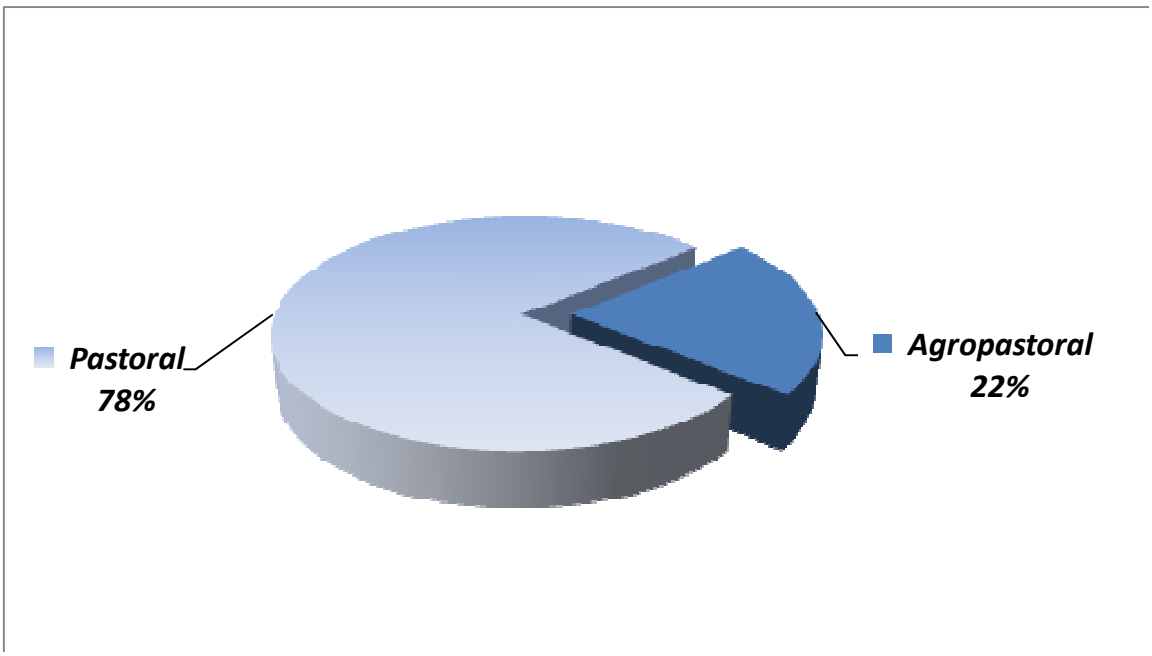
Source: Own Field survey, 2010

4.1.3.5. Livelihood Strategies

Pastoralism is the major livelihood strategy in the pastoral areas. However, it is not the sole means of living. The result of the study shows that the major means of living in the study area is pastoralism. It is also observed that agro-pastoralism is practiced by some inhabitants. As per the analysis, 78% and 22% of respondents are pastoralists and agro-pastoralists, respectively. Besides, 61% of the respondents are wage employed. Further analysis of the available data on the livelihood strategies and livestock income also shows that the average annual livestock incomes for the pastoral and agro-pastoral households are 12645.63 and 4792.50 ETHB, respectively. This implies that as the family shifts from pastoralism to agro-pastoralism way of livelihood, the income earned from livestock is likely to decline. The production inputs like labor, land, are shared between livestock and crops production as a result income from livestock is likely to decrease, however, the overall household income might not be affected.

Whether the household head is wage employed or not is also observed to affect the level of income that the family gets from the livestock. The study shows that the mean annual livestock income for wage employed and unemployed head of the family are computed as 9,882.10 and 12,336.69, respectively. Obviously, the wage employed household head shares the labor force and attention, thereby getting lower income from livestock. The t-test values also show that statistically there is high relationship among livestock income and choices of livelihoods at less than 1% level of significance.

Figure 4.4: Livelihood choices of respondents



Source: Own Field survey, 2010

Table 4.8: Level of livestock income by livelihood strategies and wage employment

Variable	Pastoral N = 78	Agro-pastoral N = 22	t-value	Total N = 100
Mean annual LSI	12645.63	4792.50	-10.097*	10839.40
Standard Deviation	11351.52	4881.80		10735.40
Variable	**Head-employed N = 61**	**Unemployed N = 39**	**t-value**	**Total N = 100**
Mean annual LSI	9882.10	12336.69	-10.097*	10839.40
Standard Deviation	9772.10	12070.72		10735.40

Source: Own Field Survey, 2010

* Significant at 1% level of significance

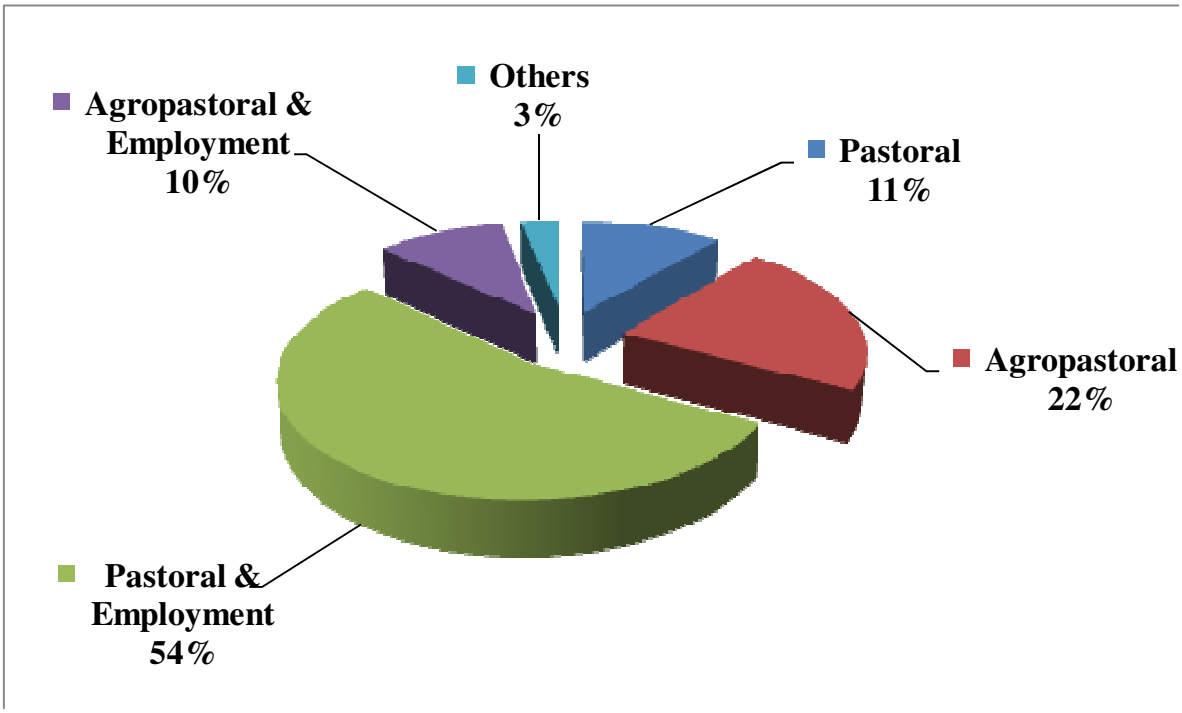
* *Significant at 5% level of significance

* **Significant at 10% level of significance

4.1.3.6. Occupation

The survey data reveal that the respondents are observed to involve in different occupations to make their living. Accordingly, five categories of occupations are identified. These include pastoral (solely livestock farming), agro-pastoral (combination of livestock and crop farming), livestock farming and employment, agro-pastoral and employment (livestock farming, crops farming, and employment) and others (combinations of pastoral and agro-pastoral with trade). Based on the result of the descriptive analysis, more than half (54%) of the respondents are involved in livestock rearing and wage employment; followed by agro-pastoralism (22%). This implies that in the study area the inhabitants are observed to support the traditional way of livestock farming by other ways of living mainly wage employment and crops farming.

Figure 4.5: Occupation of respondents



Source: Own Field survey, 2010

4.1.3.7. Land Ownership

As far as land ownership is concerned, the responses and the focused group discussions clearly indicate that in the study area land is owned by clans. As the experts in bureaus of pastoralist agriculture and rural development note even there is no clear demarcation among the lands of the different clans. They have traditional way of managing land and settling conflicts among clans over grazing land. The clan leaders deal with the private investors to rent the land for investment and all the clan members share the money from land rent via the clan leader. Therefore, it seems odd to ask the Afar pastoralist if he owns land. Some of them replied no and others yes. However, some respondents argued that they had small hectare of farm land and practice crop farming. Land for grazing is in common with the clan members. Accordingly, 45% of the respondents replied that they had land (farm land). However, not all of them began practicing crops cultivation due to different reasons including labor shortage, rain failure, *Prosopis juliflora* (locally known as dergihara or weyanezaf) invasion, lack of skills and many others. The result of the study shows 22% of the respondents involved in cultivating crops. They used to grow cereals and vegetables in

small scales. Few also grow cash crops like sisal and cotton. They involved in growing crops mainly for home consumption.

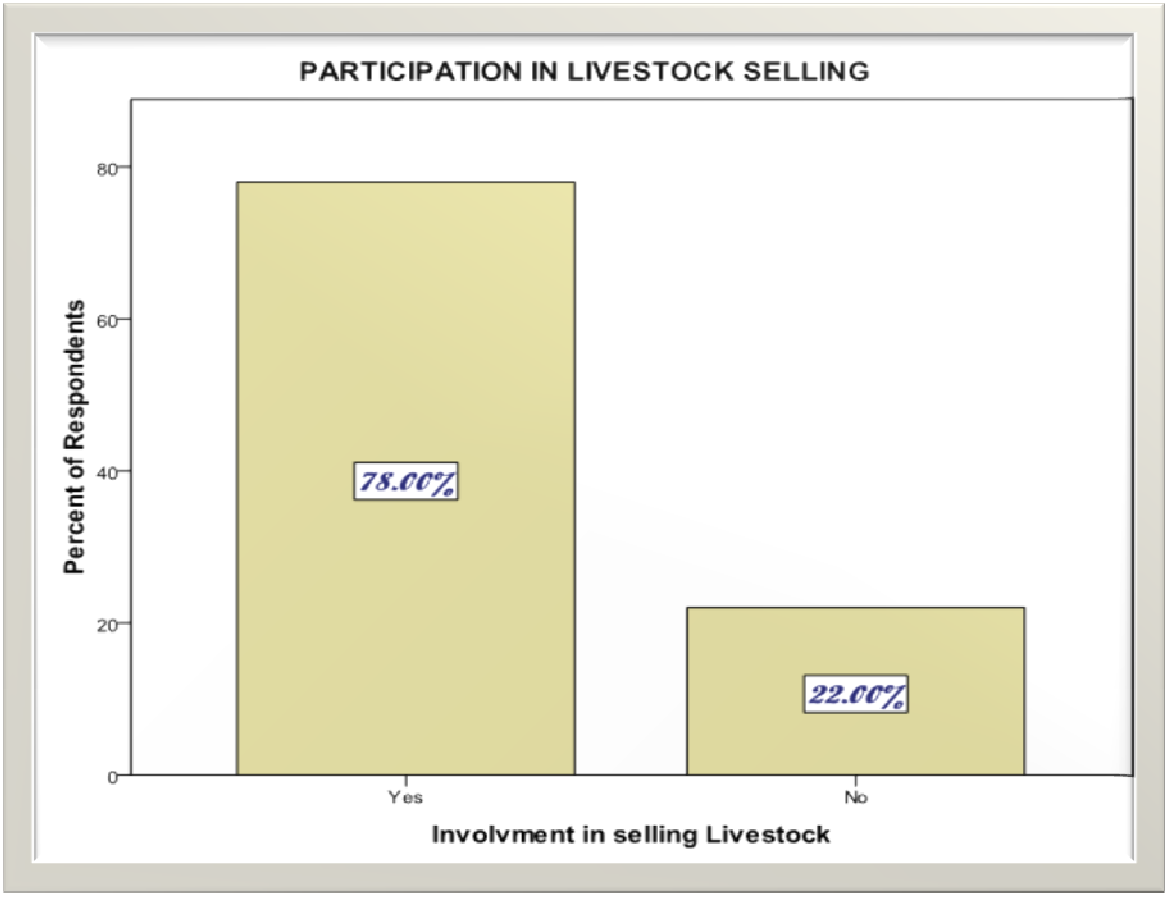
The land tenure system was described as communal. Land in the study area is rented to investors communally via the respective clans. The survey data analysis result shows that only 7% of the respondents are found receiving income from land rentals. The average number of hectare of land they owned is 3.67. The standard deviation is 11.93. Moreover, with regard to land ownership and tenure system, the results of the focused group discussions with the rural development experts of the woredas show that land is not privately owned, it is in the hands of clans. Clan leaders used to rent the land to investors and divide the collected sum to the clan members based on their tradition. The wereda finance office collects tax from the investors. In addition the investors pay 30% to the clans. The pastoralists do not pay land tax.

4.1.3.8. Market Participation

Market participation is perceived as one of the major factors determining level of livestock income. For pastoralists market participation is crucial to improve their household income basically from livestock. In this study market participation refers only to selling livestock and livestock products. Based on the results of the study 78% of the sampled respondents involved in selling (sold) livestock in the market for the past 12 months (the year before the survey) for different purposes. The respondents replied that they mainly sold livestock to get cash income to purchase food grains, clothing for the family, and expenses for children's education and health care. When mean annual livestock income is computed for those who involved in selling livestock and for those who did not involve, the results point out that participation of pastoralists in the market has direct relation with their livestock income.

Accordingly, the average annual livestock income for the participant and non-participant groups are ETHB 12,018.94 and 6,657.39, respectively. Moreover, the t-test values reveals that statistically there is highly significant relationship between market participation and livestock income.

Figure 4.6: Market participation of respondents



Source: Own Field survey, 2010

With regard to participation in selling livestock products, the study shows that majority (84%) of the sampled respondents did not involve in selling products due to different reasons. Only 16% of the sampled respondents received income from selling livestock products (mainly milk). The underlining reasons for not selling livestock products in the market as the respondents responded include short of milk production, i.e., what they produced did not go beyond home consumption, and cultural reasons (in the Afar tradition milk- specially camel milk)- is not sold, even in times of surplus production. Hides and skin are used to make home materials such as sleeping sheet, pillow, luggage, vessels; but not sold in the market; therefore, not included in livestock income calculation in this study.

Table 4.9: Livestock income distribution among market participants and non-participants

Variable	Participants N = 78	Non-participants N = 22	t-value	Total N = 100
Mean LS Income	12018.94	6657.39		10839.40
Standard Deviation	11183.51	7825.25	10.096*	10735.40
Maximum	-	-		51,686.00
Minimum	-	-		375.00

Source: Own Field survey, 2010

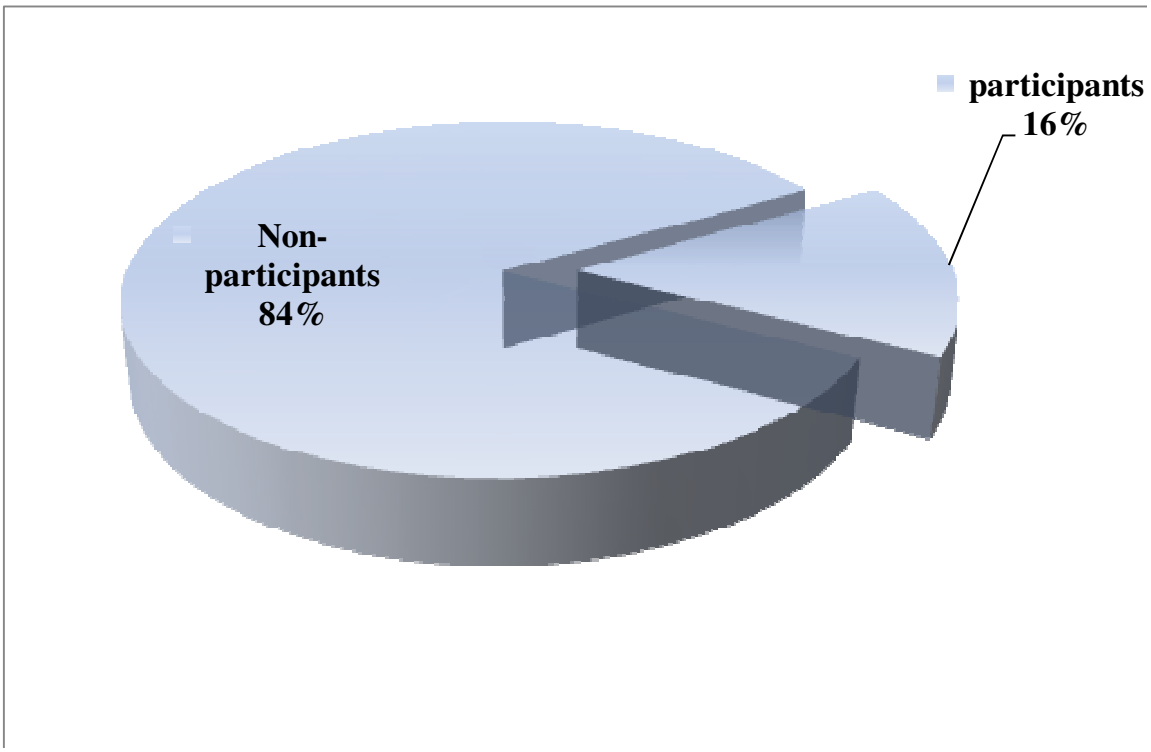
* significant at less than 1% level of significance

** significant at less than 5% level of significance

*** significant at less than 10% level of significance

As to the time of selling livestock, majority of (77.3%) the sampled pastoralists sold their animals not by their preference of time of selling but forced by different forces mainly cash shortage to purchase food grains and drought (animal feed shortage). Therefore, a good number of respondents replied that they sold livestock in times in the year when they need cash income to cover home food consumption expenditure. The remaining 22.8% of the respondents sold livestock at their best preference; they prefer to sell at the end of rainy seasons. According to their reply they prefer this time because as there is availability of good pasture animals will have good price in the market. Moreover, supply in the market is short due to grazing pasture availability. Among the participants of selling livestock 79.7% sold their animals at village (small daily) markets, 19% at neighboring wereda markets (large weekly markets) and 1.3% sold on the farm. They used the wereda markets to sell mainly large ruminants while small ruminants are sold mainly at the village markets. Accordingly, 96.6% of the respondents sold their livestock to traders, 2.5% to cooperatives and 1.3% to abattoirs.

Figure 4.7: Pastoralists participation in livestock products selling



Source: Own Field survey, 2010

Table 4.10: Distribution of respondents by time of selling livestock

No.	Time of selling	No. respondents selling	Per cent
1	Drought season (forced sale)	7	8.9
2	After rainy season (preference sale)	18	22.8
3	Any time in the year in need of cash (forced sale)	54	68.3

Source: Own Field survey, 2010

As to the market price, 82% and 18% of the sampled respondents replied unfair and fair price, respectively. Among the reasons for the low market livestock price included are market inaccessibility, lack of bargaining power, forced sale (by drought, cash short) and poor body performance of animals. When overall contribution of each factor is computed market inaccessibility took the highest share (36.23%), followed by forced sale (35.66%); to which lack of

bargaining power (19.58%) and poor body performance of animals (8.54%) are precedent. Therefore, much has to be done on market infrastructure for household income improvement.

Table 4.11: Reasons for low price of livestock in the market

Reasons for low price	Responses		Relative per cent
	Yes	No	
No market access	76.8%	23.2%	36.23
No bargaining power	41.5%	58.5%	19.58
Poor body performance	18.1%	81.9%	8.54
Forced sale	75.6%	24.4%	35.66

Source: Own Field survey, 2010

4.1.3.9. Access to Different Services

It was hypothesized that analyzing respondents' access to services such as livestock markets; veterinary services, credit etc. would indicate some factors affecting livestock income. Therefore, the respondents' access to different services that have direct or indirect impacts on the wellbeing of the sampled pastoralists had been analyzed.

The survey data show that among the sampled respondents only 34% have access to livestock market near to their residents. The rest 66% cross other adjacent woredas or even regions (korenti market in Amhara and metehara market in Oromia) to get market for selling large animals (cattle and camels), which is costly in terms of time and labor. They used to travel long distances; on the way losing animals through hunger, theft by the competing Issa clan. Finally, the remaining animals reach at market losing weight and prices adversely going down. However, sheep and goats are sold at the small daily village markets losing the advantages of multiple buyers and thereby lacking bargaining powers. In all cases they are disadvantaged.

With regard to market information and extension services, 18% have access to extension services and almost all (97%) receive information about the price prior to sale. However, the information source is not the formal one; it is local information exchange system (locally called dagu). 81.4%

of the respondents receive information informally, but only 18.6% receive from both village level extension workers and dagu.

Table 4.12: Access to different services

No.	Access to	Responses	
		Yes	**No**
1	Livestock market	34%	66%
2	Mkt extension services	18%	82%
3	Mkt information service	97%	3%
4	Marketing training	1%	99%
5	Credit services	7%	93%
6	Veterinary services	14%	86%

Source: Field survey, 2010

Among the sampled respondents, only 1% of them have access to training, 7% have access to credit and 14% have access to veterinary services during the year preceding the survey. The survey result shows that only 14% of the respondents are members of cooperatives and 44% said that there is no any cooperative organization they knew so far functioning in their kebeles. From all these, it can be concluded that services generally are found poor in the study area.

4.1.4. Purpose of Livestock Keeping

Livestock is generally the backbone of pastoralists. Livestock are everything for the pastoralists; wealth indicators, cloths, food sources, and have social values. In the study area the major animals kept by the respondents are cattle, small ruminants (sheep and goats) and camels.

Small numbers of donkeys are also observed during the survey, however, not included in the analysis and total herd (TLU) size. Among the sampled respondents, only 2% do not own livestock. As per purpose of owning livestock by the pastoralists, it is different for different animals. Among the major reasons identified in the study include milk, meat, cash income, prestige, wealth accumulation, and transportation and reproduction purpose. When seen for each

types of livestock (for this study the purposes of milking cows, oxen, sheep, goats and camels were regarded), the result of the analysis is depicted as follows in the table.

Table 4.13: Type and TLU of Livestock

Type and TLU of Livestock					
Variables	**Cows**	**Oxen**	**Sheep**	**Goats**	**Camels**
No. respondents owning livestock	90	23	54	85	49
Mean TLU	3.61	0.51	0.61	1.38	5.12
Standard deviation	3.40	1.63	0.84	1.23	10.74
Minimum TLU	0.00	0.00	0.00	0.00	0.00
Maximum TLU	21.00	14.00	3.00	5.90	75.00

Source: Own Field survey, 2010

Accordingly, numbers of sampled respondents owning cows, oxen, sheep, goats and camels are 90, 23, 54, 85 and 49, respectively. The major purposes for which cows are reared by the sampled livestock owners were reported as milk (44.56%), cash income earning from sale of live cows (28.21%) and meat (27.23%), in the order of importance. For oxen the purpose is reproduction (43.49%), cash income earning (30.14%) and wealth accumulation or prestige (26.37%); for sheep, cash incomes earning (54.18%) and meat (45.82%); for goats, cash earning (35.27%), milk (34.44%) and meat (30.29%); whereas for camels the purpose is transportation (39.19%), milk (38.41%) and wealth accumulation or prestige (23.40%), all in the orders of importance.

Table 4.14: Purposes of livestock ownership

Types of livestock	Purposes of livestock rearing		
Cows	Milk (100%)*	Meat (61.11%)	Cash (63.33%)
Rank	1 (44.56%) **	3 (27.23%)	2 (28.21%)
Oxen	Reproduction (92.31)	Cash (64%)	Wealth accumulation/prestige (56%)
Rank	1 (43.49%)	2 (30.14%)	3 (26.37%)
Sheep	Cash (96.36%)	Meat (81.48%)	
	1 (54.18%)	2 (45.82%)	
Goats	Meat (85.88%)	Milk (97.65%)	Cash (100%)
Rank	3 (30.29%)	2 (34.44%)	1 (35.27%)
Camels	Milk (96%)	Transportation (97.96%)	Wealth accumulation/prestige (56%)
Rank	2 (38.41%)	1 (39.19%)	3 (23.40%)

Source: Own Field survey, 2010

Note: *Numbers in bracket are per cent of respondents responding yes for the indicated purpose
** N umbers in bracket are overall percent of purposes of keeping livestock

The results of focused group discussions also reveal that the major types of animals kept by the pastoralists in the study area are camels, cattle, goats and sheep. They rear the animals for the major purposes of income source, food for the family, social status, spiritual and cultural values.

4.1.5. Factors Affecting Livestock Income and Suggested Interventions

Generally, livestock income is a function of many economic, social and cultural factors. In pastoral areas pastoralists are constrained by multifaceted problems, which in turn adversely affect the income that they would likely to get from the livestock. Among the problems constraining healthy

livestock production system, according to the focused group discussion results are summarized as follows:

a) Practicing traditional and backward system of livestock production
b) Grazing land degradation – poor management, unwise use of grazing resource, *Prosopis juliflora* (locally known as dergihara or weyanezaf) invasion, private crop farms expansion
c) Shortage of water for their animals – trek long ways to get water
d) Drought
e) Animals diseases
f) Breed type – no improvement has been made on the existing breed type
g) Lack of market infrastructure
h) Price fluctuation in the market (highly seasonal) – good price times are holidays and the few days following the short rainy seasons
i) Lack of market oriented production system – they do it so just for prestige, are not market minded

From literatures and own experiences, for this study some socio-economic factors were identified as check list for the pastoralists. The result implies that the major factors are unavailability of grazing pasture, conflict in the area, recurrent and long lasting drought occurrences, and livestock disease. The analysis results shows that predators, conflict, poor market infrastructure, unavailability of grazing pasture, livestock disease, lack of market demand and drought are computed to be 1st to 7th major factors determining the livestock income. Referring to the focused group discussions and the researcher's personal observation during the survey and his experience of working with the pastoralists, shortage of grazing pasture is still the major problem in the study area affecting the income from livestock. The recurrent drought is mentioned foremost for causing shortage of grazing pasture. The other factor resulting in short of grazing pasture is the invasion of the grazing land by the invasive species- *Prosopis juliflora* (locally known as dergihara or weyanezaf). Literatures revealed that the study woredas are the most invaded areas of the region (Farm Africa, 2009).

Table 4.15: Factors affecting livestock income

Factors affecting livestock income	Responses		Relative per cent	Rank
	Yes (%)	No (%)		
Breed	19	81	3.48	12
Mortality	22	78	4.03	11
Water	22	78	4.29	10
Management practice	47	53	8.61	9
Mobility	52	48	9.52	8
Drought	55	45	10.07	7
Mkt demand	60	40	10.99	6
Disease	61	39	11.17	5
Grazing	65	35	11.90	4
Infrastructure	66	34	12.09	3
Conflict	68	32	12.45	2
Predators	78	22	14.29	1

Source: Own Field survey, 2010

For the underlying problems constraining livestock production system and there by indirectly affecting income from livestock, the remedy is in the hands of the government, as the sampled respondents replied. The sole responsible body to alleviate the problems is the government. However, the focused group discussions with different experts of the woredas indicated that other bodies are included besides the government. This include the following

- The community - shall be prone to change, accept innovations
- Government offices at all levels – development agents, experts, policy makers
- Cooperatives (especially livestock marketing cooperatives, livestock products marketing cooperatives, credits and saving cooperatives)
- Non-governmental organizations
- Investors
- Traders (livestock)

For the problems, lists of interventions had been forwarded by the sampled respondents and focused groups. Accordingly, the remedies or possible interventions to be implemented in the long and short run included conflict resolution, alternative livestock feed sources, provision of veterinary services regularly, market infrastructure development, control of the invasive species, provision of livestock market extension services and promoting sedentary life. The responses of the sampled respondents towards the indicated interventions are shown in the table below.

Table 4.16: Suggested interventions to improve livestock income

Interventions to improve livestock income	N	Responses		Overall per cent	Ranks
		Yes	No		
Conflict resolution	97	75.6%	24.4%	27.36	1
Alternative livestock feed	96	72.9%	27.1%	26.38	2
Provision of veterinary service	97	64.9%	35.1%	23.49	3
Market infrastructure	97	23.7%	76.3%	8.58	4
Control of invasive species	97	22.7%	77.3%	8.22	5
Market extension services	97	10.3%	89.7%	3.73	6
Promote sedentary life	97	6.2%	93.8%	2.24	7

Source: Own Field survey, 2010

Moreover, the results of the group discussions imply that the possible interventions against livestock income factors are summarized as follows:

- Awareness, intensive training for pastoralists on modern livestock production systems
- Alternative sources of household income
- Proper land policy formulation and implementation
- Market infrastructure development
- Establishing modern market centres
- Diseases protection mechanism (vaccination)
- Well equipped and facilitated animal health centers
- Trained manpower at all levels and sectors (livestock production, marketing, cooperatives, veterinary services)

4.2. Results from Regression Econometric Model

4.2.1. Determinants of Household Livestock Income

The income of a household generally is determined by wide ranges of factors. The ranges of factors may vary between the different sources of household income. When speaking to the determining factors affecting household income from livestock, appreciably different factors can be observed. In addition to the descriptions given above, the income analysis in this sub-section was estimated using the linear multiple regression model. The study has tried to address the objective and give empirical analysis. A multiple linear regression analysis is carried out using software called Statistical Package for Social Sciences (SPSS) version 15.0. The dependent variable considered in the analysis is the total (gross) annual household income derived solely from livestock.

As it is already discussed, Multiple Regression Model (MRM) is selected to identify the determinants of livestock income in the study area. Before running the model, however, the independent variables are checked for exhibiting multicollinearity effect using variance inflation factor (VIF) and Contingency Coefficients (C). Accordingly, for the computed values of VIF, all by far below 10, all the hypothesized continuous independent variables are included in the model for estimation of parameters. Similarly contingency coefficients are calculated for the discrete variables. Contingency coefficient ranges between 0 and 1. The computed values of contingency coefficients for some discrete independent variables reveal that they are highly correlated and so multicollinearity effect observed. Therefore, conflict, livestock mortality, drought, access to veterinary services, choices of livelihood strategy and livestock diseases have been excluded from the model for exhibiting multicollinearity effect (significant at 1% level of significance). Consequently, the remaining 15 explanatory variables are used to estimate the model.

Table 4.17: Linear multiple regression estimates of determinants of livestock income

Explanatory variables	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(CONSTANT)	-20311.018	15516.677		-1.309	0.194	-51167.631	10545.596
AV_GL	11767.699	2392.062	0.263	4.919	0.000***	7010.821	16524.577
LS_MOB	3735.412	2104.622	0.087	1.775	0.080*	-449.861	7920.685
PR_LS	-52.255	3682.336	-0.001	-0.014	0.989	-7374.983	7270.473
PRD_RISK	-5037.958	2614.554	-0.098	-1.927	0.057*	-10237.286	161.370
ACC_LSM	-2698.350	2402.608	-0.060	-1.123	0.265	-7476.200	2079.499
LS_BRT	4913.851	2707.121	0.090	1.815	0.073*	-469.557	10297.258
MGT_LS	-566.458	498.259	-0.056	-1.137	0.259	-1557.300	424.384
AGE_H	-138.449	94.774	-0.077	-1.461	0.148	-326.917	50.018
EDU_H	-1712.920	1641.956	-0.054	-1.043	0.300	-4978.129	1552.289
FAM_SIZ	-93.733	392.420	-0.012	-0.239	0.812	-874.103	686.636
EMPT_WAGE	-2454.297	2199.594	-0.056	-1.116	0.268	-6828.430	1919.837
TLSH_TLU	880.865	65.625	0.731	13.423	0.000***	750.363	1011.367
PPT_MKT	-4984.663	3318.342	-0.097	-1.502	0.137	-11583.551	1614.224
ACC_EXT	3769.627	3027.798	0.068	1.245	0.217	-2251.481	9790.736
CRDT_AC	9242.286	4292.914	0.110	2.153	0.034**	705.356	17779.217
R^2 value				0.824			
Adjusted R^2 value				0.793			

Source: Own Field survey, 2010

* Significant at less than 1% level of significance
** Significant at less than 5% level of significance
*** Significant at less than 10% level of significance

Hence, family size, educational status of household head, total livestock holding, age of the household head, livestock mobility, risk of predators, price of livestock in the market, access to credit, market participation, employment, availability of grazing land, livestock breed type, access to livestock market, livestock management practice and access to extension services are the independent variables assumed to explain the dependent variable using the specified model. However, it doesn't mean that the variables included are exhaustive.

As indicated in Table 4.16, the coefficient of determination (R^2) and the adjusted R^2 values are 0.824 and 0.793, respectively. It means that about 80% of the variation in the dependent variable is explained by the independent variables, indicating relatively high explanatory power (goodness of fit) of the model.

The regression analysis result reveals that most of the coefficients of the explanatory variables included in the model have negative sign. The negative sign of the coefficients indicates that the explanatory variables influence the dependent variable negatively. However, the level of significance varies from one independent variable to the other.

Out of these 15 explanatory variables, only 6 variables are found to be significantly affecting pastoralists' household livestock income. Those variables which are considered as important determinants of livestock income as per the analysis result are a) total livestock holding (TLSH_TLU), b) access to credit (CRDT_AC), c) availability of grazing land (AV_GL), d) risk of predators (PRD_RISK), e) livestock breed type (LS _BRT) and f) livestock mobility (LS_MOB).

Total livestock holding (TLSH_TLU) and availability of grazing land (AV_GL) are statistically significant at less than 1 per cent probability level, access to credit (CRDT_AC) is statistically significant at less than 5 per cent probability level and the remaining significant variables, risk of predators (PRD_RISK), livestock breed type (LS _BRT) and livestock mobility (LS_MOB) are found to be statistically significant at less than 10 percent probability level of significance, respectively; whereas the coefficients of the remaining explanatory variables are not statistically different from zero at the conventional levels of significance. Discussions on the statistically significant independent variables are as under.

4.2.1.1. Total Livestock Holding (TLSH_TLU):

As hypothesized and expected, total herd size exerts a positive impact on the level of income from livestock for the household and significantly at less than 1% level of significance. This means, a unit increase in the number of herd size in TLU leads to an (73.1%) increase in level of livestock income. The implication is that, livestock are sources of cash income for pastoralist households. They receive cash from the sale of livestock and/or livestock products. Moreover, when all other contributions of livestock such as transportation, stock replacement, reproduction, manure, prestige, social values and etc are valuated, add to the total household income from livestock. Therefore, pastoralists who owned more livestock are able to assume more income for their families.

4.2.1.2. Access to Farm Credit for the Household (CRDT_AC):

The result of the regression analysis shows that the pastoral household's access to farm credit observed to have a positive relationship with the income that the household derives from the livestock (camels, cattle and small ruminants). The impact of credit access on the level of livestock income to the household is significant at less than 5% level. The positive relation implies that the more the household is likely to get credit access from any source, the higher is the probability that the family's income from livestock improved. This is justifiable from many angles. In rural areas farm families mostly challenged by production failures which leads them to loss of assets (most probably livestock). This results in decline in stock and thereby small income from livestock. The result will be the worst if not supported by credit availability to back store the stock and pass the bad days. Pastoralists will pass the bad times if they have access to credit. They will have bargaining power to wait for good times and receiving good prices for their animals. Moreover, access to credit for the herders helps them to purchase concentrates (alternative feed) for their animals. Herders can improve the livestock production and productivity by adopting different production technologies such as improved livestock breeds. Obviously adoption and wise use of different production inputs helps herders boost production, hence, surplus for the market resulting, in turn in rise in income from livestock resources. Availability of credit for the pastoralist households eases access and adoption of all the production inputs thereby, contributing to increase in income from livestock for the households.

4.2.1.3. Livestock Mobility (LS_MOB):

It is common for the pastoralists to move their animals in search of pasture and water. The regression analysis shows that livestock mobility impacts livestock income significantly at less than 10% level of significance. However, the impact is found to be positive as the coefficient is computed as a positive value which is contradictory to the hypothesized proposition. The justifications for the positive relationship between livestock income and herd movement might be when the pastoralists move their animals they get access to pasture and water for the animals. Leaving the risks associated with movement like predators, diseases, theft and others aside, access to pasture and water help the animals be more productive. Obviously, the more productive are the animals the more will be the household income derived from the animals for the family. Otherwise, the positive relation may be interpreted as it happened by chance.

4.2.1.4. Livestock Breed Type (LS _BRT):

Breed type here refers to adoption of improved livestock breed types by the households. It is assumed that improved breeds are more productive and bringing additional incomes to the households. As hypothesized, the regression model analysis reveals that livestock breed type in the study area found to have a positive relationship with livestock income. The influence was significant at less than 10% level. Therefore, the implication of the result of the analysis is that as the pastoralists adopt improved livestock breed types the more will be their probability to assume high income from the livestock.

4.2.1.5. Availability of Grazing Land (AV_GL):

Availability of grazing land is one of the most figurative constraints of pastoralists in the study area. The study showed that 61 per cent of the sampled respondents responded that they have a problem of grazing land availability and perceive that the problem affects their income from livestock. According to the results of focused group discussions and the researcher's personal observation grazing land in the study area is administered and allotted by the clan leaders and the pastoralists use by communal mode. Moreover, pastoralists used to cross long distances in search of grazing pasture.

More appreciably, the result of regression model coincided with the above result from descriptive analysis. The econometric model analysis result reveals that availability of grazing land as

hypothesized has a positive relationship with the level of income from livestock. The relationship between livestock income and availability of grazing land is significant at less than 1% level of significance. The implication of the analysis result is that grazing pasture and water are the major inputs for healthy livestock production. Livestock produced with sufficient grazing resources will be more productive and cost well in the market resulting in boost in output (production). In such a case, pastoralists will have surplus for the market which in turn brings additional income to the household.

4.2.1.6. Risk of Predators in the Pastoral Areas (PRD_RISK):

Risk of predators refers to likelihood of animals eaten by beasts in times of herding, which results in herd loss. According to the result of the regression analysis, predators affect livestock income significantly at less than 10% level of significance. As expected, risk of predators found to affect income negatively. Obviously, predators near to the residents of pastoralists eat animals which in turn result in decline in stock. As level of income derived from livestock is a function of level of stock (herd size), the overall result will then be assuming livestock income less than the actual potential.

4.2.2. Conclusion from Results of Econometric model analysis

As indicated earlier, the major concern of this study is to analyse the determining factors affecting livestock income in the study area. To achieve the stated objective, first some 21 factors are identified and tested for exhibiting multicollinearity using VIF for continuous and Contingency Coefficient for discrete variables before running the model. Based on the result, six of the variables are excluded from the model for exhibiting multicollinearity effect and the remaining 15 variables are used to estimate the livestock income of the respondents. Out of these 15 explanatory variables, only 6 variables are found to be significantly affecting pastoralists' household livestock income. Those variables which are important determinants of livestock income as per the analysis result were a) total livestock holding, b) access to credit, c) availability of grazing land, d) risk of predators, e) livestock breed type and f)livestock mobility.

Total livestock holding and availability of grazing land are statistically significant at less than 1 per cent, access to credit at less than 5 per cent and the remaining significant variables, risk of predators, livestock breed type and livestock mobility are found to be statistically significant at less than 10 percent probability level of significance.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusion

The study is conducted in the Middle Awash area (Amibara and Gewane woredas of Gebi-Resu zone) of Afar National Regional State. It focused mainly on the determinant factors affecting pastoralists' livestock income. Primary data are gathered by individual interviews and focus group discussions using structured interview schedule and check list, respectively.

From the Afar region of Ethiopia, Gebi-Resu zone (administrative zone III) is randomly selected for the present study. From six woredas in Gebi-Resu zone, two woredas namely Amibara and Gewane are selected at random for the study. From the total of 27 PAs in these two woredas, ten PAs were selected at random (six from Amibara and four from Gewane). A random sample of 100 household heads (ten heads from each PA) is selected for the study.

Data are collected mainly on sources of household income and the levels of livestock income for the respondent households; and on determining factors affecting the livestock income. Using the mean livestock income value as a reference, the respondents are divided into two livestock income groups (those who lied above and those who lied below the average livestock income [ETHB 10,839.40] for the respondents).

As per the survey results, large numbers of sampled pastoralist households in the study area lies below average livestock income (66 per cent of the respondents are observed to earn annual livestock income from their livestock resources below ETHB 10,839.40).

In this research four major sources of household income are identified for the study area; these are livestock, wage employment, crop and rent of land. The result of descriptive analysis shows that majority of pastoralists' household income in the study area is from livestock. Livestock income contributes 73.30% of the total household income in the study area; followed by employment (18.09%) and crops cultivation (5.28%).

The descriptive analysis results shows that risk of predators, conflict, poor market infrastructure, unavailability of grazing pasture, livestock disease, lack of market demand for livestock and risk of drought were ranked as 1st to 7th major factors determining the livestock income. Referring to the focused group discussions and the researcher's personal observation during the survey and his experience of working with the pastoralists, shortage of grazing pasture is still the major problem in the study area affecting the income from livestock. The recurrent drought is mentioned foremost for causing shortage of grazing pasture. The other factor resulting in short of grazing pasture is the invasion of the grazing land by the invasive species- *Prosopis juliflora* (locally known as dergihara or weyanezaf).

In addition to the descriptive analysis, the livestock income is estimated using the linear multiple regression model. A multiple linear regression analysis is carried out using software called Statistical Package for Social Sciences (SPSS) version 15.0. The dependent variable considered in the analysis is the total (gross) annual household income derived solely from livestock. Family size, educational status of household head, total livestock holding, age of the household head, livestock mobility, risk of predators, price of livestock in the market, access to credit, market participation, wage employment, availability of grazing land, livestock breed type, access to livestock market, livestock management practice and access to extension service are the independent variables assumed to explain the dependent variable using the specified model.

The regression analysis result reveals that most of the coefficients of the explanatory variables included in the model have negative sign. The negative sign of the coefficients indicate that the explanatory variables influence the dependent variable negatively. However, the level of significance varies from one independent variable to the other.

Out of these 15 explanatory variables, only 6 variables are found to be significantly affecting pastoralists' household livestock income. Those variables which are important determinants of livestock income as per the analysis result are a) total livestock holding, b) access to credit, c) availability of grazing land, d) risk of predators, e) livestock breed type and f) livestock mobility.

Total livestock holding and availability of grazing land are statistically significant at less than 1 per cent probability level, access to credit is statistically significant at less than 5 per cent probability level and the remaining significant variables, risk of predators, livestock breed type and livestock mobility are found to be statistically significant at less than 10 percent probability level.

5.2. Recommendations

Based on the results and findings of the study, to improve pastoralist households' income from livestock, some recommendations are suggested to be addressed by the pastoral societies themselves, concerned different government sectoral bodies and non-governmental funding agencies. Those variables which are most important determinants of livestock income as per the analysis result are total livestock holding, access to credit, availability of grazing land, risk of predators, livestock breed type and livestock mobility. Sticking to the significant factors affecting livestock income, the following has been suggested;

- **Improving livestock production and productivity:** Livestock sub sector plays a great role contributing to household income. Its contribution to the total household income is significant. The highest proportion of the household income in the study area comes from livestock. Hence, necessary effort should be made to improve the production and productivity of the sector so as to benefit much from the sector. Higher production and productivity can be achieved through the use of improved breeds (introduction of timely and effective artificial insemination services to up-grade the existing breeds), introduction of alternative feed sources (like concentrates, cut and carry system and etc.) other than the natural grazing pasture, modern livestock production techniques (strategic feeding, feed storage, housing and etc.); and better management of communal grazing resources and risks management. Furthermore, provision of adequate veterinary services, improved water supply points, launching sustainable and effective forage development program, provision of training for the livestock holders on how to improve their production and productivity, improving the marketing conditions, etc. by the local community, NGOs and the local government are needed so as to derive the maximum possible income and thereby secure food consumption needs at household level.

- **Organizing pastoralists into cooperatives:** The existing situation of Afar region with respect to cooperatives promotion is poor. Currently, only 239 cooperatives of different operational areas are functioning in the region. Out of which 11 and 10 are working in the areas of savings and credits and livestock marketing, respectively (Martha T, personal information from the region's cooperative promotion bureau, April 2010). The livestock owners have over many years suffered to access financial support due to factors such as lack of financial institution and

collateral systems fit to their situation. Therefore, organizing the pastoralists in to saving and credit cooperatives solves the problem as these organizations are ideal in serving as one of the funding mechanisms that aim at broadening access by pastoralists to finance through credit. The role of credit in the household economic portfolio can be interpreted as when credit is received, it creates an addition to the financial resources available in the current time period for support of the household incomes; enabling herders use production inputs and technologies. The cooperative promotion offices in the study area should work hard in creating awareness among pastoral families towards objectives, values, principles and importance of cooperatives and help them organize in to cooperatives of their own. Furthermore, livestock marketing cooperatives, milk and milk products marketing cooperatives are needed to be initiated at least at woreda level so as to help herders bargain in the market.

- **Market oriented livestock production:** Livestock production in the study area is subsistence with limited or no market orientation and poor institutional support and infrastructural development. Pastoralists produce and keep animals for various valid reasons, with little market-orientation. However, producing for the market requires re-orientation of the production system and development of a knowledge based and responsive institutional support services. Institutional support services of extension, research, input supply, rural finance and marketing are key areas of intervention that can play central role in the transformation of subsistence mode of production in to market orientation with market infrastructure development. Markets and roads networking the pastoral woredas with other woredas and with neighboring regions are crucially important so as to milk the available market advantages. Moreover, training of the livestock owners is an important aspect of commercialization of the small-scale livestock sector. Training will significantly increase their probability of participation in the livestock markets. There are various methods which can be used to transfer marketing knowledge and skill to the pastoral households. A product demand-led type of training will be very crucial as it will attempt to balance what the livestock owners are currently producing and what the market requires. It is fundamental that the BOPARD should play a leading role by supporting pastoralists training programs in an effort to orient pastoral households market minded.

- **Improving pastoralists' access to and participation in the markets:** The ability of pastoralists to market their livestock and/or livestock products in a timely fashion and at a fair price is essential to improve their income at the household level. It fosters monetization, savings and investment. If prices of livestock in the market are relatively stable, attractive and predictable over space and time, marketing efficiency can be enhanced, in which case pastoralists will be motivated. Therefore, it demands to improve their access to markets through construction of modern markets and access roads, provision of water along stock routes and improved security along market routes. Moreover, strengthening pastoralists' access to markets and livestock trade through better linkages between pastoralists and traders is particularly important.
- **Managing associated risks of mobility:** Mobility is a primary way of managing livestock related risks in pastoral areas. However, there are multiple risks associated with moving along with livestock in search of better grazing rangeland and water. In the study area, ethnic conflicts and predators risks are mentioned foremost challenging mobility. Therefore, while mobility is a lasting tradition to pass bad times of the year in pastoral areas, managing associated risks is worthwhile. Sustainable conflicts management and peacemaking schemes led by elders of rivalry ethnicities are need to be promoted by the regional government. Participatory range resources demarcation or allocation among the ethnicities is another option to bring them into harmony in using range resources. Working on the control of the invasive *Prosopis juliflora* species, which invades the grazing land and harbours predators, is also needed. Clear demarcation between communal grazing range lands and wildlife reserves will also decrease the predators' risks.
- **Control of the invasion rate of *Prosopis juliflora* species:** Most land in the study area is used for pastoral purposes, although much of the land in the Awash valley in the riverine zone has been turned over to large irrigated farms. The damage that the current expansion of crop farms causes shortage of grazing range resources to pastoral livelihoods. This would be worsened when it has been compounded by the encroachment of the invasive *Prosopis juliflora* species from the farms into the surrounding rangelands; consequently, affecting healthy livestock farming system. Eradication has not been that easy. Thus, proper management and control of the invasion rate of the invasive species from grazing lands is urgent using the control methods like economic exploitation of the species.

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Appendix

Appendix 1: Average Daily Milk Production (Litres/Animal) and Average Lactation Period (Months) for cows and camels of Ethiopia

Item	Quantity Produced and Frequency
Cow Milk	
Average Daily Milk Production (Litres/Cow)	1.688
Average Lactation Period (Months)	6.0
Camel Milk	
Average Daily Milk Production (Litres/Camel)	5.053
Average Lactation Period (Months)	10.0

Source: CSA, 2010

Appendix 2: Average Producers' Prices of Livestock in Rural Areas by Zone, Afar Region

Type and grades of animals	Price		
	Zone 1	Zone 3	Afar average
SHEEP (CASTRATED)	272.14	323.21	306.19
LAMB	116.04	141.99	122.90
OTHER SHEEP (10-15Kg)	188.38	179.64	186.89
GOAT (CASTRATED)	287.50	407.27	319.63
GOAT KID	114.75	129.32	120.88
OTHER GOAT (10-15Kg)	183.33	154.69	174.84
CALF (1-2Years)	537.06	369.17	467.59
HEIFER (2-4Years)	2 929.00	936.00	931.80
COW (4 Years & Above)	1531.25	1340.56	1430.29
BULL (2-4Years)	1067.86	691.82	838.06
OX (4 Years & Above)	2083.33	1804.29	1948.62
CAMEL /MALE	2120.59	2158.33	2130.43

Source: CSA, 2010

Appendix 3: Conversion Factors to Estimate Tropical Livestock Unit equivalents

Animal category	TLU
Cattle	0.7
Shoat	0.1
Camel	1.25

Source: Storck, et al. (1991) as cited in Ephrem (2010); Taylor and Turner (2000), cited in Stefan Schwarze (2004)

Appendix 4: Goats herd size of a respondent

Source: Own picture during survey, 2010

Appendix 5: Discussion with pastoralists (Amibara)

Source: Own picture during survey, 2010

Appendix 6: Summary results of FGD on purposes and current market prices of livestock

Type of animals		**Purpose in the order of importance**				**Current market Price in Birr**	
		1	**2**	**3**	**4**		
Sheep	Female	Milk	Cash	Meat		Drought	100
						Rain/holydays	250
	Male	Cash	Meat			Drought	150
						Rain	300
Goat	Female	Milk	Cash	Meat		Drought	100
						Rain	300
	Male	Cash	Meat			Drought	150
						Rain	350
Cattle	Cow	Milk	Cash (if not good milking)	Meat (when get old/sick)		Not sold. In some cases, cows are sold for up to 2000	
	Ox	It is not usual to keep ox, when male calf is born it is culled at its early age, rarely grown for reproduction					

		purpose only.					
	Calf*	If female, grown to milking cow otherwise culled					
	Heifer	Grown to cow	Cash (if unmanageable)				
Camel	Female	Milk	Prestige	Wealth indicator	Meat (when old)		
	Male	Meat	Transportation	Cash (high priced at young)	Meat (when get old)	Small	6000
						Medium	5000
						Old	3000
Donkey	Transportation		Cash			1000-2000	

Source: FGD with BPARD experts, 2010

*Note: In Afar tradition, female calves are given the greatest value for they are tomorrows milking cows. In general female animals are never sold or slaughtered except forced to do so (in times of drought, sickness or punishment by the community)

Appendix 7: VIF of continuous variables

Variables	VIF
AGE_H	1.390
FAM_SIZ	1.318
TLSH_TLU	1.766

Source: Field survey, 2010

Appendix 8: Contingency Coefficient for discrete variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.00																	
2	0.469	1.000																
3	0.050	0.015	1.000															
4	0.038	0.013	0.136	1.000														
5	0.165	0.002	0.027	0.060	1.000													
6	0.469	0.420	0.011	0.001	0.078	1.000												
7	0.170	0.173	0.180	0.103	0.075	0.140	1.000											
8	0.338	0.420	0.111	0.001	0.029	0.311	0.054	1.000										
9	0.363	0.415	0.024	0.005	0.092	0.294	0.072	0.396	1.000									
10	0.125	0.004	0.006	0.028	0.072	0.083	0.131	0.021	0.125	1.000								
11	0.140	0.174	0.178	0.053	0.192	0.101	0.140	0.266	0.238	0.205	1.000							
12	0.276	0.197	0.222	0.225	0.216	0.220	0.280	0.138	0.131	0.231	0.155	1.000						
13	0.150	0.217	0.189	0.191	0.054	0.190	0.380	0.235	0.203	0.038	0.155	0.228	1.000					
14	0.143	0.067	0.070	0.054	0.214	0.033	0.032	0.033	0.060	0.031	0.132	0.232	0.146	1.000				
15	0.086	0.155	0.069	0.053	0.049	0.078	0.024	0.127	0.139	0.011	0.057	0.128	0.061	0.174	1.000			
16	0.071	0.042	0.033	0.247	0.122	0.052	0.221	0.052	0.160	0.094	0.089	0.237	0.070	0.210	0.127	1.000		
17	0.126	0.020	0.128	0.027	0.043	0.179	0.113	0.059	0.012	0.067	0.134	0.187	0.057	0.059	0.051	0.269	1.000	
18	0.173	0.091	0.041	0.111	0.006	0.144	0.166	0.091	0.041	0.192	0.157	0.118	0.215	0.200	0.199	0.319	0.002	1.000

1. Availability of Grazing land
2. Conflict over resources*
3. Livestock Mobility
4. Price of livestock in market
5. Risk of Predators
6. Livestock Disease *
7. Market access
8. Livestock Mortality*
9. Drought risk*
10. Livestock Breed type
11. Livestock Management practice
12. Education level of HHH
13. Choice of Livelihood strategy*
14. Wage Employment
15. Market participation
16. Extension access
17. Credit access
18. Veterinary services Access*

* Note: Exhibiting high multicollinearity effect at less than 1% level significance

Appendix 9: Interview Schedule for pastoral income survey

Interview schedule for Pastoral Household Income survey

Mekelle University

College of Business and Economics

Department of Co-operative Studies

This interview schedule is prepared to collect data from pastoral households for the purpose of studying the "Determinants of Pastoralists' Livestock Income in Middle Awash, Southern Afar, Ethiopia". (Gewane and Amibara woredas)

Date of interview _____

Name of the interviewer _____

General Instructions to Enumerators;

- Make brief introduction about the purpose of the interview to the respondent;
- Please ask the question clearly and patiently until the respondent understands;
- Please fill up the interview schedule according to the respondent replies;
- Please do not use technical terms while discussing with the respondents; and
- Please do not forget to record the data.

I. GEOGRAPHIC INFORMATION

1.1. Zone; 3

1.2. Name of Woreda _____

1.3. Name of pastoral association _____

1.4. Distance of PA to the nearest district town _____ walking time (in hours or days)

II. DEMOGRAPHIC CHARACTERSTICS OF THE RESPONDENTS

2.1. Name of the household head _____

2.2. Age of the respondent (in number of years) _____

2.3. Sex of the household head; _____ Female; _____ Male

2.4. Marital status of the household head; _____ Single; _____ Married;

_____ Divorced;

2.5. Health status of household head; _____ healthy; _____ disable; _____ HIV positive; _____ TB patient; _____ other health problem if any (specify)

2.6. Level of education of the household head; _____ Illiterate; _____ Read and write; _____ Primary cycle; _____ Above primary cycle; _____ Other (Specify)

2.7. Family size _____ (list the family members, including head).

III. OCCUPATION/EMPLOYMENT

3.1. What is your occupation? _____ Pastoral; _____ Agro-pastoral; _____ Civil servant; _____ Trade; _____ Clan leader; _____ Religious leader; _____ Other (specify)

3.2. Are you wage employed? _____ Yes; _____ No

3.3. If yes, what is the status of employment? _____ Daily labourer; _____ Contract basis; _____ Permanent

3.4. Are any of your families wage employed? _____ Yes; _____ No

3.5. If yes, fill the following table

S. No	Family members	Nature of employment (use code)
1		
2		
3		

Codes:

1. Daily laborer; 2. Contract basis; 3. Permanent

IV. ASSETS OWNERSHIP

4.1. Do you own land? _____ Yes; _____ No

4.2. If yes, what is the total size of your land (in ha. Or other local measurement): _____

4.3. How is land tenure system in your locality? _____ (1=Communal; 2=Rent or lease; 3=privately owned; others (specify) _____

4.4. What for is the land allotted? Grazing _____; Crops _____; Rent _____; other purpose (specify) _____ (in ha or other local measurement)

4.5. Do you own houses? _____ Yes; _____ No

4.6. If yes, i) what type is it? (grass roofed, corrugated iron roofed or both types) ii) what is its current value in birr? _____ iii) what for is it built? ____ Own residence; _____ Rent; Other purpose (specify) _____

4.7. Do you own livestock (now)? _____ Yes; _____ No

4.8. If yes, please fill the following table;

S. No	Type of livestock owned		Number owned now	Current value in Birr
1	Cattle	1. Cow		
		2. Ox		
		3. Heifer		
		4. Calf		
2	Sheep			
3	Goat			
4	Camel			
5	Others (if any)			
Total				

4.9. What for is the livestock kept?

S. No	Type of livestock owned		Purpose (use codes below)
1	Cattle	a. Ox	
		b. Cow	
		c. Heifer	
		d. Calf	
2	Sheep		
3	Goat		
4	Camel		
5	Other (if any)		

1=Cash income 4=Prestige 7=Draught power

2=Meat 5=Festivals/rituals 8=By-products (manure)

3=Milk 6=Transportation

9=Wealth accumulation; 10=Others (specify) _____

V. HOUSEHOLD INCOME

5.1. What are the sources of income for your household? _____ Livestock; _____ Crops; _____ Employment; _____ Rent (house, land, livestock); _____ Pension; _____ Remittance; Others (specify) _____

5.2. What are the levels of income from different sources?

No.	Source of income	Annual income (in Birr)	Rank
1	Livestock		
2	Crops		
3	Employment		
4	Rent (house, land, livestock)		
5	Pension		
6	Remittance		
7	Others		
Total			

5.3. Did you sell livestock during the last 12 months? _____ Yes; _____ No

5.4. If yes, list type sold and amount of Birr sold for.

No.	Type of animal sold		Number sold	Selling price (in Birr)	Reasons for selling
1	Cattle	Ox			
		Cow			
		Heifer			
		Calf			
2	Sheep				
3	Goat				
4	Camel				
5	Other (if any)				
Total					

1. Food; 2. Clothing; 3. Loan repayment, 4. Weeding, 5. Funerals; 6. Social affairs 7. Health 8. Education 9. Transport 10. Drought/feed shortage; 11. Others

5.5. When (season of the year) did you like to sell livestock? _____. Why do you prefer the season? _____

5.6. Where did you sell livestock? _____ on the farm; _____ village market; _____ regional market; _____ export market

5.7. To whom did you sell your livestock? _____ abattoirs, _____ cooperatives, ____ traders

5.8. What costs did you incur while selling livestock? _____ Transportation; _____ Feed/water; _____ Tax; ____ Brokers; _____ Others (specify)

5.9. What is your say about the price you receive for your livestock in the market? ____ reasonable/fair; _____ Not fair

5.10. If no, what do you think are the reasons?

_____

_____

_____

5.11. Did you experience receiving income from sell of livestock products? _____ Yes; ____ No

5.12. If yes, what are the products you sold during the last 12 months? _____ Meat; _____ Milk and milk products; _____ Hides and skins; Others (specify) _____

5.13. What is the level of income you received from sell of livestock products last 12 months?

No.	**Livestock product sold**	**Total income received (in Birr)**
1	Meat	
2	Milk and milk products	
3	Hides and skins	
4	Others	
Total		

5.14. Where did you sell livestock products? ____ Home, _____ village, ____ market

5.15. If the response for 5.11. is no, what are the reasons? _____

_____

5.16. Did you slaughter livestock for home meat consumption? _____ yes; ____ no; if yes, recall type and number of livestock (TLU).

VI. DETERMINANTS OF LIVESTOCK INCOME

6.1. What do you think are the major factors affecting your income from livestock you keep?

No.	**Determinants**	**Yes or No**	**Rank/prioritize**
1	Grazing land/feed availability		
2	Water availability		
3	Livestock disease		

4	Livestock breed/Adoption of improved breeds		
5	Conflict in the area		
6	Drought		
7	Mobility		
8	Predators		
9	Market demand		
10	Morbidity		
11	Management practice/Adoption		
12	Market infrastructure		

6.2. Whom do you think is responsible for taking corrective actions? _____

_____

6.3. What suggestions would you recommend for improvement of your income from livestock?

1. _____

2. _____

3. _____

4. _____

6.4. Do you involve in cultivating crops/forage? _____ Yes; _____ No

5.20. List the crops you are cultivating now in the order of importance

1. _____

2. _____

3. _____

6.5. If response for 6.4 is yes, what for is you doing so?

_____ Food (home consumption); _____ Cash income

6.6. If no, what are the reasons? _____

6.7. Have you involved in conflict over resource during last 12 months? ___ Yes ___ No

6.8. Do you perceive that conflict in the pastoral areas affect your income? ____ Yes ____ No

6.9. Do you move livestock to other place in search of feed and water? ____ Yes ____ No

6.10. Will mobility affect your income? ____ Yes ____ No

VII: HOUSEHOLD CONSUMPTION AND EXPENDITURE

7.1. What are the major sources of household food consumption?

_____ Livestock

- Own use
- Purchase
- Gift
- Others

____ Crops

- Own use
- Purchase
- Others

____ Food aid; or _____ Others (specify)

7.2. Level of expenditure and reasons (for the last 12 months)

No.	Reasons for expenditure	Amount in Birr
1	Food	
2	Clothing	
3	Farm implements	
4	Animal feed	
5	Rent	
6	Loan repayment	
7	Utensils/furniture/electronic goods	
8	Social affairs	
9	Health expenditure	
10	Education fee for children	
11	Festivals	
12	Others (specify)	
Total		

VIII: ACCESS TO DIFFERENT SERVICES

8.1. Did you have extension contact in relation to livestock marketing? ___ Yes, ___ No

8.2. Do you receive market information prior to sale? ____ Yes ____ No

8.3. If yes, what is /are your source(s) of information?

____ Radio/TV; ____ VEWs; ____ Cooperatives; ____ Broker or ____ By means of local information exchange (dagu); Others (specify) _____

8.4. If don't receive market information, would you like to have a regular source in the future? ____ Yes ____ No

8.5. How often would you like to receive? _____ Daily _____ Weekly _____ Monthly

8.6. Do you have access to livestock market? ____ Yes ____ No. Distance from the PA to the nearest market centre _____ walking time (in hour or day)

8.7. What are the factors creating risks when producing livestock?

_____ Drought risk: _____ Stock theft _____ Mortality/morbidity? _____ Conflict; Others (specify) _____

8.8. Are there any cooperatives in your PA? ____ Yes ____ No

8.9. Are you a member of cooperative (saving and Credit cooperative, Irrigation cooperative, livestock marketing cooperative)? ____ Yes ____ No

8.10. Do you have access to credit service? ____ Yes ____ No

8.11. If yes, what is the source of credit?

____ Bank; ____ Microfinance; ____ Credit and saving cooperative; or Others (specify) _____

8.12. Do you have access to veterinary service? ____ Yes ____ No. if yes, at what distance from your home? _____ (walking hrs. or days)

8.13. How do you transport live animals when you want to selling?

_____ Trucking; _____ Trekking

8.14. What general problem do you experience when moving your live animals for sale? _____

8.15. What are the primary sources of feed for livestock?

_____ Grazing in the range _____ Backyard forage _____ Fallow land grazing _____ Crop residue; _____ concentrates; others, specify _____

8.16. Did you attend training in relation to livestock marketing? ____ Yes ____ No

8.17. Did you adopt any improved livestock breed type? ____ Yes _____ No

8.18. Did you adopt any improved livestock production management systems? ___ Yes ____ No

Appendix 10; FGD checklists with Pastoralist Agriculture and Rural Development Officers

These checklists are prepared to collect data from Pastoralist Agriculture and Rural Development Officers for the purpose of studying the "Determinants of Pastoralists' Livestock Income in Middle Awash, Southern Afar, Ethiopia". (*Gewane and Amibara* woredas)

Date _____

Name of the wereda _____ No. of pastoral associations _____

I. Livelihood related checklists

1. How do you describe the livelihood of the wereda? (pastoral, agro-pastoral, trade)
2. How is the land tenure system of the wereda? (privately, communal, clan, rent/lease)

II. Assets ownership

1. What major types of animals are kept in the wereda? For what purpose are they kept?
2. What is the current value (current market price in birr) of each type of animal?
3. Which livestock products are valuable/marketable? How are the livestock products valued?
4. What is the average lactation period of the milking animals in the wereda? How many litres of milk each animal does give per day?
5. What are the houses of the pastoralists made of? How are they valued?

III. Sources of income

1. What are the major sources of household income for the pastoralists in the wereda?
2. What are the major factors affecting the livestock income?
3. Who do you think is the responsible body to deal with factors affecting livestock income?
4. What interventions are needed to improve the livestock income?

IV. Access to services

1. Is there livestock market? How is the distribution? How is livestock marketing channel?
2. Do pastoralists receive fair income from the sale of their animals? Why?
3. How many veterinary clinics are there in the wereda?
4. How many cooperatives are there? In what areas are they organized?

Appendix 11; FGD checklists with Pastoralist Agriculture and Rural Development Agents

These checklists are prepared to collect data from Pastoralist Agriculture and Rural Development Agents for the purpose of studying the "Determinants of Pastoralists' Livestock Income in Middle Awash, Southern Afar, Ethiopia". (Gewane and Amibara woredas)

Date _____

Name of the wereda _____ Name of pastoral associations _____

I. Assets ownership

1. What major types of animals are kept in the wereda? For what purpose are they kept?
2. What is the current value (current market price in birr) of each type of animal?
3. Which livestock products are valuable/marketable? How are the livestock products valued?

4. What is the average lactation period of the milking animals in the wereda? How many litres of milk each animal does give per day?
5. What are the houses of the pastoralists made of? How are they valued?

II. Sources of income

1. What are the major sources of household income for the pastoralists in the wereda?
2. What are the major **factors affecting** the livestock income? (in the order of severity)
3. Who do you think is the responsible body to deal with factors affecting livestock income?
4. What interventions are needed to improve the livestock income?

III. Access to services

1. Is there livestock market? How is the distribution? How is livestock marketing channel?
2. Do pastoralists receive fair income from the sale of their animals? Why?
3. How many veterinary clinics are there in the wereda?
4. How many cooperatives are there? In what areas are they organized?

I thank you very much!!