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LIVELIHOOD DIVERSIFICATION AND SUSTAINABLE LAND MANAGEMENT: THE CASE OF NORTH EAST ETHIOPIA

By

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Abbreviations

Abbreviations	Name
CSA	Central Statistic Agency (of Ethiopia)
GDP	Gross Domestic Product
MoFED	Ministry of Finance and Economic Development (of Ethiopia)
IMF	International Monetary Fund
MDGs	Millennium Development Goals
EPRDF	Ethiopian People's Revolutionary Democratic Front
MoARD	Ministry Of Agriculture And Rural Development
AESE	Agricultural Economics Society of Ethiopia
ETB	Ethiopian Birr (Name of Ethiopian currency)
CSA	Central Statistical Agency of Ethiopia
BoFED	Bureau of Finance and Economic Development (of Amhara Region)
BoARD	Bureau of Agriculture and Rural Development (of Amara Region)
WCED	World Commission on Environment and Development
DFID	Department for International Development
UN	United Nations
MoLSA	Ministry of Labor and Social Affairs
CIA	Central Intelligence Agency

Abstract

This study analyzed the determinant factors for livelihood diversification and its effect on sustainable land management practices in Gozamin District of Ethiopia taken from 151 sample farm households using econometric models. To examine this general objective, the study employed three econometric models: the Univariate Probit model, the Seemingly Unrelated Regression (SUR) model and the Recursive Bivariate Probit model.

The regression result of the Univariate Probit model indicates that livelihood diversification decision of a given farm household is positively and significantly determined by institutional factors, including land-rights perception and cooperative membership of a given farm household. While, household and socio-economic characteristics, like age, location, secondary educational level and market distance have negative effects on livelihood diversification activities.

The Seemingly Unrelated Regression model is employed to test empirically the intensity of livelihood diversification based on a typical farm household's income categorization of on-farm, non-farm and off-farm income generating activities. The regression result indicates that; male-headed household, land size, and agricultural technology determine the *on-farm income* positively. On the other hand, being a male-headed household and cooperative-membership affect *off-farm income* positively; whereas, market distance and credit service affects it negatively. Finally, being a household is male-headed and current market values of livestock affect the level of *non-farm income* positively; while, the proportion of students in the household affects it negatively.

The effect of livelihood diversification on sustainable land management practices is analyzed using the Recursive Bivariate Probit model. The Inverse Herfindhal-Hirschman Diversity (IHHD) index, which is a measure of livelihood diversification,

has a positive and significant effect on sustainable land management index of a farm household.

These findings implied that institutional factors, farm technologies, rural trading and urbanization could facilitate livelihood diversification. In the study area, livelihood diversification has positive impact for land management practices. Institutional factors, such as land rights, tree plantation cooperatives, rural trading and gender equity across farm households at micro and macro level need to be established and developed in Gozamin District and rural Ethiopia to implement jointly the livelihood diversification activities and sustainable land management practices.

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

Ethiopia is one of the Least Developed Countries (LDCs) located in Sub Saharan Africa. The livelihood of the majority of its population depends mainly on agriculture. Agricultural land area is estimated to be 35% of total land coverage (World Bank, 2012). From the total population, 80% of the livelihood is based on agriculture, and 77% of the national labor force has employed on this sector (FAO, 2011).

According to the classical theory of trade, any country that has a relatively abundant factor of production needs to be a producer and exporter of that specific abundant factor commodity and net importer of the scarce resource product (Free, 2010). Based on this theory, Ethiopia, being abundant in land and lower skilled labor, will need to focus on the production and export of agricultural commodities.

From the equity dimension aspect, the GDP contribution of agriculture needs to be much higher than the contribution from other economic sectors. However, starting from the year 2008, the service sector GDP contribution took the lead from the agriculture sector while the majority of the livelihood of the population still depended on the latter sector. Given all these facts, agriculture is growing at an average rate of

8 percent from 2005/06-2009/10 (MoFED, 2010). However, this growth in agriculture GDP has resulted from the average annual 11% cultivated land expansion; which means it is hardly coming from the productivity and efficiency growth effect (Nisrane, Berhane, Asrat, Getachew, Taffesse & Hoddinott, 2011). This fact seems to be motivating the government of Ethiopia to focus on agricultural land expansion, including towards the marginal lands, in order to boost agricultural growth, at least for the moment.

Since the year 1991, the Ethiopian government has formulated and implemented "Agricultural Development Led Industrialization (ADLI)" policy. This policy emphasizes on the improvement of smallholder farmers' agricultural productivity and on the expansion of agro-processing industrialization so as to boost export, growth, and to ensure food security (Assefa, 2008).

However, when we look at the productivity of agriculture in Ethiopia; it is very stagnant in terms of percentage growth rate. This is also true for the whole Sub Saharan Africa as studied by Department of Economic and Social Affairs of UN from 1961-2006 (UN, 2008). This leads to the persistent problems of food insecurity, higher food price inflation, and food aid in Ethiopia. This goes against the classical economists' theory of factor (resource) abundant scenario, as there should be surplus agricultural production in the country where in reality this is not what is happening.

This imbalance between values of agricultural product to total GDP versus proportion of agricultural labor force in the country indicates agriculture is found to be in a low efficiency and productivity condition. It is found to be in a productivity trap in that the sector is vulnerable to drought, high soil and wind erosion, loss of soil fertility, low technological adoption, and market and institutional constraints. For instance, soil erosion estimated to be 42 tons per hectare per year and soil nutrient depletion is one of the highest in Sub Saharan Africa on farmlands that result in further diminishing of land productivity (Pender, Gebremedhin, Benin and Ehui, 2001).

That is, cereal productivity averaging less than one ton per hectare and milk yield is about one-fourth of the average of all developing countries (Pender et al. 2001, p.1231). Moreover, there is high population growth rate in rural areas of Ethiopia that leads to a "disguised unemployment"[1] (Lewis, cited in Meier & Rauch 2005). The low productivity nature of agriculture and the ever-increasing population growth rate pushes farm households in the North East Ethiopia of Gozamin District to diversify their livelihood strategy, so as to maximize their personal income and to smooth their annual consumption expenditure.

1.2 Statement of the Problem

The impact of economic development on the environment is debatable among various

[1] *Unemployment where the marginal productivity of labor is negligible or zero*

scholars in the world. On one hand, there are scholars who argue that development affects the environment negatively from its initial stage. On the other hand, others argue that development initially affects the environment negatively, however, with the passage of time and people's demand for a better quality of life, including the demand for a clean environment and increased awareness about the environment, development will likely enhances environmental quality (Panayotou, 2003)

This development-environment debate nexus is more applicable to the most advanced and the newly industrializing developing nations, where the industrial sector plays a substantial role in their economic growth. However, for the less developing nations, like Ethiopia, where agriculture plays a principal role in their economy, it is more appropriate to call it livelihood-environment debate rather than development-environment debate. According to Ellis (2000), livelihood diversifications of the farm household emanates from the necessity and choice rationales. The necessity rationale is motivated by "involuntary and distress" reasons while diversification by choice stands from "voluntary and proactive" reasons (Ellis, 2000).

Similarly, there is a scholarly debate about the relationship between livelihood strategies and the environment. Some scholars say farm household livelihood strategies positively affect the environment through diversification activities like planting cash trees in their farm lands and so on. On the other hand, there are scholars who argue that farm livelihood diversification activities affect the environment

negatively. Farmers may deforest frontier forests for farm expansion, charcoal and fuel wood purposes, degrading the soil nutrient further by expanding agriculture towards marginal lands (Ellis & Freeman, 2005; Jones & Carswell, 2004; Sporton & Thomas, 2002; Ellis, 2000).

Global and country level empirical studies also indicated mixed results. Sheng, Fan and Ma (2006) with 946 sample peasant farm households in the Zhaotong and Yunnan Province of China studied about the livelihoods and environmental change. Their finding indicates that, mainly due to the population pressure, farm households were forced to expand agriculture to marginal lands through deforestation and depletion of the vulnerable biodiversity. However, after the Conversion of Cropland to Forest and Grass Program (CCFGP) incorporated this study-area, the environment-livelihood relations showed positive improvement.

In two regions of the north highlands of Ethiopia, Pender et al. (2001) found mixed results about the relation between livelihood and environment in the study that they conducted across 198 villages that pursued various livelihood strategies. In their econometric regression result, off-farm diversification activities were found to be environmentally beneficial for land management like soil bund and stone terrace activities as farm households diversified their livelihood strategies and were affected positively. On the other hand, the same study showed that live fence construction activity affected negatively as farmers diversify more to the off-farm income

generating activities due to shift of labor resources.

These researchers also found out that institutions could play important roles in the livelihood diversification and natural capital sustainability. Their finding indicated that more land insecurity is associated with significantly reduced the use of fallow-land, less investment in soil bunds, and worsening soil conditions. The availability of credit service is associated with reduced use of fallow and increased tree planting, improved adoption of soil bunds, and constructing live fences. Various types of livelihood strategies favor different kinds of sustainable land management practices. There are also important differences in resource and welfare outcomes across different livelihood strategies (Pender et al., 2001).

Other researchers like Gebru and Beyene (2012) through multinomial regression method identified determinants of rural household livelihood diversification of off-farm and non-farm activities. These include education, credit and market access, remittance, and business activity extension services. Likewise, Berhanu and Fayissa (2007) in Southern Ethiopia of pastoralist society using Cobb-Douglas production model found out that the low marginal return to labor due to surplus labor in pastoralist activities leads them to diversify their livelihood strategies to the non-pastoralism diversification activities. Factors like human capital investment and other technical supporting schemes contribute positively for livelihood diversification in the pastoralist areas.

The low productivity growth of agriculture in Ethiopia leads farmers to diversify their livelihoods to other non-farm and off-farm income generating activities. In North East Ethiopia of Gozamin District, small-scale farmers are diversifying their income sources to non-farm and off-farm activities to maximize their income and livelihood securities. In most developing nations such as Ethiopia, agricultural diversification activities are highly related to using and exploiting natural resources. Some of the livelihood diversification activities may have positive impacts on the environment while others may have an adverse effect.

However, there were no studies conducted about the determinants and intensity of farm households' livelihood diversification in the study area of North East Ethiopia, Gozamin District. In addition, most researches did not indicate the effect of farm household livelihood diversification activities on the land management practices. Therefore, this research will try to find out the determinant factors for livelihood diversification activities and its effect on sustainable land management practices. The specific questions include:

1. What are the determinants of farm households' livelihood diversification in the study area?
2. What are the determinants for on-farm, off-farm and non-farm diversification activities of farm households?
3. What are the effects of farm households' livelihood diversification activities on the sustainable land management practices?

1.3 Research Objective

The general objective of this research study is to examine the determinants of livelihood diversification strategies and its effect on the sustainable land management practices at farm household level in North East Ethiopia of Gozamin District. From this general objective, the study will examine the following specific objectives:

- To assess the agricultural development policies of Ethiopia
- To identify factors that determine farm households' livelihood diversification incidence on the study area
- To describe the determinant factors for on-farm, off-farm and non-farm activities intensity of farm households
- To describe the effects of livelihood diversification on the sustainable land management practices of farm households
- To suggest policy recommendations for livelihood diversification and land management practices

1.4 Significance of the Study

In Ethiopia, where the livelihood of majority of the society is dependent on agriculture, it is hardly possible to achieve sustainable development without attaining sustainable growth in livelihood and agriculture. In Ethiopia, achieving sustainable

agricultural development means; solving the food security problem, alleviating deforestation and soil erosion problems, improving resource distribution (equity) aspects of the rural majority society in general. Moreover, eradicating extreme poverty and hunger, which is also one of the "Millennium Development Goals (MDGs)", will be successfully attained if the country could motivate sustainable livelihood and agriculture. In this regard, the findings may help development practitioners, both governmental and non-governmental organizations who are interested in sustaining the livelihood and the environment, alleviating poverty, improving the food security, and income distribution of farm households. The study will also be of importance in indicating policy issues that support agricultural practices and livelihood diversifications to be environmentally sustainable and resilient.

1.5 Limitations of the Study

The study employs secondary data to assess the agricultural policies of Ethiopia. However, due to the unavailability of time series and panel datas, the study is limiting its scope only to survey data in 3 rural villages, in North-East Ethiopia of Gozamin District. Therefore, the study faces difficulties in analyzing the dynamics of livelihood diversification and sustainable land management practices across time in Gozamin District of Ethiopia. The other limitation of the study will be related to technical issues. The study employs only indicator and binary measures using yes/no

answers to measure sustainable land management incidences in the study area. The techniques like extents of soil erosion and mineral depletion of farmlands have not been measured, due to technical limitation of the researcher and requirement of detailed extents. Time and budget constraints have also put their own impacts in limiting the scopes of this study.

CHAPTER TWO: LITERATURE REVIEW

In this chapter, related literatures discussed by various scholars have been explored. In addition, important working definitions of the study, theoretical and empirical studies related to livelihood diversification and its relation with land management have been assessed. Finally, the summary of the literature has been presented.

2.1. Theoretical Background

2.1.1. Definition of Livelihood Diversification and Sustainable Livelihood

Different scholars define livelihood in different ways. World Commission for Environment and Development (WCED) defined livelihood as "a means to gain adequate stocks and flows of food and cash to meet basic needs, together with reserves and assets to offset risk, ease shocks, and meet contingencies"(WCED 1987, p.4). One of the most known definitions of livelihood given by Chambers and Conway (1992, p.6) is "a livelihood comprises the capabilities, assets (stores, resources, claims and access) and activities required for a means of living" in their work. According to Dreze and Sen (1989, p.18), capabilities refer to "the set of

alternatives being that a person can achieve with his or her economic, social, and personal characteristics".

Similarly, livelihood defined in a clearer and descriptive way by Ellis (2000, p.10). It "comprises the assets (natural, physical, human, financial and social capital), the activities, and access to these (mediated by institutions and social relations) that together determine the living gained by the individual or household". In this case, it has to be clear that income and livelihood are not synonymous, in which the composition and sum of individual income at a given time is the direct and measurable outcome of livelihood process. The typical farm household income can be composed of three components: farm income, off-farm income, and non-farm income (Ellis, 2000).

Farm income is income gained either through farming own-land or land acquired or accessed by share tenancy or cash. In addition, it also incorporates income generated from livestock products. Off-farm income is labor wage working from other farms with-in agriculture sector. On the other hand, "non-farm income refers to income from non-agricultural sources like non-farm salary employment, urban-to-rural remittances, rental income, non-farm rural-wage, and international remittances to a farm household" (Ellis 2000, pp.11-12).

There are also other terms that are related to livelihood, which are diversity and diversification. The term diversity directs that the approach for livelihoods typically the 'single-sector' approach to have solutions for various rural development challenges and problems (Scoones, 2009). On one hand, while both diversity and diversification used to mean multiple and multiplying income sources, diversity refers to the existence of various income sources at one time. On the other hand, diversification refers to "the creation of diversity" as a dynamic economic and social process of the farm household (Ellis, 2000).

Based on these concepts, Ellis (2000, p.15) briefly defined rural livelihood diversification as "the process by which rural households construct an increasingly diverse portfolio of activities and assets in order to survive and improve their standard of living". Scoones advanced in defining livelihood diversification in 1998. Accordingly, livelihood diversification is defined as "developing a wide income earning portfolio to cover all types of shocks or stress jointly or the strategy may involve focusing on developing responses to handle a particular type of common shock or stress through well-developed coping mechanisms" (Scoones1998, p.9).

Sometimes, confusion may be created between livelihood diversification and livelihood strategy. A definition of livelihood strategies given by Ellis (2000, pp.40-41) is "composed of activities that generate the means of household survival". The scholar further categorized activities broadly into natural resource based, which

mainly includes collection (e.g. from forests), food and non-food cultivation, livestock keeping and so on. Non-natural resource based included rural service and trade, rural manufacture and so on. Similarly, Lipper, Pingali, Zurek, Ruben, Pender and Kuyvenhoven (2007, p.23) defined livelihood strategy as "the range and combination of activities and choices that people undertake in order to achieve their livelihood goals (including productive activities, investment strategies, reproductive choices, etc.)".

There is also one key concept, agricultural diversification, which needs to be clear while we are discussing livelihood diversification. Barbieri and Mahoney (2009, p.2) defined farm and ranch diversification as "the reallocation and recombination of farm resources (i.e., land, labor or capital) into new unconventional crops/animals or non-agricultural enterprises developed on the farm or ranch" (Ilbery, 1991). On the other hand, Pingali and Rosegrant (1995, p.1) defined agricultural diversification and commercialization as "that involves the gradual replacement of integrated farming systems by specialized enterprises for crop, livestock, poultry and aquaculture products". In addition, they added that changes in product mix and largely the market forces determine agricultural input employments during this transition.

For the last few decades, especially after the 1987 WCED Convention, the sustainability development issue has been mainstreaming in various concepts and fields of study. Similarly, sustainable livelihood definition is provided by Chambers

and Conway (1992, p.10) as "a livelihood comprises the capabilities, assets (stores, resources, claims and access) and activities required for a means of living: a livelihood is sustainable which can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation; and which contributes net benefits to other livelihoods at the local and global levels and in the short and long term".

By following and modifying the Chambers and Conway (1992) definition, the Institute of Development Studies team defined sustainable livelihood as such, “a livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks, maintain or enhance its capabilities and assets, while not undermining the natural resource base” (Scoones1998, p.5).

The other related concept with sustainable livelihood is “sustainable livelihood security”. It incorporates resources, environment, development and population I with respects to fending of exploitation of resources, stabilizing population, reducing migration, and promoting long-term sustainable resource management Barbier and McCracken (1988).

Even though, they are different conceptually, sustainable livelihood has some conceptual similarities with sustainable development. According to Repetto (cited in Pearce et al.1990, p.4) sustainable development is defined as "a development strategy that manages all assets, natural resources, and human resources, as well as financial and physical assets, for increasing long-term well-being. Sustainable development as a goal rejects policies and projects that support current living standards by depleting the productive base, including natural resources, and that leaves future generations with poorer prospects and greater risks than our own".

The necessary key condition for sustainable development is to at least keep the constancy or non-negative changes in the environmental quality and stocks of natural resources (Pearce et al., 1990). World Commission Environment and Development (1987, p.43) provide the prominent definition of sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". From these ground definitions, sustainable development incorporates two key issues; first, making the present generation better off without making future generations worse off, and second, focusing current development on the most poor and disadvantaged (Pearce, 1993).

In relation to sustainable development, two typical important terms involved are strong sustainability and weak-sustainability. On one hand, strong sustainability gives priority for natural capital, and it demands that the available stocks of both natural

and human-capital be kept and maintained. On the other hand, weak sustainability underlies the importance of trade-offs between human-made and natural capital (Adams, 2009). Strong sustainability argues that natural resources need to be conserved in order to maximize utility sustainably while weak sustainability assumes that there is no fundamental constraint in sustainability (Lopez & Toman, 2006).

2.1.2. Theories and Determinants of Livelihood and Livelihood Diversification

2.1.2.1 Livelihood and Livelihood Diversification

In the classical orthodox view, the change in a nation's economy was interpreted as the shifts in the economic structure. This would be like a shift of the economic sector from agriculture to industry and then to service that can be identified and clearly categorized from each other (Ellis, 1998). The central theme of this view is that, as far as there is progress in development, transition from rural to urban and "from the traditional sector(s) to the modern sector(s)" will be inevitable. The implicit assumption of this view is that division of labor and specializations, rather than diversification, are the necessary conditions for the transformation of economic sectors (Ellis1998, pp.1-4).

Livelihood activities are not supporting monolithic development plans; rather they are diverse, multiplex and cross - sectorial in nature (Ellis & Freeman, 2005).

Diversification is not only just a developing country and rural area phenomenon but also it is a strategy for developed countries and urban center areas. Then, currently it becomes a feature of developed country farm households, in which home-based and part time jobs become ordinary practices of these families (Maxwell, 1995; Levin, Ruel, Morris, Maxwell, Armar-Klemesu and Ahiadeke (1999). The diversification strategy is against the concepts of compartmentalized and transitions of sectors, and specialization of farm household labor (Saith, 1992). Diversification may be either signs of success in attaining improved economic conditions by securing livelihood or they may imply livelihood deterioration while the economy is getting worse (Ellis, 1998).

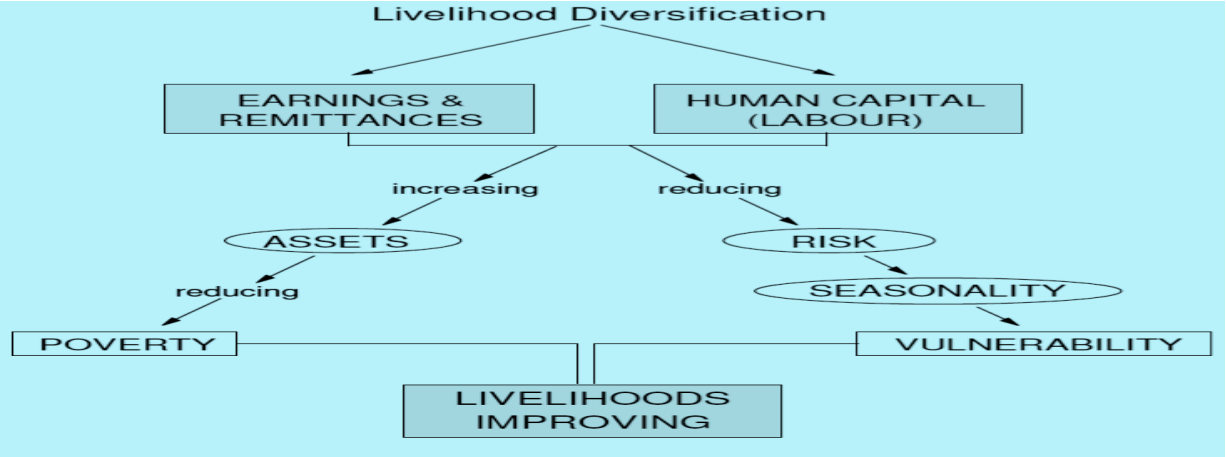
The farm households' social relation, income and asset level, opportunities and locations determine the cause and effect of diversification (Ellis, 1998). Livelihood and income are not identical. Household income includes liquid cash earnings and the current market values of payments in-kind like consumption of farmers' own production (Lipton & Maxwell, cited in Ellis 1998). On the other hand, livelihood of the farm household includes income of cash and in-kind, property and land rights, social institutions like family and village which help to maximize and sustain wellbeing and living standard (Bryceson, 1996). In addition, livelihood encompasses access and opportunity to state social services such as infrastructures, education, water, and health services (Blackwood & Lynch, 1994).

Likewise, livelihood diversification and income diversification are not similar in concept. Analogous to livelihood diversification and livelihood diversity difference, there is a conceptual difference between income diversification and income diversity. Income diversity explains the farm households' incomes at the given instant moment; whereas income-diversification refers to a continuous process of portfolio engagement activities of the farm households (Reardon, 1997). Saith (1992) categorized a typical farm household income into three, namely; farm, non-farm, and off-farm income sources.

Accordingly, Saith (1992) and Ellis (1998, 2000) explained these income source categories briefly. Farm-income includes cash and in-kind consumption from agricultural crop production and income from livestock sources. Off-farm income is explained as income within the agriculture sector, but it refers to labor-wage or other form of income on the other household farm. Finally, non-farm income referred to non-agricultural income, which may include non-farm wage and self-employment, rents from property, remittances within the nation or international from migrated family members, and so on.

Ellis and Allison (2004) mentioned the benefits of livelihood diversification and the need to incorporate in the developing countries' poverty reduction policies. They mentioned some of the benefits of livelihood diversification in the process of improving livelihood and reducing poverty as indicated below in Figure 2.1.

Figure2.1: Positive Attributes of Livelihood Diversification



Source: Ellis and Allison (2005, P.13)

The positive contributions of livelihood diversification include improvements in household human capital through enhancements in innovation, skill, and experiences. It could also help in generating income and remittances from domestic and international sources that could boost assets that in turn help in reducing poverty level of the household. Livelihood diversification could also help to reduce impacts of risks from disasters and any other shocks, thus reducing effects of seasonality by smoothing out the income-consumption gap of the household. This will help improve the resilience capacity by reducing the vulnerability impact on the household. All these impacts of livelihood diversification strategies ultimately help to maximize the livelihood of the household (Ellis & Allison, 2005).

2.1.2.2 Determinants of Livelihood Diversification

There are various factors, social, economic, and environmental factors which try to explain why farm households diversify their livelihood activities. Ellis and Freeman (2004, p.64) categorized determinants in to asset-based and insurance-based diversification theories. Asset-based diversification theories argue that the degree and level of diversity in a farm household's income mix indicates the degree of diversity in the resources or assets it has access to or owns. For example, a household who owns a large plot of land relative to the amount of labor will be expected to engage in cultivation. On the other hand, a farm household who has a large amount of labor relative to farmlands will be expected to specialize his activities in wage labor. Farm households who own some land but cannot employ fully all the families' labor supply will try to diversify their income from own cultivation to wage labor.

On the other hand, the insurance-based diversification theory argues that income failures and shocks dictate and pushes the farm household to diversify its activities. Accordingly the household demanded the particular form of insurance; diversification is also expected to differ among them. Then, the degree of how risk affects the farm household positively determines the need for diversification as a form of insurance. This may also negatively affect the degree of access to other ways of settling and coping with shocks and risks (Ellis & Freeman, 2004).

There are different views for the rationales of livelihood diversification strategy by the farm households. Some argue that livelihood diversification arises for survival strategy against high vulnerability to disasters and shocks, asset shortages, and poverty. On the other hand, other scholars consider expanding choices and opportunities to improve income level and living standards as the rationale behind livelihood diversification (Hart, cited in Ellis 1998, 2000). Similarly, Ellis (2000, p.55) rationalizes the reasons for livelihood diversification mainly emanates from necessity versus choice conditions.

One of the main determinant factors for livelihood diversification is the existence of seasonality. The concept of seasonality is to describe that income flows and consumption of the farm household are not parallel and mostly they are mismatched. Therefore, due to these income flow-consumption discrepancies, livelihood diversification activities are assumed to smooth the household consumption level. The other argument about seasonality is that there is a discrepancy in the return of labor across seasons during the year in on-farm and off-farm activities in the labor market. This leads to seasonal switch of labor hours from lower to higher pay occupation and across different agricultural zones so as to stabilize the flow of income (Alderman & Sahn, cited in Ellis 1998, 2000).

The other determinant factor for livelihood diversification strategy is the heterogeneity of labor markets that come from the differences in household gender,

location, technical skills, and cultural differences (Davies & Hossain, 1997). These authors added that, for instance if there is the difference in marginal productivity of the farm household working in on-farm activity is assumed to be lower than the labor time return to trading activity, then the household will shift his/her time to the non-farm activity which pay have a higher return or pay a higher wage.

According to Bryceson (1996), risk is another principal determinant variable for income diversification. Risk is the "result of a threat, intent and capability to cause harm, with adverse effects to a vulnerable system" (Haimes 2006, p.293). Dercon and Krishnan (1996) mentioned that there are biased arguments between coping versus risk, and voluntary versus involuntary strategies of the farm household. The difference between risk and coping strategies as household diversification determinant factors could be interpreted as ex-ante and ex-post of risk management and coping with shock crisis actions, respectively. The author mentioned that while risk management is the voluntary strategy of households from the intended failure of income, coping strategy is the involuntary action of the household to the unintended failures of income.

As the household is involved in income diversification activities that embedded risk in it, the individual will be weighing the trade-off between the much higher income opportunity with a higher chance of income failure, and lower income with a small chance of income failure (Roumasset, Boussard & Singh, 1979). The implication is

that the households are found to be risk-averse, and they are assured of greater security but ready to have lower income (Ellis, 1998, 2000).

Wisner, Blaikie, Cannon and Davis (2005) also described coping as the vulnerability of farm households to income deterioration while they face drought, disaster and other shocks. In addition, these authors explained vulnerability through the concepts of sensitivity and resilience, in which sensitivity is the degree of disaster exposure of natural resource by human beings while resilience explains the capability of the livelihood system to control the change. Accordingly, the most optimistic and viable livelihood shows lower sensitivity and higher resilience. On the other hand, the most vulnerable livelihood strategy shows higher sensitivity and lower resilience.

Some researchers like Reardon (1997) justified for diversification in developing countries due to the low credit access rate across the farm household in these countries. Farm households participate in either non-farm or off-farm activities to gain cash, which substitute for the credit market failure, and the high interest cost of the existing financial intermediaries.

Taylor and Wyatt (1996) argued that mostly the households engaged in income diversification activities when they needed cash to smooth consumption rather than to generate income for investment to boost future production and productivity. However, it is argued that households with owners of none or small plot of land

engage to diversification for survival while households with large plot of land and other resources diversified income for saving and accumulation purpose (Ellis, 1998).

The other determinant factor for livelihood diversification is migration of the household members or the whole family itself. On this regard, Bigsten (1996) categorizes two major factors for migration to exist, pull and push factors. Differences in income across the geographical places, such as between rural and urban areas are assumed to be pull determinants. On the other hand, deterioration of assets, seasonality, disasters are considered to be push factors. The author also considered the concepts of push and pull factor for migration as analogous to involuntary versus voluntary reasons for diversification, respectively.

The other determinant factor for livelihood diversification strategy and, which is not mentioned directly by many authors, is population pressure .As the growth in population continues, that is currently true in most less developed countries including Ethiopia; the marginal productivity of farm labor will decline due to the existence of excessive labor. Some family members of the farm household will shift their occupation and will be expected to diversify and engage in the non-farm and off-farm activities (Malmberg & Tegenu, 2007).

2.1.2.3. Framework for Livelihood Diversification

The livelihood diversification framework can be used as a tool to analyze micro-level policies and interventions, such as micro credit policies focused in the improvements of livelihood of rural communities and helping to analyze institutional set up and framework (Scoones, 1998; Ellis, 2000). The livelihood framework can also serve as an input for designing macro level rural development policies at local and community level. Recently, however, more attention has been given to micro level rather than macro level and large "domain policies". This is because of the existence of heterogeneous and intrinsic characteristics between nations, regional provinces, local areas, and even among individual households (Ellis, 2000).

Ellis and Freeman (2005, p.3) put the basic framework for livelihood diversification. In the basic livelihood framework process, the household is considered as the main social unit (Ellis, 2000).

Figure2.2: The Basic Livelihoods Framework

Source: Ellis (cited in Ellis & Freeman 2005, P.3)

According to Scoones (1998), Ellis (2000), and Ellis and Freeman (2005) assets, upon which individual households engage in the labor markets and production activities are assumed to be the initial blocks of the livelihood framework.

In the livelihood framework, assets are interchangeably interpreted as resources or capitals. Many researchers have categorized assets, which can be owned and accessed by households into five broad divisions: natural capital (water, land, trees and other biological resources), physical capital (machines and other produced investment goods), social capitals (cooperatives, networks, associations), human capital (skills, education, experience, health), and financial capital and its substitutes (access to financial market, savings, money). It is mentioned that one of the basic principles in poverty reduction policy is to increase the endowment and accessibility of assets or resources to the poor (Ellis and Freeman, 2005).

The other fundamental element of livelihood framework is livelihood activities. According to Ellis (2000, p.40) activities are components of livelihood strategies and they are divided in to two broad categories, namely non-natural resource based and natural resource based activities. Activities that are grouped under natural resource based categories include cultivation of food and non-food productions, collections from forest and wood lands, livestock production, and non-farm resource based like brick making and so on. On the other hand, non-natural resource based encompasses rural manufacture, rural trade, other transfers, and remittances (Ellis 2000, pp.30-41).

Finally, Ellis and Freeman (2005, p.4) explained the risk variables that could make difficulties for household living as shown in the livelihood framework and described under "vulnerability context". On the other hand, the structural organizations of local and national governments, property rights, laws, participation of the community, and democracy status are grouped under "institutional context and policy". The people's activities and livelihood diversification activities within these various contexts gives rise to outcomes; however, these outcomes may be either higher or lower wellbeing, increased or decreased vulnerability, attaining or not attaining food security, environmentally sustaining or degrading in natural resources, and so on (Ellis & Freeman, 2005).

2.1.3. Theories of Livelihood Diversification and Environment

2.1.3.1. Poverty and Environment

There are conflicting debates about the nexus between poverty and environment (Ruijs, Dellink & Bromley, 2008). Specifically, in the debate whether poverty is the cause for environmental degradation, mostly the two occur together; however, it is not clear whether household poverty causing environmental degradation or vice versa is not yet proved (Clark, Goudie & Peach 2002, P.4). The orthodox view argues that extent of poverty and environmental degradation appears in a downward spiral,

indicating that the necessary condition to minimize environmental damage is through alleviating poverty.

Because the orthodox concept of environment and poverty (or vulnerability) nexus is based on the following important assumption: the livelihoods of aggregate people are based mainly from natural resources. There is direct and causal linkage between poverty and environmental depletion, and poverty is assumed to be the pivotal cause of environmental degradation, and vice versa also holds true (Forsyth, Leach, & Scoones 1998, P.11).

Especially, the nexus between poverty and environment is much stronger in developing countries than the developed (Bigg, 2004). This view argues that poverty leads people to degrade the forests, to expand agriculture towards marginal lands, to use forest products for fuel and food (Gow1992, p.2). In addition, the orthodox thought and the World Commission for Environment and Development Report (1987) mentioned that poverty is the base and also effect to the world environmental degradation problems. In addition, they argue that the nexus is sometimes "self-enforcing" in which the poor people mainly depend on farming and exploiting the available natural resources for survival and subsistence purpose and the depletion of the environment impoverishes back themselves that makes future survival difficult (WCED, 1987; Gow, 1992).

On the other hand, there are some scholars who argue that poor people can cope up and adopt their own protective strategies to minimize the impact of population growth and economic activities on environment (Forsyth, Leach & Scoones 1998, p.2). And they contradict the poverty-environment nexus debate using the concept of environment entitlements, which is an approach that gives entitlement to the poor and local community to solve resource allocation and environmental depletion problems. Their argument is that, first poor people are rational beings, and second their livelihood is fundamentally based on environmental resources and they do care for its sustainability and resilience. The authors argue that the poor people can set up their own suitable and appropriate institutions and collective mechanisms to respond to social, economic, and environmental changes (Forsyth, Leach & Scoones, 1998).

Similarly, researchers like Bucknall, Kraus, and Pillai (2000, p.8) justified that the relations between environment and poverty are too complex. There are various mediators of macro and micro level variables, such as development policies, market arrangements, formal and informal institutions, property right arrangements, environmental resource entitlements, and so on.

These authors added that the system and specific ways of how poor people based their livelihoods on the environmental resources and how they will in turn be affected by environmental degradation could not be universally uniform. Rather the ways could be most likely local-, regional-, or country specific. Therefore, they argue that,

one cannot fully conclude that poor people are the actors and victims of natural resource depletion. Because, in some circumstances, determinant factors and correction measures of environmental degradation are found to be outside the environmental sector (Bucknall et al., 2000).

2.1.3.2. Livelihood Diversification and Environment

Similar to the poverty-environment nexus, there are also conceptual debates between livelihood diversification and environment. The debates mainly rest on two contradicting views. Some scholars argue that diversification affects the environment positively by improving the efficiency of the system by recovering from environmental degradations and by improving its resilience capacity (Scoones, 1998; Ellis, 2000). The poor farm households labor input allocation may be shifted from natural resource based livelihood activities to other environmentally non-harmful off-farm and non-farm activities, such as, trade, rural manufacture, and so on. Therefore, the adverse impact of natural resources caused by such as firewood and charcoal production, collecting and gathering of forest products, hunting animals, and so on are expected to decline (Ellis, 2000).

Ellis (2000, p.136) argues that livelihood, poverty and environment are related to each other through the asset endowment of rural poor, and their capacity to substitute between assets. The author argues that poor people are more endowed with labor

resource than other assets. Therefore, where labor is coordinated to the other assets while engaging in the livelihood activities, the rural poor people are less likely to degrade the environment compared to anyone else. However, if there is less substitutability between the assets, poor individuals may engage on depletion of natural resources (Ellis, 2000).

Related to the above proponents' argument, livelihood diversification and environmental resource conservation may also mutually reinforce each other. For instance, Sim, Appanah and Durst (2000, p.124) in their study in India argue that the livelihood of the rural poor is highly based on forest resources and products that support them economically, socially and even culturally too. Then, the authors rationalize that forest resource exploitation would be increasing the extent and vulnerability of the poor to abject poverty.

On the other hand, the opponents argue that the livelihood diversification of the poor may be towards the production and intensive trading activities of natural resources, including mineral overexploitation, over fishing, forest product production, and so on that enhances adverse environmental degradation. Sometimes, while diversification may increase household income of the rural poor, the activity may simultaneously lead to the degradation of the environment. However, these temporary activities cannot be environmentally sustainable and later the poor household may suffer more. Therefore, this issue helps us to assess the concept of sustainable livelihood and its framework.

2.1.4. Sustainable Livelihood and Framework

Chambers (1987, p.10) interprets the sustainable livelihood security as a concept that integrates population, resources, environment and development in four respects: stabilizing population growth, reducing distress migration, declining exploitation of resources and promoting long-term sustainable resource management of the poor. Similarly, Scoones (1998) described sustainable livelihood as issues, which are related to the poverty-environment conceptual debates. The traditional top down policy intervention practices are starting to be replaced by bottom-up community participation and the sustainable livelihood approach has gained attention in the World Commission for Environment and Development of 1987 (Clark et al.2002, p.5). Moreover, the authors added that sustainable livelihood approach is focusing on assets, capabilities, and activities of the poor. It gives more emphasis to being local-centered and enhancing the community-capacity by giving due regard to the environmental resource base (Clark et al., 2002).

According to Scoones (1998, p.5) sustainable livelihood has five major core elements. The first has been related to creating gainful rural employment. The author argues that livelihood activities are sustainable if they could generate employment either through off-farm or on-farm practices or through wage labor or may be through subsistence production activities. The second has related to poverty reduction since the level of poverty is the main criteria to measure livelihood of the poor.

Therefore, both quantitative and qualitative indicators of poverty need to be addressed to assure the sustainability of a given livelihood. The third basic criterion in livelihood assessment is improved wellbeing and capabilities. Sen (cited in Scoones, 1998) described capabilities as "what people can do or be with their entitlements" leads to a mix of sustainable livelihood criteria, which include subjective measures of wellbeing like values of self-esteem, happiness, security and access to material assets (Scoones, 1998).

The last two measures explained the most key elements of sustainability, which are the livelihoods resilience and the environmental resource base in which they depend. The fourth key element is the resilience of a livelihood strategy to recover from and to adapt with the long-term shocks. As Davies (1996) explained, the ability to cope during the stress situation and long-term shocks are pivotal to adaptation of livelihood strategy and coping from any shocks.

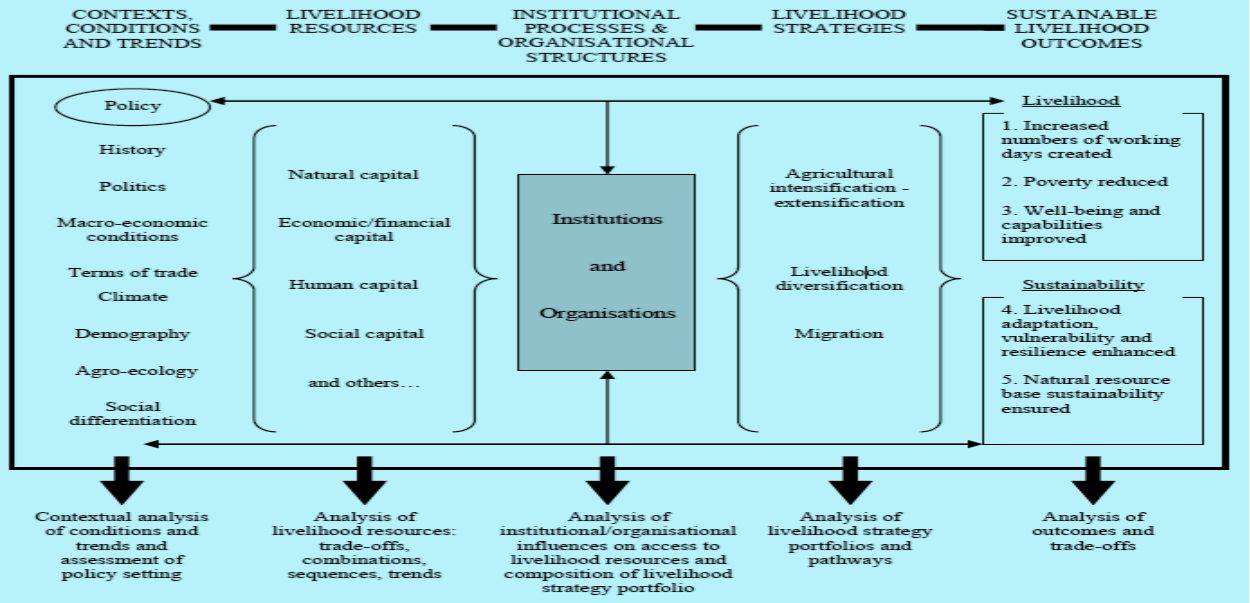
On the other hand, livelihood activities that cannot cope or adapt are not sustainable and resilient. They are vulnerable. Finally, the fifth key criterion is the sustainability of natural resource base. Many rural livelihood activities depend on environmental resource bases; then one can say these activities are sustainable if in the long-term natural resources are resilient from stresses and any shocks (Scoones, 1998; Sporton & Thomas, 2002).

Similarly, Mckeller and Smardon (2012) in their recent work explained the concepts of sustainable livelihood. According to the authors, a livelihood is sustainable if it at least fulfills the following minimum requirements: "livelihoods that have the ability to cope with, recover from, and adapt to stress and shocks; which maintaining and enhancing its capabilities and assets at the present and to the future; its potential to generate sustainable livelihood alternatives for the future generation; has the capacity to generate net benefits to other livelihood alternatives at the global and local levels; and the ability to practice in the livelihood activities without depleting the environmental resources" (Mckeller & Smardon 2012, p.17). Alternatively, researchers like Karl, Potters, Colatei and Dohrn (2002, p.8) briefly described the livelihood as sustainable if it fulfills the following characteristics: poor - centered, participatory and responsive, multi-level, performed in dynamic, partnership, and sustainable.

The other important concept related to sustainable livelihood is sustainable livelihood framework. Sustainable livelihood framework is a tool to enhance the understanding of the livelihood of the poor (Ashley & Carney 1999, p.13). It is an analytical structure that helps to interpret the complex livelihood system that mainly includes assets, activities, institutions and outcomes that help in aggregate to improve livelihood conditions of the poor (Farrington, Carney, Ashley & Turton 1999, p.3). Similarly, scholars like Scoones (1988, p.4) as indicated in Figure2.3 below

mentioned the five interrelated elements of the sustainable livelihood framework, namely: contexts, assets (resources), institutions, strategies and outcomes.

Figure2.3: A Framework Analysis for Sustainable Rural Livelihoods



Source: Scoones (1998, p.4)

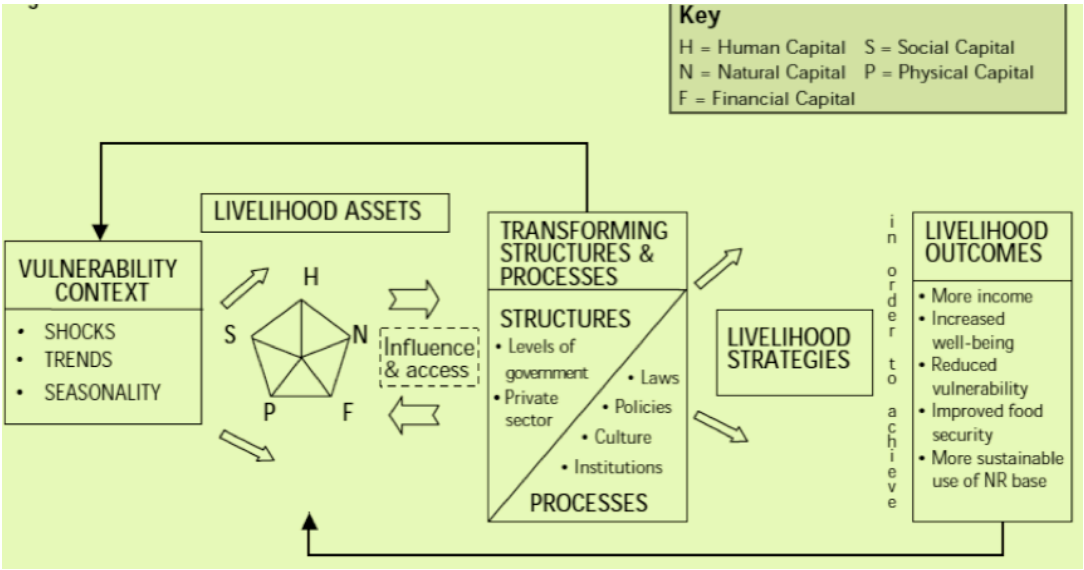
In analyzing the sustainable livelihood framework, Scoones (1998, p.3) pose below the key question of interpretation.

> Given a particular context (of policy setting, politics, history, agro ecology and socio-economic conditions), what combination of livelihood resources (different kinds of 'capital') result in the ability to follow what combination of livelihood strategies (agricultural intensification/extensification, livelihood diversification and migration) with what outcomes? Of particular interest in this framework are the institutional processes (embedded in a matrix of formal and informal institutions and

organizations), which mediate the ability to carry out such strategies and achieve (or not) such outcomes.

The author affirmed that one could implement sustainable livelihood framework at various levels and scales of starting from individual and household level even to national level since the sustainable livelihood framework result can be assessed at various scales and levels (Scoones, 1998). However, Scoones' (1998) framework does not clearly show the key elements, such as assets and does not show the causality of these elements too. On this regard, Ashley and Carney (1999) clearly indicates in Figure2.4 below the key elements and the causality of these elements.

Figure 2.4: Alternative Sustainable Livelihood Framework



Source: Ashley and Carney (1999, p.47)

However, it is understood, in which the framework only just helps to arrange and organize different variables and gives a general way of thinking about livelihood strategies. This framework is rather the simplification of the rural livelihood reality because livelihood activities and the whole systems is complex and one cannot expect to present the exact model in reality (Ashley & Carney, 1999; Neefjes, 2000).

In the Figure2.4 above the vulnerability context represents the external environments such as trends (like population growth, resource stock trends, and ways of government administration), shocks (like crop failure and natural hazards) and seasonality (like seasonality in price and production) and other factors, which are outside the control of households and other stakeholders. The vulnerability contexts like trends and seasonality may affect the livelihood conditions either negatively or positively. Livelihood assets of the poor in this framework include physical capital, social capital, financial capital, human capital, and natural capital (Ashley & Carney, 1999) as discussed in the livelihood section.

Policies, institutions, and organizations help with structural transformations and processes in changing livelihood status of the households that determine the exchange and accessibility of assets (Keeley, 2001). Livelihood strategies are described as the poor households' activities, choice and opportunities that help to attain their livelihood objectives (Ashley & Carney, 1999). As poor people have greater

alternatives in livelihood strategies, their capacity to withstand any natural disasters and shocks of the vulnerability context will be enhanced.

Finally, figure 2.4 indicated that, the results or achievements of livelihood diversification are livelihood outcomes. Livelihood outcomes may be conflicting and affect the household positively or negatively. For instance, income of the poor household may increase at the expense of natural resources. Livelihood strategies can give rise to positive livelihood outcomes if poor households can generate higher income, improve their well-being, increase food security, decline vulnerability, and improve sustainable use of the environment resource bases due to their diversification activities (Ashley & Carney 1999, pp.13-37).

2.1.5. Agricultural Productivity, Livelihood Diversification and Environment

In most developing countries, agriculture takes the dominant share in livelihood contributions. Therefore, to support the ever-increasing population pressure in least developed countries agricultural productivity is the necessary condition to assure the sustainable supply of food and stabilization of price. The general definition of agricultural productivity is given by Norton, Alwang and Masters (2010, p.5) as "farm output divided by farm inputs".

However, according to Wen (1993) there are two types of productivity, partial and total factor productivity. Partial factor productivity or average product is defined as a

ratio of output to a particular input. This measure is said to be partial because it ignores the contribution of other inputs; on the other hand, "total factor productivity (TFP) is a ratio of output to the weighted sum of factor inputs, which is the total factors of production" (Wen1993, p.3).

Based on the conventional view, agricultural productivity improvement has direct and positive linkages with industrialization (Matsuyama1992, p.318). Similarly, researchers such as Irz, Lin, Thirtle and Wiggins (2000, p.449) concluded that agricultural productivity growth has direct benefits in reducing poverty by creating employment opportunity in the rural economy, increasing linkages to the non-agricultural sectors, and leads to a decline in the cost of food for the other sectors. Researchers, such as Hwa (1988, pp.1329-1330), mentioned that there are at least six benefits that the agriculture sector gives for industry development, these are: i) agriculture growth helps to generate market for manufacture products, ii) raw materials supply for agro processing industries, iii) helps to provide adequate food supply, iv) helps as a source of export to earn foreign exchange, v) helps as a source of labor for non-agricultural economies, and vi) can facilitate the process of industrialization by providing capital and creating entrepreneurs.

2.1.5.1 Livelihood Diversification and Agricultural Productivity

The impact of livelihood diversifications on agricultural productivity is complex and sometimes it is debatable. On one hand, researchers like Preston (1994) argue that non-farm diversification opportunities may take able farm labors from the agriculture sector and that eventually may cause a decline in farm productivity.

On the other hand, there are scholars who argue that livelihood diversification by increasing farm household income can enhance farm investment used for adopting new farm technology resulting in a boost in farm productivity. In the developing countries where there is credit market failure, the off and non-farm income including remittances may help the household to purchase modern technologies that would help to boost the agricultural productivity (Lanjouw & Lanjouw 2001, p.2). Similarly, researchers like Tiffen, Mortimore and Gichuki (1994) explained that the non-farm and off-income may help as a substitute for on-farm crop insurance, which can help the farm households to participate in risky but more productive farming practices. These researchers added that non-farm income might be helpful for agricultural development while the reverse less likely held true.

2.1.5.2 Environment and Agricultural Productivity

Scholars like Abdelgalil and Cohen (2007, p.107) argue that there is conflict between economic growth and environmental quality. Similarly, the environment-agricultural

productivity linkage is debatable and considered as one of the hybrids of the broad and complex development-environment debate. Similarly, Abdelgalil and Cohen (2001, p.848) argued that environmental degradations including soil erosion, deforestation, and desertification could jeopardize the economic growth of agriculture by declining productivity.

These authors added that, the environmental impacts are severe especially in developing countries where livelihood activities of the majority of people have depended upon land resources, like for their agriculture and animal husbandry. They also mentioned the factors that aggravate land degradation in developing countries. These include lack of private property rights over natural resources; agricultural product price is higher in the world market than the domestic market that discourages farmers for conservation. Among other things, inaccessibility of modern technology by developing country farmers, and poor farm households in developing countries mostly maximize short-term benefits than long-term benefits like environmental quality (Abdelgalil & Cohen 2001, pp.848-849).

Crosson (1997, p.2) argues that losses of agricultural productivity because of land degradation and soil erosion may not create a serious problem. The author says that the primary factor that helps to increase yield is "the current systems capacity to generate agriculturally relevant knowledge". The researcher added, to achieve the

future demand for food at a reasonable cost, more resources need to be employed to agricultural research than focusing on erosion control mechanisms.

Other scholars like Abalu and Hassen (1999, p.447) claim that, agricultural productivity is linked positively to natural resource base protection. Therefore, the authors recommended that to raise agricultural productivity and rural incomes, simultaneous protection of the natural environment should be the primary agenda.

In most developing countries, small-scale farmers dominate the agricultural sector. This becomes a basis to assess the theoretical literatures about farm size and productivity linkages. In this regard, Sen (cited in Chen, Huffman &Rozalle 2011, p.580) argued that in developing countries farm size and agricultural productivity are inversely related. The authors added that small-scale farm is efficient, and the policy implication of this theory is redistribution of land (a decrease in farmland size) will improve efficiency in the agricultural sector (Townsend, Kirsten &Vink 1998, p.175). On this regard, an efficient farm is defined to be a farm that employs fewer resources than other farms to produce the same agricultural output (Townsend, Kirsten &Vink 1998, pp.175-176).

Different researchers provide various explanations for the farm size-productivity inverse relationship arguments. The first explanation is the existence of labor dualism in the agriculture sector of large and small farm size and “small-scale farmers have

lower opportunity cost of their labor than their counter large farms" (Chen, Huffman & Rozalle 2011, p.581).

Similarly, Taylor and Adelman (2003) justified that, as there are labor market imperfections. Small-scale farms will use the family labor only and cannot sell labor indicating the lower opportunity cost of labor. Others like Assuncao and Ghatak (2003, pp.190-191), with constant returns to scale and perfect labor assumptions; they formulate a theoretical model indicating that farming skill differences and credit market imperfections may explain the inverse relationship.

2.2 Empirical Literature

Most studies mentioned that the major determinants of livelihood diversification decisions of the farm household in developing countries include farm household sex, age, educational status, family size, farm size, labor, access to credit, and institutional factors like land-rights and cooperative associations (Ellis, 2000; Scoones, 2009). The livelihood diversification and sustainable land management (environment) determinant factors can be grouped broadly in to household characteristics, socio-economic characteristics, market characteristics and asset endowments of the farm household.

The empirical determinant factors for livelihood diversification and its effect to the sustainable land management may vary from country to country or there may even be

variations among individual farm households. The variations of the determinant factors may be also extended between developed and least developed countries' farm households. Since, Ethiopia is categorized under the group of less developed nations; in the empirical literature section, except in rare situations, mainly the studies and experiences of developing countries have been included.

2.2.1 Rural Livelihood Diversification in Least Developed Countries

In least developed countries, insurance and credit markets are missing, and if they exist, they concentrate for low-risk rather than high-risk (but higher return) activities. As a result, farm households demanded to diversify their activities to fill this market gaps (Holden & Binswanger, 1998). Income generated from participating in non-farm activities accounts for a significant share in developing nation's farm households. In developing countries, the mean income generated from non-farm livelihood sources was estimated to be 40-50 percent of total income (Bezabih, Gebreegziabher, Gebremedhin & Kohlin, 2010).

A study done by Barrett, Reardon and Webb (2001) in rural Africa concluded that wealth of the farm household had shown a positive correlation with non-farm income. Similarly, it had been concluded that access to market had significantly and positively affected the participation decision to non-farm activities in Uganda and Tanzania (Barrett et al., 2001). A related study by Mduma and Wubet (2005) concluded that;

land-size, educational attainment and access to financial markets affects the participation decision of the farm household.

Similarly, a study by Ellis (1998) reviewing 31 surveys conducted in 18 Sub Saharan Africa least developed countries found that the share of income from non-farm diversification activities ranges from 15-93 percent. According to the study, the main determinant factors of livelihood diversification in least developed countries include risk strategy behavior of farmers, existence of labor market variations, seasonality, shock coping behavior and missing credit markets. This study concluded that a farm household's educational level had a significant impact on livelihood diversification process.

A study by Barrett et al. (2001) from various survey studies concluded that education improves the chance of engagement in non-agricultural activities that required higher skills. It had no impact on engagement probability in non-farm diversification activities that did not require higher technical skills. Similarly, a study by Mishra and Goodwin (1998) concluded that the impact of education to off-farm activity was found to be insignificant. Another study by Bryceson (2002) found that educated farm households had fewer participants than households with no educational background.

A study by Kimhi and Lee (1996) by employed ordered Probit model concluded that age of the farm household had non-linear relation to off-farm diversification activities

in that it first increased and then declined with age. However, they concluded that educational level increases the probability to engage in off-farm diversification activities. In their study, it is found that women headed households had been engaged in low-paying off-farm business activities than the men-headed farmers. Similarly, a study by Bremen (1996) found that young male household members in the family had participated in seasonal and circular migration diversifications of non-farm livelihood activities.

In the study of off-farm livelihood diversification probabilities by Benjamin and Guyomard (1994), it is indicated that better educational level of farm households results to a higher chance of off-farm diversification adoption. Similarly, De Janvry and Sadoulet (2001) using the multinomial regression method found that education leads to farm households to engage in better off-farm diversification activities that had comparatively higher return rate.

Another study analyzed that farm household who simultaneously faces land scarcity and better access to roads leads to a higher rate of non-farm livelihood diversification activities (Corpal & Reardon, 2001). The impacts of education show mixed results in that it depends on the type of non-farm and off-farm activities. In four districts of Pakistan, a study by Fafchamps and Quisumbing (1999) indicated that educational level enhances productivity of off-farm activities, and it motivates the movement of labor from farm to off-farm economic sectors. In their analysis, the researchers found

that the health status of the farm household also has a positive effect on off-farm income diversification practices.

A study in India by Lanjouw and Shariff (2004) concluded that education increases the chance in getting non-farm employment opportunities. However, it was found that farm size of the farm household had a negative impact on the probability of off-farm participation. Studies made by Reardon, Stamoulis, Balisacan, Cruz, Berdegue and Banks (1998) and Barrett, Reardon and Webb (2001) concluded that the probability of off-farms activity participation is higher for poor households who are vulnerable to crop failures and other weather shocks compared to the rich farmers. Another study done in Chile by Berdegue, Ramirez, Reardon and Escobar (2001) found that availability of credit service improves the chance of participation of the farm household in non-agricultural activities.

A study by Warren (2002) concluded that individual farm households found to diversify more to off-farm livelihood practices mainly due to the availability of asset, access to market and public goods in the study area. On the contrary, the researcher concluded that a decline in arable land and environmental deterioration led to motivate participation decision of the farm households to non-farm activities. In addition, it also concluded that location specific situations that are related to local market availability and rural infrastructure developments played an essential role in farm households' probability to engage in non-farm diversification activities.

Similarly, a study by Ellis (1996) concluded that rural infrastructures mainly communications, road and power improves the chance of households participation decision in non-farm activities. From the farm household characteristics, gender of the farm household head has an effect on the probability of participation by the household in non-farm livelihood activities. In addition, a study by Lanjouw and Shariff (2002) in India found that non-farm income generated by men farm households was higher than that of women. On the other hand, a study in Honduras by Ruben (2001) indicated that more women farm households participated in non-farm income generating activities than that of their men counterparts.

A study by Davis (2005) showed that natural resource endowment of an area played an essential role for the participation decision of the farm household. Similarly, the researcher concluded that labor flow from the on-farm activity to non-farm sectors depend on whether the transformation of agriculture releases or absorbs labor supply.

The related study by Man and Sadiya (2009) also concluded that labor flows from the farm sector to non-farm and off-farm sectors depends on the amount of income earnings harvested from the sector, in which more labor will be shifted to higher potential return economic sectors. On the other hand, the rate of economic returns from each activity may not necessarily dictate farm households' determination in participating in off-farm diversification activities. For instance, a study by Davis et al.

(2010) across 16 nations found that poor farm households diversify their income more than rich farmers.

Similarly, a study by Man (2009) in Malaysia using descriptive and logit regression model found that the household family size had significant and positive effect while the level of education and land-size had no impact on the farm household adoption probability of off-farm activities. On the other hand, Benjamin and Kimhi (2006) found that educational level affects the farm households' decision in participating in non-farm labor markets.

A study by Glauben, Herzfeld and Wang (2008) in China using multinomial Logit model concluded that educational level had significant and positive effect on the farm households' probability to participate in off-agricultural diversification activities. On the other hand, a farm household with a greater number of males had a lower chance of participating in off-farm activities. When they did, it resulted in a higher chance of participation in on-farm (crop production) practices. Similarly, a study by Huang, Wu and Rozelle (2009) in China using Probit, ordinary least square and Tobit estimation techniques found that the chance of off-farm participation by young and educated household members was found to be higher.

In Nigeria, a study by Babatunde and Qaim (2010) using multivariate Probit model found that income generated from off-farm activities comprised 50 percent of the

gross farm income. In this study, farm-size had positive and significant effects on off-farm income participation probability. However, households with lower or no educational background and had no access to infrastructures had a lower chance of adoption of off-farm activities. Another study by Matshe and Young (2004) in Shamua District of Zimbabwe using double hurdle model concluded that educational level, productive assets and agricultural terms of trade all have significant effects on farm household's decision in participating probability of off-farm activities.

2.2.2. Livelihood Diversification and Land Management

In this section we will look at the empirical literatures of livelihood diversification and land management. Jianzhong et al. (2009) in China found out that as farm households transformed from the socialist economy system to the individual household economic management system, they were able to diversify livelihood strategies from agriculture to the industrial sector, which were much higher than before. Therefore, farm households shift and allocate their labor input from agriculture, from concentrating mainly on grain plantations, to the more environmentally sustainable and diversified farming activities like vegetables and fruits productions (Yan, Zhang & Wu, 2009).

A study by Holden, Shiferaw and Pender (2004), argued that increasing the participation rate of off-farm and non-farm income leads to a shift in labor hours from on-farm production. That means there will be less stress on the natural resource

exploitation and it will be good for sustainable land management. However, non-agricultural livelihood diversification activities would take labor from land conservation and management efforts.

Research work by Holden et al. (2004) studied non-farm diversification activities and land management in Ethiopian highlands using a calibrated dynamic bio-economic model. They concluded that participation in non-farm diversification activities decreased the farm households' motivation to invest their resources and time in suitable land management and conservation activities. The researchers justified that the return of labor from land management is lower than that of off-farm wage rate. They concluded that extent of soil erosion and land degradation had been increased. On the other hand, they also concluded that low-wage non-farm employment opportunities had significantly and positively affected the income level of the farm households.

A related study by Kaimawitz and Angelsen (1998) found that improvements in market access for non-farm labor leads to deforestation caused by road construction and other infrastructure expansion works. Likewise, a similar study by Holden et al. (2001) in Ethiopia of Amhara National Regional State using bio-economic model found that farmers who were not engaged in off-farm livelihood sectors were less likely to have fallow lands. A similar study by Shiferaw and Holden (1998) concluded that income from off-farm activities leads to the decline in incentives to

conserve the land management situation. They also concluded that land scarcity, which comes from population pressure, leads the probability of removing land conservation structures.

Pender, Gebremedhin and Haile (2002), in their study in Ethiopia of Tigray National Regional State, found that farm households who had a higher level of non-farm income more intensively participated in sustainable land management practices like in stone terraces than other farm households. On the contrary, a study by Hagos and Holden (2006) in the same region found that off-farm diversification opportunities were negatively affected by the probability of investing labor on land management activities like soil bunds.

A study by Pender, Gebremedhin, Benin and Ehui (2001) in Amhara and Tigray Regional States of Ethiopia found that off-farm activities had resulted in increased investments, in soil bund while it leads to decline in live fences construction. They concluded that access to market by the farm households resulted in a decline in the probability of land management activities like a decrease of the use of fallow land. In addition, they also found that the probability of construction of soil bunds had been diminished where farm households are located closer to the roads.

Their findings showed that the growth in population was related to the decline in use of manure for land management and it did not result in an increase in construction of gully checks Likewise, frequent redistribution of farmlands (less secured land

ownership) led to a reduction in adoption of fallowing and less labor hour allocation in soil bund practices. On the other hand, as households' educational level increased there was adoption of manure; however, there was less investment in terraces. Similarly, access to credit service resulted in increased adoption of compost, tree planting, and construction in live-fences and soil bunds.

A study by Chang and Boisvert (2009) using trivariate Probit model found that adoption of the farm households in conservation programs and off-farm livelihood sectors increases income of households significantly.

2.2.3. Poverty, Livelihood and Environment

Environmental resources degradation decreases the productivity capacity of the poor who highly depend on them. This makes the poor more vulnerable to extreme poverty. Poverty by itself also facilitates degradation of the environment. The poor are supposed to have shorter time horizons in their investment decisions and are mostly unable to do sustainable natural resource management investments (Gray & Moseley, 2005).

The development policies, rural poverty reductions and livelihoods of poor people are highly linked to social, environmental and economic aspects of the concepts of sustainability (WCED, 1987; Poole, Gautheir &Mizrahi, 2007; Oumer & Neergaard, 2011). To achieve long-term and sustainable goals, Poole et al. (2007) underlined the

need for deeper understanding in livelihood-poverty linkage and existence of heterogeneity at farm household and local levels.

According to the study done by Okello, Seno, Simon and Nthiga (2009) in Kenya, the livelihood of poor farm households found highly dependent on natural resource exploitation for their temporal subsistence needs rather than maximizing sustainable and sustainable goals. On the other hand, the researchers found that access to social capital and leadership increases environmental and livelihoods benefits of the farm households. Similar studies by Babulo et al. (2008) and Liyama, Kariuki, Kristjanson, Kaitibie and Maitima (2008) indicated that livelihoods found highly oriented to market or subsistence farming types, and the latter greatly depended on natural resource base of the area. As a result, it is mentioned that extreme poverty level depletion of natural resource base and food insecurity were considered as negative livelihood impacts (Scherr, 2000; Niehof, 2004; Oumer & Neergaard, 2011).

A study by Ellis (2000) argued that livelihood strategies depend on the quantity and quality of assets .An empirical study by Cramb, Purcell and Ho (2004) in Vietnam found that there are variations in asset endowments between the poor and better-off farm households. Their research finding shows that the better-off farm households participate in sustainable land management systems like in using manure while the poor farm households participated highly in off-farm activities. On the other hand, a study by Ellis and Mdoe (2003) in Tanzania found that poverty level of the farm

households were strongly correlated with a shortage of assets including livestock and land that made them hardly diversify to non-farm livelihood activities.

Related studies by Oumer and Neergaard (2011), Morera and Gladwin (2006), Wagayehu and Drake (2003) and Tizale (2007) found that poor farm households had less participation in soil conservation works, but they had higher participation in off-farm livelihood diversification activities. This was because the immediate concern of poor households is food security rather than long-term sustainable land management. A study by Liyama et al. (2008) concluded that farm households that participated in various income portfolios and off-farm activities were found to have adopted new farming technologies and land resource conservation activities.

A study by Oumer and Neergaard (2011) in Ethiopia found that farm households with upper income quartiles had better asset endowments and access to institutional support. This resulted in higher participation of livelihood diversification activities than households with lower income quartiles. The researchers added that there are entry barriers of poor farm households with lower income quartiles to high return and profitable off-and non-farm livelihood diversification activities.

A related study in Kenya concluded that the poor farm households diversify their income towards less return and less risky non-agricultural diversifications such as charcoal and firewood selling practices. The researchers mentioned the determinant variables like lack of knowledge and skill, and shortage in the financial capital as

major barriers for the participation of the poor in high return economic activities (Abdulai & CroleRees, 2001; Ellis & Freeman, 2004; Freeman, Ellis & Allison, 2004; Babulo, Muys, Nega, Tollens, Nyssen & Deckers, 2008; Liyama et al., 2008; Van den Berg, 2010; Oumer & Neergaard, 2011).

In Ethiopia, a study by Babulo et al. (2008) found that the livelihood diversification of poor farm households continued to depend on forest related diversification activities like production of charcoal and firewood. They also added that on-farm agricultural crop production activities were unable to satisfy the poor to maintain their annual consumption needs. That pushed farm households to diversify their activities to non-farm activities.

A related study in Nepal by Bhandari and Grant (2007) found that farm households who diversify their activities to off-agricultural diversification activities had shown stronger livelihood security than households that just stuck to on-farm activities. Other studies by Kristjanson, Radeny, Baltenweck, Ogutu and Notenbaert (2005) in Kenya, and Oumer and Neergaard (2011) in Ethiopia, found that farm household poverty level was significantly determined by soil fertility, agricultural potential, market distance, and access to the road and education services.

2.2.4. Livelihood Diversification and Environment in Ethiopia

A study by Woldehanna (2000) in Ethiopia estimated that non-agricultural income comprises 35% of gross farm households' income. Similarly, studies in Ethiopia by Davis (2003) and Deininger, Jin, Adenew, GebreSelassie and Nega (2003) estimated that 20% of total farm household income had been generated from non-farm livelihood diversification activities. However, Beyene (2008) described that when compared with other developing African countries, the amount of rural labor participating in non-farm diversification activities is insignificant.

On the other hand, labor participation rate of non-agricultural diversifications in Ghana and Sierra Leone are 26.7% and 15%, respectively. In Sub Saharan Africa, the average participation rate is 10% to 20%. However, the researcher argued that the definition of non-farm and off-farm activities in Ethiopia by the Central Statistical Authority office is narrow, and it understates the values of non-farm diversification activities of farmers (Beyene, 2008).

The study conducted in Ethiopia about agriculture and rural non-farm wage employment using logit regression model concluded that the probability of participation of literate farm households on non-farm activities is higher than farm households who has no formal educational background (MoLSA, 1997). On the other hand, Woldehanna (2000) in Tigray region of Ethiopia found that better educational

level improves the efficiency of farm activity much higher than the productivity of off-farm diversification activities.

That indicates educational level has a negative effect for non-agricultural activities. Similarly, a study by Gebreegziaber (2000) in Southern Nations and Nationalities of Peoples (SNNP) Regional State in Ethiopia concluded that educational level helps to expand non-farm diversification activities in rural households. In addition, the researcher in his analysis found that farm households with more resource endowments had less interest towards non-agricultural diversification activities.

Likewise, Demeke and Regassa (1996) had studied the determinants of non-agricultural diversification practices in North Shoa of Ethiopia. They found that educational achievement of the farm household indicated a positive impact as long as the farm household is located near the urban areas; otherwise, education has no significant effect if the farm household is located far from the urban areas. On the other hand, in this study, age of the farm household has a negative effect on participation decision. However, land size has significant and positive impact on off-farm participation probability of the farmers. They also concluded that gender difference of the farm household head has no significant effect.

A study by Beyene (2008) in Ethiopia about the determinants of off-farm participation using the bivariate Probit model concluded that ages of the male-headed households have significant impact for participation decision on the off-farm

diversification activities. On the other hand, education had no significant impact on participation decision to off-farm activities. However, taking training skills by the household, such as handicraft trainings, had positive and significant impacts to off-farm employment.

Similarly, male-headed farm families have shown a better chance of participating in non-agricultural livelihood activities than female-headed households (Beyene, 2008). Financial position and credit access had significant and positive impacts on farm households' decision to engage in off-farm diversification practices.

However, land size had significant and negative effects on adoption decisions of female-headed and male-headed households. Similarly, value of livestock had a positive impact on off-farm livelihood diversification activities. However, home distance from the market place had positive and significant results, which were against both the theoretical and empirical literatures. Location of the farm household also had an effect. The study area farm households that are located in relatively drought-prone areas adopt off-farm activities, which are relatively higher than households that live in food-surplus villages.

The studies made by Block and Webb (2001) in Ethiopia found that as the level of farm households' wealth increased, the chance of participation in non-farm activities also went up. A study in Ethiopia by Egziabher (2000), on the other hand, found that

farm households with relatively more farm assets had a lower rate of participation in non-agricultural diversification practices than a poor farm household.

In Ethiopia, a study done by Lemi (2006) found that male-headed households participated significantly higher than female-headed households. However, a study by Berg and Kumbi (2006) in the same study area concluded that sex of the household head had no effect on the adoption probability of the farm households' engagement in the non-agricultural income sources. On the other hand, a study by Bezu, Holden and Barrett (2009) found that sex of the household, educational level and farm-size found to be a significant determinant factor for engagement probability of non-farm activities.

Another study in Ethiopia by Sisay (2010) concluded that family size has positive effects on the chance of engagement decision of the farm households. Similarly, age of the female-headed household shows significant and positive impact on participation decision on off-farm economic sectors. In addition, in this study education of the household showed significant and positive impact on participation probability. On the other hand, wealth of the farm household indicated significant and negative effect on participation decision to off-farm activities. On the contrary, credit service opportunities motivate farm households significantly to engage in off-farm activities.

Likewise, a study by Bezabih, Gebreegziabher, GebreMedhin and Köhlin (2010) using multinomial logit model found that variation of rainfall was found statistically significant on the effects the probabilities of farm households' participation in off-farm activities. On the other hand, financial constraint and ages of the farm household had a negative impact on the adoption probabilities of the farmers. Gender difference and educational level have no significant impact. The researchers found that family size, which is the proxy measure of labor, and stock of livestock the farmer had showed a positive effect on the non-agricultural activities adoption decision by the farm families.

A study in Amhara Regional State of Ethiopia by Legesse, Tegegn, Belachew and Tushune (2007) found that 84.4 percent of the farm household had a skill of non-agricultural activities. The average age level of farm households who participate in non-agricultural activities is 35 years old, showing there were large numbers of younger farm households' participants than older farm households. In this study, the main determinant factors for livelihood diversification that were mentioned included failure in agricultural crop production and drought.

2.3 Summary of the Literature

This study adopts the definition of livelihood given by Ellis (2000, p.10) as it "comprises the assets (natural, physical, human, financial and social capital), the activities, and access to these (mediated by institutions and social relations) that together determine the living gained by the individual or household". The typical farm household income can be composed of three components: on-farm, off-farm, and non-farm income.

On-farm income is income gained through farming own-land or land acquired or accessed by cash or share tenancy, and income from livestock production. Off-farm income is income gained from labor wage working from other farms within the agriculture sector. On the other hand, non-farm income refers to income from non-agricultural sources like non-farm salary employment, urban-to-rural remittances, rental income, non-farm rural-wage, and international remittances to a farm household (Ellis 2000, pp.11-12).

Livelihood diversification is not only just a developing country and rural area phenomenon, but also it is a strategy for developed countries and urban center areas. It has currently become a feature of developed country farm households; in which home-based and part time jobs become ordinary practices of these families (Maxwell, 1995; Levin et al., 1999).

Livelihood and income are not identical. Household income includes liquid cash earnings and the current market values of payments in-kind like consumption of farmers' own production (Lipton and Maxwell, Cited in Ellis 1998). On the other hand, livelihood of the farm household includes income of cash and in-kind, social institutions like family and village, property and land rights, which help to maximize and sustain wellbeing and living standard (Bryceson, 1996).

In the classical orthodox view, the change in nation's economy was interpreted as the shifts in the economic structure, like a shift of the economic sector, which can be identified and clearly categorized, from agriculture to industry and then to service (Ellis, 1998). The implicit assumption of this view is that division of labor and specializations, rather than diversification, are the necessary conditions for the transformation of economic sectors (Ellis1998, pp.1-4). On the other hand, livelihood activities are not supporting monolithic development plans; rather they are diverse, multiplex and cross - sectorial in nature (Ellis & Freeman, 2005).

Ellis and Allison (2004) mentioned some of the benefits of livelihood diversification in the process of improving livelihood and reducing poverty. It is argued that farm households diversify their livelihood because of asset-based and insurance-based diversification theories. Other scholars mentioned the reasons for livelihood diversification mainly emanates from necessity versus choice conditions.

The main determinant factors for livelihood diversification include the existence of risk (Bryceson, 1996); the heterogeneity of labor markets that come from the differences in household gender, location, technical skills, and cultural differences (Davies & Hossain, 1997), and the existence of seasonality (Ellis, 2000). Similarly, researchers like Reardon (1997) justified the existence of livelihood diversification in developing countries. This was due to the low credit access rate across the farm household in these countries; and cash to smooth consumption rather than to generate income for investment (Taylor & Wyatt, 1996). Some scholars mentioned deterioration of assets, disasters that are considered to be push factors; migration of the household members or the whole family itself (Bigsten, 1996); and population pressure (Malmberg & Tegenu, 2007) as determinants of livelihood diversification.

Livelihood activities are components of livelihood strategies, and they are divided in to two broad categories, namely natural resource based and non-natural resource based activities. Activities of natural resource based categories include cultivation of food and non-food productions, collections from forest and wood lands, livestock production, and non-farm resource based like brick making and so on. On the other hand, non-natural resource based encompasses rural manufacture, rural trade, remittances, and other transfers like pensions (Ellis 2000, pp.30-41).

Therefore, the debate between livelihood diversification and environment rests on two contradicting views. Some scholars argue that diversification affects the environment positively by improving the efficiency of the system by recovering from

environmental degradations and by improving its resilience capacity (Scoones, 1998; Ellis, 2000). On the other hand, the opponents argue that the livelihood diversification of the poor may be towards the production and intensive trading activities of natural resources, including mineral overexploitation, over fishing, forest product production, and so on that enhances adverse environmental degradation (Ashley & Carney 1999, pp.13-37).

In developing countries, scholars conducted various empirical livelihood diversification studies. In developing countries, formal credit and insurance markets are missing. As a result, farm households demanded to diversify their activities to fill this market gaps (Holden & Binswanger, 1998). A study by Bezabih et al. (2010) indicated that, in developing countries, the mean income generated from non-farm livelihood source was estimated to be 40-50 percent of total income.

Similarly, a study by Ellis (1998) by reviewing 31 surveys in 18 Sub Saharan Africa least developed countries found that the share of income from non-farm diversification activities ranged from 15 to 93 percent. As empirical determinant factors risk strategy behavior of farmers, existence of labor market variations, seasonality, shock coping behavior, missing credit markets, farm household sex, age, educational status, family size, farm size, labor, and institutional factors like land-rights and cooperative associations were mentioned by various scholars.

CHAPTER THREE: METHODOLOGY OF THE STUDY

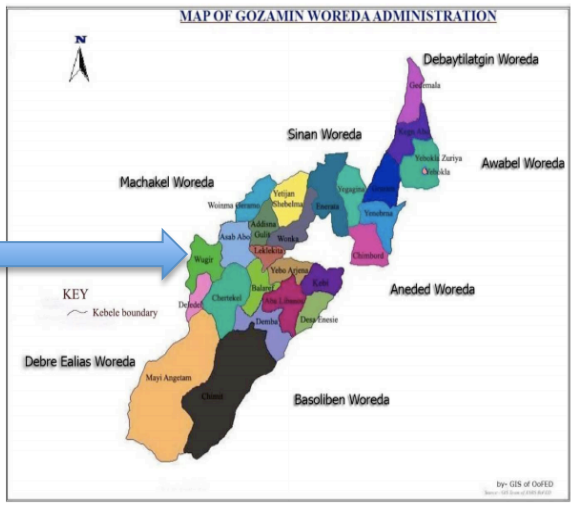
3.1. Description of the Study Area

Ethiopia is located in the Horn of Africa and bordered with six countries namely, Kenya, Somalia, Djibouti, Eritrea, Sudan and South Sudan. The country has various altitudes that range as high as 4550 meters above sea level in the Semen Mountains of North Ethiopia to as low as 110 meters below sea level of Afar Depression. Ethiopia is located geographically between Latitude of 3^0N and 15^0N and Longitude of between 33^0E and 48^0E (Bielli, 2001).

Figure 3.1: Geographical Map of Ethiopia

Source: Central Intelligence Agency (2007)

Figure3.2: Geographical Map and Location of Gozamin District, the study area



Source: Haile (2011)

According to 2007 Census data, the Ethiopian population was 74 million however in July 2012 estimate, it was 91.2 million populations with 2.9 percent of growth rate. That makes the country the second most populous nation in Africa continent next to Nigeria (CSA, 2008; CIA, 2013).

Ethiopia has an area of 1.1 million square kilometers, of which the arable-land comprises for only 35% of the aggregate land area. However, irrigated land accounts only just 0.5% of the total land areas. However, the economic livelihood of more than 80% of the total population is dependent on the agriculture sector.

It is mentioned that, beginning from 2008/2009 Ethiopian Fiscal Year the lasting dominance in GDP contribution of the agriculture sector was surpassed by the service sector that employs only less than 15 percent of the national labor force. This is mainly because among other factors agriculture in Ethiopia is based on seasonal rain fed system. Without adopting high technology for this sector, its productivity will continue to be lower and in a trap.

Ethiopia has nine administrative provincial regional states and two city administrative councils. The study area, the Amara National Regional State, has eleven administrative zones, including East Gojjam zone, where the study district is located. The Amara Regional State is geographically located between 9^0 21' and $14^0$0' North Latitude and $36^0$20' and $40^0$20' Longitude, approximately. The state has the total area of 154,708.96 Square kilometers (CSA, 2013). According to CSA (2013), the Amara

Regional State has a population of 18,866,002 in which male population accounts for 9,461,005 while female population comprises 9,404,997 in number.

The major economic sector in Amara region is agriculture, in which 90% of the aggregate labor force of the Regional province engaged in this sector. In this regional province, the main crops that have been produced include cereal crops (maize, sorghum, teff, barely, millet, and wheat), oil crops (sesame, sunflower, noug), pulses (like chick pea, lentils, vetch, etc.) and horticulture crops (garlic, onion, tomato, pepper, and various fruits) (BoFED, 2008).

In addition, BoFED (2008) described that 80.7 % of the arable land in this region is planted to cereals, and 12.5 percent and 6.5 percent of arable land account for pulses and oil crops, respectively. The Region also has huge livestock resources, which is one-third of Ethiopia's livestock population. According to BoFED (2004) report, the non-agricultural livelihood activity in Amara Region is second in employment generation. The major non-agricultural livelihood activities in this region include small trade, handcrafting, small-scale agro processing, etc.

East Gojjam Zone is one of the administrative zones in Amara National Regional State, where the study area (Gozamin District) is located. According to 2007 national census, Gozamin District has a population of 133,857 (CSA, 2008). The study by Tsegaw (2007) about the land cover dynamics of Gozamin District from 1972-1999 described that there is a large increase in cultivated and grazing land area. However,

the forest coverage also increased from 3258.01 hectare (1.8% of the total district land) to 4488.5 hectare (2.5% of the total district area) due to afforestation programs of the previous and current governments. On the other hand, the researcher mentioned that the average soil erosion rate is 9.25 tons per hectare per year and land degradation is found to be in the highest rate.

3.2. Sampling Techniques and Data Type

This study has used both secondary and primary data types. From the primary survey, both qualitative and quantitative data were collected to analyze its objectives. From the quantitative data types, for instance, farm household family size, age of the household head, non-farm income, on-farm income, off-farm income, farm size, livestock (estimated in the current market values), distance to the nearest market place, etc. have been collected and analyzed.

The study also used qualitative data types, which include: land right characteristics, access to credit service, sex of the household head, etc. Secondary data from literatures including books, journal articles, working papers, reports and policy documents, other published and unpublished materials have been used.

The primary data for this study purpose was collected using a survey technique of 151 farm households in Ethiopia, Amara National Regional State, and East Gojjam Zone of Gozamin District. Secondary data collected from some of the Ethiopia

organizational institutions such as MoFED, BoFED, BoARD, Ethiopian Economic Association and CSA of Ethiopia. Gozamin district was selected because livelihood diversification activities have mainly been conducted along with on-farm activities and for the convenience of the researcher in using specialized enumerators.

This study employs multistage stratified sampling technique based on geographical location references. There are 9 provincial regional states in Ethiopia among which Amara National Regional State has been chosen. In this Region there are 11 administrative zones and East Gojjam Zone was selected. This Zone has 17 districts and Gozamin district was chosen. From the 15 villages in the Gozamin District, Leqileqit, Weynmager, and Addis-Gulit villages were picked as study areas. Finally, from the 3 stratum villages through applying equal proportion technique, the study selected 50 farm households each two (and 51 sample farm households from Weynmager village) and 151-sample size in total using simple random sampling method.

3.3. Theoretical Framework

3.3.1. Theoretical Models for Participating in Livelihood Diversification

Following the neoclassical farm household model of Singh, Squire and Strauss (1986), Ellis (2000), and Jugo and Hassan (2010) the study employed the analytical

framework approach for interpreting the consumption and production, the decisions of resource allocation made by farm households in most less developed countries. The fundamental concept of this method is grounded on the assumption that, farm households that live in a subsistence economy are simultaneously supposed to be both consumers and producers. However, the decisions in consumption and production by farm households can first be separated by maximizing profit from producing food and then using profits to maximize the farm household's utility from consumption.

This study used the neoclassical model of the farm household in developing countries as adopted in Singh et al. (1986), and Jugo and Hassan (2010) to design the model for analyzing the factors determining farm households' resource labor allocation. Labor is supposed to be the major asset for developing country farmers' decisions for participating in livelihood diversification activities.

Therefore, the livelihood diversification model incorporates the situation of farm household income diversification activities towards participating in on-farm, non-farm and off-farm livelihood diversification activities (Ellis, 2000). Just for this theoretical model construction purpose let us categorize farm households' income sources broadly only in to two, namely agricultural (on-farm) and non-agricultural (includes both non- and off-farm) diversification activities.

The question of why farm household diversifies the income in developing countries has so many arguments and justifications by different researchers. According to the

scholars namely; Singh et al. (1986), Abdulai and CroleRees (2001), Govereha and Jayne (2003), and Beyene (2008) justified that in developing countries where market is imperfect, the livelihood diversification activities of farm households' consider food market failures and production risks. This leads to the non - separabilities of farm household decisions in consumption and production processes.

There are also non-separabilities between agricultural crop choice decisions, and accessibility and opportunity for investment decisions by farm households. For instance, a farm household with limited cash income and inaccessibility in credit opportunities cannot afford to buy key agricultural inputs. Therefore, that will be rationale decision by a farm household to engage in livelihood diversification activities towards non-agricultural activities for adding more income other than income generated only from on-farm agricultural activities (Singh et al., 1986; Abdulai & CroleRees, 2001; Govereha & Jayne, 2003; Beyene, 2008).

The farm household's decision to participate in non-agricultural income generating livelihood practices could help them to purchase modern agricultural inputs and smoothening consumption that otherwise could not be accessible. The decision of any farm household to participate in livelihood diversification activities, in this case non-agricultural activities is determined by farm household characteristics, non-agricultural and agricultural income diversification activities. For the objective of utility maximization, therefore, the farm household allocates its labor resource in to these two activities and also consumes outputs from these diversification activities.

The neoclassical model assumed that a typical farm household is expected to maximize its utility function by consuming on-farm agricultural products that include livestock products (X_A), non-agricultural products of non-farm and off-farm income diversification activities (X_N), a market purchased goods (X_M), and leisure time (X_L). Therefore, a farm household's utility-maximization objective can be defined as:

$$MaxU = U(X_A, X_N, X_M, X_L; H) \quad \text{.....(1)}$$

Where H indicates a vector of all household characteristics that influences utility. The utility of a household is maximized subject to the income level, time and production technology employed constraints of the farm household (Singh et al., 1986).

$$P_M X_M = P_A(Q - X_A) - w(L - F) \quad \text{... ... ... (2)}$$

$$T = X_L + F \quad \text{.....(3)}$$

$$Q = Q(L, A) \quad \text{.....(4)}$$

Where symbols P_A and P_M indicates the prices of the on-farm (agricultural) product and market purchased commodity, respectively, where Q is the farm household's production of the agricultural output and ($Q\text{-}X_A$) shows its marketed-surplus, w is the market wage, L is the total labor and F represents family labor resource. Then, *(L-F)* is positive if the farm household hired (sells) labor, and negative if the household supply labor to non-agricultural production (X_N) of non-farm and off-farm diversification practices. The farm households cannot allocate more than the total time for leisure, agricultural production and non-agricultural production, and from equation (3) above T represents total farm household time. Finally, equation (4)

indicates the constraints in production and where A indicates farm household's plot of land in hectares.

The three constraints mentioned from equation (2)- (4) above can be summarized in to one constraint by substitute production-constraint in to income constraint for Q and substituting the time constraint in to the income constraint for F gives one constraint of the form:

$$P_M X_M + P_A X_A + wX_L = wT + \pi \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5)$$

Where ！ is a measure of farm household profit and it can be described as:

$$\pi = P_A Q - wL \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

In the summarized equation, the left hand side of equation (5) shows the expenditure on the market purchased commodities, the farm household purchase its own leisure time. The right hand side of equation (5) indicates the full income. The general assumption on this model is that the farm household is a price-taker rather than a price-maker.

Equation (6) indicates the profit function, and as profit is maximized, its slope (the marginal profit) will be zero. And the first order or necessary condition at this point is:

$$\frac{\partial \pi}{\partial L} = P_A \frac{\partial Q}{\partial L} = w \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (7)$$

Profit will be maximized in which the marginal revenues product of household labor is equal to the market wage.

Therefore, according to the neoclassical model a farmer will engage to participate either on the agricultural or non-agricultural diversification activity depending on the marginal return from each activity (Singh et al., 1986; Beyene, 2008). Specifically, for a typical farm household, the decision to engage in non-agricultural activity is decided by taking comparisons of the ongoing market wage rate and the shadow (reservation) wage rate. According to Beyene (2008) the marginal value of time is the reservation wage rate, as a farm household does not participate in the non-agricultural livelihood diversification activities. The non-agricultural activity (X_N) reservation wage rate is the value of the margin of a household time when all of the time is assigned to agricultural (on-farm) or for (X_A) production purpose. The equation can be presented as:

$$W_i^{X_A} = \alpha_{iX_A} F(X_i) + \varepsilon_{iX_A} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (8)$$

$$W_i^{X_N} = \alpha_{iX_N} F(X_i) + \varepsilon_{iX_N} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (9)$$

$i = 1, 2, \dots\dots\dots\dots\dots\dots\dots\dots\dots n$ individual farm household

Where: $W_i^{X_A}$ represents the reservation wage

$W_i^{X_N}$ represents the market wage

X_i represents the distribution of explanatory variables

α_{iX_N} and α_{iX_A} are the random error (disturbance) terms of the reservation and market wage rates of agricultural and non-agricultural activities, respectively.

For this study, it is assumed disturbance terms to be distributed normally and having a zero mean. Equations (8) and (9) are not restricted to be linear and their distribution is determined on the distribution of their respective error terms. The *i*th farm household will choose to engage on agricultural activities if $W_i^{X_A}$ $W_i^{X_N}$, and it will choose to participate on non-agricultural activities if $W_i^{X_N}$ $W_i^{X_A}$. Then the study will define a dichotomous variable N_i that equals one if a farm household *i* participates in non-agricultural activities, otherwise zero (if the farm household did not participate).

$$N_i = \begin{cases} 1 if W_i^{X_N} \quad W_i^{X_A} \\ 0 if W_i^{X_A} \quad W_i^{X_N} \end{cases} \text{.....(10)}$$

The probability that the farm household participates in non-agricultural income diversification activities or that N_i equals one is a function of the explanatory variables.

$$\begin{aligned} P_i &= \Pr(N_i = 1) = \Pr\left(W_i^{X_N} > W_i^{X_A}\right), \\ &= \Pr\left[\alpha_{iX_N} F(X_i) + \varepsilon_{iX_N} > \alpha_{iX_A} F(X_i) + \varepsilon_{iX_A}\right], \\ &= \Pr\left[\left(\varepsilon_{iX_N} - \varepsilon_{iX_A}\right) > F(X_i)\alpha_{iX_A} - \alpha_{iX_N})\right], \\ &= \Pr\left[\mu_{X_N} > F(X_i)\beta)\right], \\ &= F(X_i\beta) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (11) \end{aligned}$$

In this case, X represents a $n \times k$ matrix of regressors (explanatories), while β is a $k \times 1$ vector coefficient that the study is going to estimate using this model. Therefore, the probability that the *ith* farm household engages in non-agricultural diversification activity is the chance that the reservation wage of agricultural activity is less than the market wage gained from participating in non-agricultural activity or the cumulative distribution of F for the disturbance term evaluated at the explanatory variable X_i. For the purpose of this model analysis, the disturbance (error) term is assumed to be normally distributed, which helps to make the coefficient estimation of the possible probability using a Probit model.

3.3.2 Seemingly Unrelated Regression (SUR) Model

For a single linear equation model, one can employ Ordinary Least Square (OLS) estimation technique. But, for many general linear system equations, Generalized Least Squire (GLS) analysis technique is more efficient than OLS (Wooldridge, 2002).

One of the GLS system equations model is the Seemingly Unrelated Regression (SUR) model. In the previous discussion of section 3.3.1, we see the dichotomous model of whether the farm household is adopting non-agricultural livelihood diversification activities or not. Ellis (2000) divided a typical farm household's income diversification activities broadly into three categories of on-farm, non-farm

and off-farm livelihood diversifications as described in the literature. This will help analyze the determinant factors of these farm-income categories of the rural households in detail.

There are assumptions made to present this study objective. The first assumption is that individual farm household's income generated from on-farm, non-farm and off-farm activities are determined by almost the same explanatory variables (X). Since the farm household can allocate the resources, mainly labor, to diversifications of on-farm, non-farm or off-farm livelihood sectors one at a time, then that is not (at least for the short period) expected to affect one another.

However, the farm household makes a decision to participate in either one or more of the activities based on the explanatory variables that include resource endowments that the household has, therefore, these participation decisions in either of the activities cannot be fully independent. As a result, single OLS estimations of each equations or treating them independently may not give consistent and efficient results due to the possible correlation between the error terms (Wooldridge, 2002; Greene, 2012) between on-farm, non-farm and off-farm incomes equations of individual farm households.

Therefore, following the theories of Wooldridge (2002) and Greene (2012), the Seemingly Unrelated Regression model of income diversifications of the farm household in Gozamin District of Ethiopia can be presented as:

$$\begin{cases} Y_1 = X_1\beta_1 + \varepsilon_1 \\ Y_2 = X_2\beta_2 + \varepsilon_2 \\ Y_3 = X_3\beta_3 + \varepsilon_3 \end{cases} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots.. (12)$$

Where, i = 1,2,3 - for on-farm, off-farm and non-farm income diversification activities and in matrix form it can be modeled as:

$$\boldsymbol{Y = X\beta + \varepsilon}$$

X represents explanatory variables that may vary across equations, and while β represents coefficients.

The second assumption is that X is strictly exogenous and do not incorporate endogenous variables, which is the expected value of ε and X is zero. That is:

$$E[\,!\ /\ X_1 + X_2 + X_3\,] = 0 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (13)$$

In this model, there are a total of 151 sample observations that are used to estimate the parameters of the 3 equations. Each equation involves Ki explanatory variables (regressors), for a total of $K_i \sum_1^3 K_i$ and Ki<T (in this case T=151) (Greene 2012, p.332).

For this model, the disturbances are assumed to be uncorrelated across observations; however, they are supposed to be correlated across the 3 equations, then:

$$E[\varepsilon_i\varepsilon_i' \,|\, X_1, X_2, X_3] = \sigma_{ii}I_T = \Omega = \begin{pmatrix} \sigma_{11}I\ \sigma_{12}I\ \sigma_{13}I \\ \sigma_{21}I\ \sigma_{22}I\ \sigma_{23}I \\ \sigma_{31}I\ \sigma_{32}I\ \sigma_{33}I \end{pmatrix} \dots\dots\dots.. (14)$$

Where ***I*** is an identity matrix.

Therefore, the correlation of error terms between on-farm, off-farm and non-farm livelihood activities make possible to implement a joint estimation procedure, which is better and more efficient than separate least square estimation (Hill, Griffiths & Lim, 2012).

Therefore;

$$Cov(\varepsilon_1, \varepsilon_2, \varepsilon_3) = \sigma_{1,2,3}\ and\ \sigma_{1,2,3} \neq 0 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (15)$$

This indicates that, at the same point in time, the disturbance (error) terms are correlated, and this type of correlation is called contemporaneous correlation (Hill et al., 2012). The error terms of $\varepsilon_1, \varepsilon_2, and\ \varepsilon_3$ in this model contains the effect of farm household livelihood factors that have been omitted from the on-farm, off-farm and non-farm equations, respectively.

The rationale why the error terms be correlated in the 3 equations in our model would be since the farm household who engage on the on-farm, off-farm and non-farm livelihood activities is the same, then the effects of omitted factors in on-farm activity will be similar to their effects on off-farm and non-farm activities and vice versa, and will also most likely be correlated. Therefore, the most efficient generalized least square estimation technique that accounts for the differences in variances of the disturbance terms of the on-farm, off-farm and non-farm equations and contemporaneous correlation between the equations is efficiently explained by the Seemingly Unrelated Regression (SUR) model (Hill et al., 2012).

3.3.3 Recursive Bivariate Probit Model of Sustainable Land Management and Livelihood Diversification

In this section, we will develop the econometrics model to estimate the effects of livelihood diversification strategies of the farm household on the sustainable land management practices. Before we are going to present the recursive bivariate probit model, it is necessary to discuss the Inverse Herfindahl-Hirschman Diversity (IHHD) index and the Sustainable Land Management (SLM) index. According to Anderson and Deshingkar (2005, p.68) household level livelihood diversification extent is measured by the Inverse Herfindahl-Hirschman Diversity index using the following formula:

$$IHHD_i = \left[\frac{1}{\sum b_j^2}\right]_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots. (16)$$

Where each bj representing the proportional contribution of each livelihood activity j to household i's overall income. Following Ellis (2000), j in this model represents the three broad categories of farm household income sources: on-farm, off-farm and non-farm activities. The maximum value of IHHD index is the total number of various income sources (in this model it is 3) that was achieved if the farm household income is distributed equally between each income sources (Ellis, 2000; Anderson & Deshingkar, 2005). Therefore, the minimum value of IHHD is one; it is true if the farm household income is obtained from one income source only.

In this model, it is assumed that all sample farm households have engaged in the on-farm activities that mainly include the production of crops and livestock. On the other hand, only some farm households engaged on either off-farm or non-farm or both activities simultaneously. Therefore, for the purpose of regression and simplicity the IHHD index is changed to binary endogenous variable if IHHD>1 the farm household is considered to be diversified in its income. If the IHHD=1, the farm household, is considered to be not diversified in its income sources, it is supposed to focus just on the on-farm activity of specialization.

Similarly, the Sustainable Land Management (SLM) index, the dependent or explained variable, is constructed from 10 different sustainable land management indicators and practices in the study area. These indicators include adoption of tree planting, terracing, fallowing, manure and compost, soil-bund, gully-check, shelterbelt, contour farming, strip cropping and building live fence by the farm household's own farmlands. However, based on the institutional and socio-economic characteristics of the individual farm households while some of them adopt these sustainable land management practices in various degree and extent, others adopts none. Therefore, a scale of one is assigned to each land management practices if the individual sample farm household adopts that specific practice; otherwise a score of zero is assigned if not adopted at all. Finally, all scores are added and divided in to ten to find a Sustainable Land Management (SLM) index as follows:

$$SLM_i = (\text{Sum of all Sustainable Land Management scores})/10 \ldots\ldots\ldots (17)$$

Where *i* is assigned for an individual farm household.

In the introduction and literature sections of this study, it was argued that some livelihood diversification strategies of the farm household may have either positive or negative impacts on the environment. As the farm household diversify the livelihood activities, that is if IHHD is strictly greater than one, (or if that household engaged in trade) then the income level would increase .The farm household can smoothen the annual consumption level that may lead to an increase in the rate and extent of fallowing rate which improves land management practices. The farm household may then allocate the food crop land for more environmentally sustainable livelihood activities like tree planting and perennial cropping purposes. On the other hand, depending on the household characteristics and institutional setup, other livelihood activities may have contrary and adverse effects for the land management.

Accordingly, for the farm household who adopts all sustainable land management practices, the SLM index value will be 1. If he/she does not adopt any of the practices SLM index will be given zero score. Therefore, SLM index will be between 0 and 1, inclusive. As a rational economic agent, the farm household is expected to adopt land management techniques for its sustainable agricultural practices if the benefit gained from adopting them is higher than otherwise.

Following Maddala (1983) and Greene (2012), the recursive bivariate probit model that treats livelihood diversification index of the household is explained by the Inverse Herfindhal-Hirschman Diversity (IHHD) index as an endogenous variable. Sustainable Land Management (SLM) index is chosen to estimate the model simultaneously. The univariate single equation model is not used to estimate since it ignores the possible correlations in the error terms of simultaneous equations.

The error terms correlation in the simultaneous equation arises mainly because the omitted and unobserved characteristics may influence the farm household's decision to adopt sustainable land management practices and livelihood diversification activities simultaneously. In addition, the univariate probit and logit models may ignore the chance that a decision to adopt a particular practice may be conditioned on the adoption of another complementary practice.

And the recursive bivariate Probit model is presented as:

$$IHHD^* = X_1'\beta_1 + \varepsilon_1, IHHD = 1 \; if \; IHHD^* > 1; \; 0 \; otherwise \; \ldots\ldots\ldots\ldots\ldots\ldots\ldots (18)$$

$$SLM^* = X_2'\beta_2 + \gamma IHHD^* + \varepsilon_2, SLM = 1 \; if \; SLM^* > 0 \; \ldots; \; 0 \; otherwise \; \ldots\ldots (19)$$

Where X_1 and X_2 represent column vectors of exogenous or independent variables, $\beta_1, \beta_2 \; and \; \gamma$ represent coefficients, and $\varepsilon_1 \; and \; \varepsilon_2$ are error terms for livelihood diversification and sustainable land management practices, respectively.

Equations (18) and (19) indicate a system of equations and the parameters need to be estimated simultaneously. These equations are said to be recursive bivariate probit models of simultaneously equations, since the endogenous variable IHHD index appears on the equation of SLM index, while SLM doesn't appear on the right-hand side of IHHD equation. In these simultaneous equations, the error terms

$\varepsilon_1 \; and \; \varepsilon_2$ have a bivariate normal distribution. And the $cov(\varepsilon_1, \varepsilon_2) = \rho \neq 0$.

According to Greene (2012) the cumulative distribution function of the bivariate distribution can be presented as:

$$Prob(X_1 < x_1, X_2 < x_2) = \int_{-\infty}^{x_2} \int_{-\infty}^{x_1} \emptyset_2 \, (z_1, z_2, \rho) dz_1 z_2$$

which we denote by $\emptyset_2(x_1, x_2, \rho)$ and where the density function can be presented as:

$$\emptyset_2(x_1, x_2, \rho) = \frac{e^{\frac{-(\frac{1}{2})(x_1^2 + x_2^2 - 2\rho x_1 x_2)}{(1-\rho^2)}}}{2\pi(1-\rho^2)^{1/2}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (20)$$

And, ρ represents correlation coefficient between the error terms.

According to Maddala (1983) and Greene (2012), the endogenous nature of one of the variables on the right hand side of the equation, which is IHHD index in this model, surprisingly can be ignored while in formulating the log likelihood function.

For the estimation of the recursive bivariate probit model, denote the joint distribution of $(\varepsilon_1, \varepsilon_2)$ by $\emptyset(.,.)$ and for simplicity purpose assume they have

symmetric distributions (Maddala, 1983). Therefore, the joint probability distribution of (IHHD, SLM) is presented below as:

$$\left.\begin{array}{l} P(SLM=1, IHHD=1)=\emptyset[(x_2'\beta_2+\gamma, x_1'\beta_1);\rho)] \\ P(SLM=1, IHHD=0)=\emptyset[(x_2'\beta_2, -x_1'\beta_1);-\rho)] \\ P(SLM=0, IHHD=1)=\emptyset[(-(x_2'\beta_2+\gamma), x_1'\beta_1;\rho)] \\ P(SLM=0, IHHD=0)=\emptyset[(-(x_2'\beta_2), -(x_1'\beta_1);\rho)] \end{array}\right\} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (21)$$

and the likelihood function to be maximized is:

$$L(\beta_1, \beta_2, \gamma)=\pi P_{11}^{(IHHD)(SLM)} P_{10}^{(1-SLM)IHHD} P_{01}^{(1-IHHD)SLM} P_{00}^{(1-IHHD)(1-SLM)} \ldots . (22)$$

Given the model presented in equation (21), the marginal probability for IHHD is $\emptyset(x_1'\beta_1)$ where as the conditional probability is given by $\frac{\emptyset_2(\ldots.)}{\emptyset(x_1'\beta_1)}$, and $\emptyset_{2\,(\ldots..)}$ is indicated above, in the equation (20).

3.4. Empirical Model Specification

The primary data collected using survey method has been tabulated to make it orderly and easier for analysis and presentation. Then for the analysis purpose the data is processed using the statistical econometrics tool, software version called STATA12.

3.4.1 Empirical Model for Livelihood Diversification

The second objective of this study is to analyze factors that determine farm households' livelihood diversification in the study area. In order to estimate and to test the hypothesis of Gozamin district farm household decisions to engage on livelihood diversification activities, the univariate probit model is employed. The

livelihood diversification probit model can be presented:

P(diversification=1)= F(hhsex hhage fam_siz vill_leqleq vill_weynma elem_educ secon_educ stud_prop lnmrkt_dist land_ha land_right coop_memb credit_serv agri_exten lnlivestock lnwage labor)

$$Diversification = \\ = C + \beta_1 hhsex + \beta_2 hhage + \beta_3 fam\_siz + \beta_4 vill\_leqleq \\ + \beta_5 vill\_weynma + \beta_6 elem\_educ + \beta_7 secon\_educ + \beta_8 stud\_prop \\ + \beta_9 lnmrkt\_dist + \beta_{10} land\_ha + \beta_{11} land\_right + \beta_{12} coop\_memb \\ + \beta_{13} credit\_serv + \beta_{14} agri\_exten + \beta_{15} lnlivestock + \beta_{16} lnwage \\ + \beta_{17} labor + \varepsilon$$

Where c is constant and $\beta's(beta)$ represents coefficients.

Definition of variables:

Dependent Variable: diversification= is dichotomous dependent variable and diversification=1 if the farm household participates in non-agricultural livelihood diversification, 0 otherwise

Explanatory Variables:

hhsex	Dummy variable of variable of gender, 1 if male, 0 otherwise
Hhage	Age of the household head (in years)
fam_siz	Size of the family (in number)
noformal_edu (base for education)	Dummy variable of education, 1 if no formal education, 0 otherwise
elem_educ	Dummy variable of education, 1 if elementary education, 0 otherwise
secon_educ	Dummy variable of education, 1 if secondary education, 0 otherwise
stud_prop	Proportion of students in the household
mrkt_dis	Distance of home from nearest market (in km)
land_ha	Land size owned by the household (in ha)
Labor	Number of labor (between age of 15 and 65) in a farm household

land_right	Dummy variable, 1 if household feels secured for his land, 0 otherwise
coop_mem	Dummy variable, 1 if household is member of the cooperative, 0 otherwise
credit_serv	Dummy variable, 1 if household has access for credit, 0 otherwise
exten_serv	Dummy variable, 1 if household participated in agriculture-extension, 0 otherwise
livestockY	Market value of livestock
Lnwage	Logarithm of wage of labor (annual wage)
Cropy	On-farm income
offarmy	Off-farm income
nonfarmy	Non-farm income
total_inco	Total income
vill_leqleq	Location dummy, 1 if Leqleqit, 0 otherwise
vill_weynma	Location dummy, 1 if Weynmager, 0 otherwise
vill_addisgult(base for location variable)	Location dummy, 1 if Addis-gulit, 0 otherwise

3.4.2 Empirical Model for Seemingly Unrelated Regression (SUR)

The third objective of this study is to examine the determinant factors for on-farm, off-farm and non-farm activities of farm households. Therefore, in order estimate the coefficient, the seemingly unrelated regression Model is employed. The SUR model can be estimated simultaneously as:

lncropy= F(hhsex lnhhage vill_leqleq vill_weynma elem_educ secon_educ stud_prop lnmrkt_dist land_ha land_right coop_mem credit_serv exten_serv lnagri_tech lnlivestock lnwage lnoxen_manday labor)

lnoffarmy = F(hhsex lnhhage vill_leqleq vill_weynma elem_educ secon_educ stud_prop lnmrkt_dist land_ha land_right coop_mem credit_serv exten_serv lnlivestock lnwage labor)

lnnonfarmy= F(hhsex lnhhage vill_leqleq vill_weynma elem_educ secon_educ stud_prop lnmrkt_dist land_ha land_right coop_mem credit_serv exten_serv lnlivestock lnwage labor)

Definition of variables:

Dependent Variables:

lncropy= is the logarithm of the value of annual income from on-farm activities

lnoffarmy= is the logarithm of the value of annual income from off-farm activities

lnnonfarmy= is the logarithm of the value of annual income from non-farm activities

Explanatory Variables: These variables are described under 'explanatory variables' of section 3.4.1, and indicated below in Table 3.1.

3.4.3 Recursive Bivariate Probit Model of Sustainable Land Management and Livelihood Diversification

Finally, to analyze the effects of livelihood diversification to the sustainable land management practices of farm households the recursive bivariate probit model is employed.

ihhd_index= F (hhsex lnhhage vill_leqleq vill_weynma elem_educ secon_educ stud_prop lnmrkt_dist land_ha land_right coop_mem credit_serv exten_serv lnagri_tech lnlivestock lnwage labor)

slm_indx= F(hhsex lnhhage vill_leqleq vill_weynma elem_educ secon_educ stud_prop lnmrkt_dist land_ha land_right coop_mem credit_serv exten_serv lnagri_tech labor ihhd_index*)

*ihhd_index**- is endogenous variable

Definition of variables:

Dependent Variables:

slm_indx= Sustainable Land Management (SLM) index, 1 if slm_indx>0, 0 otherwise.

Endogenous Variable:

ihhd_index= Inverse Herfindhal-Hirschman Diversity (IHHD) index, 1 if ihhd_index>1, 0 otherwise

Explanatory Variables: Similarly, these variables are all described under 'explanatory variables' of section 3.4.1, and indicated below in Table 3.1.

Table 3: Definition of variables and their expected sign

Variable Name	Definition of Variables	Model I	Model II	Model III
Dependent Variables:				
Model I: diversification	It is dichotomous dependent variable and diversification=1 if the farm household participates in livelihood diversification, 0 otherwise			
Model II: lncropy, lnoffarmy, lnnonfarmy	is the logarithm of the value of annual income from on-farm, off-farm and non-farm activities, respectively			
Model III: slm_indx	Sustainable Land Management (SLM) index, 1 if slm_indx>0, 0 otherwise.			
Endogenous Variable: ihhd_index	Inverse Herfindhal-Hirschman Diversity (IHHD) index, 1 if ihhd_index>1, 0 otherwise			+(-)
Explanatory Variables				
hhsex	Dummy variable of gender, 1 if male, 0 otherwise	+(-)	+(-)	+(-)
Hhage	Age of the household head (in years)	(-)	(-)	+(-)
fam_siz	Size of the family (in number)	+	+	+(-)
noformal_edu	Dummy of education, 1 if no formal education, 0 otherwise	(-)	+(-)	(-)
elem_educ	Dummy variable of education, 1 if elementary education, 0 otherwise	+(-)	+(-)	+
secon_educ	Dummy of education, 1 if secondary education, 0 otherwise	+	+(-)	+
stud_prop	Proportion of students in the household	+(-)	+(-)	+(-)
mrkt_dis	Distance of home from nearest market (in km)	(-)	(-)	+(-)
land_ha	Land size owned by the household (in ha)	+(-)	+	+
Labor	Number of labor (between age of 15 and 65) in a farm household	+	+	+(-)
land_right	Dummy, 1 if household feels secured for land, 0 otherwise	+(-)	+(-)	+
coop_mem	Dummy, 1 if household is member of the cooperatives, 0 otherwise	+	+	+
credit_serv	Dummy, 1 if household has access for credit, 0 otherwise	+(-)	+	+(-)
exten_serv	Dummy variable, 1 if household participated in agriculture-extension, 0 otherwise	+	+	+
livestockY	Market value of livestock	(-)	+(-)	+
Lnwage	Logarithm of wage of labor (annual wage)	+	+(-)	+(-)
vill_leqleq	Location dummy, 1 if Leqleqit, 0 otherwise	+(-)	+(-)	+(-)
vill_weynma	Location dummy, 1 if Weynmager, 0 otherwise	+(-)	+(-)	+(-)
vill_addisgult	Location dummy, 1 if Addis-Gulit, 0 otherwise	+(-)	+(-)	+(-)

CHAPTER FOUR: OVERVIEW OF AGRICULTURE SECTOR IN ETHIOPIA

The Agriculture sector contributes pivotal roles for the growth of the country's economy. Previously the role of agriculture has been wrongly intended as the provider of capital and labor to the manufacturing sector, which is considered to be the best sector for economic development. For instance, countries have levied various taxation systems to the agriculture sector products while they need to enhance the growth of the industry sector. This leads to the decline in agricultural incomes. On the contrary, if the development in the agriculture sector is supported, rural and urban poverty will decline, and because the propensity to spend in domestic markets for rural community will increase that will have a higher multiplier effect to the urban sector. In recent years there seems to have been more emphasis being given to agriculture in most developing and developed nations (Cafiero, 2003).

4.1. Overview and Structure of the Ethiopian Economy

Ethiopia's economy is dominated by agriculture in terms of livelihood support and contributing as a source of foreign exchange through the export of primary agriculture products like coffee, sesame, hides and skins. According to CSA of Ethiopia on its 2007 population census, the rural population of Ethiopia amounts to

83.9 percent and only the remaining 16.1 percent is composed of urban dwellers (CSA, 2007). Therefore, agricultural development in Ethiopia is the issue of poverty reduction, rural development, and empowerment of the majority rural community. Some argues that the growth of agriculture is the fundamental prerequisite for the development of developing countries.

According to Meier and Rauch (2005), the percentage of total labor force of the agricultural sector declined, in the median, from 79.6 percent to 75.2 percent for low-human development countries, from 40.1 percent to 30.3 percent for medium-human development countries, and from 7.1 to 5.2 percent for high-human development countries in the years of 1990 and 2000, respectively. These figures indicates that; first, the percentage of the labor force of the agriculture sector is much higher in less developed countries than advanced nations, for instance 82.4 percent of the labor force in Ethiopia is supported by the agriculture sector in the year 2000. Second, in almost all the nations, the share of the labor force for the agricultural sector declined through time while the industrial and the service sector labor forces increased on the reverse.

Similarly, when we compared the median of agricultural productivity gap, measured by the ratio in value added per worker of non-agricultural to agriculture; first, in all groups of nations it is greater than one indicates that agriculture's productivity is less than that of the non-agricultural sector productivity, and for Ethiopia, for instance the

ratio is about 6.3. That is, in Ethiopia a typical non-agricultural sector labor is six times more productive than the agricultural labor-force. However, the productivity gap between agriculture and non-agricultural sector is relatively small in developed nations, which is 1.8 times, than the less developing nations, which is approximately 7.1 times (Meier & Rauch, 2005).

Agricultural growth also has beneficial impacts for the development of other sectors with in a country. Various development economists have concluded that enhancing the efficiency of agriculture serves as an important part of a successful growth direction for a nation. In this regard, Nurkse (1954, p. 52) justified that, "everyone knows that the spectacular industrial revolution would not have been possible without the agricultural revolution that preceded it". Likewise, Rostow (1960, p. 83) added, "Revolutionary changes in agricultural productivity are an essential condition for successful takeoff." In line with this argument is the classical view that is mentioned in the success stories of the Industrial Revolution in Britain, where there seems to be a positive relationship between agricultural productivity and industrialization. The conventional wisdom is that revolution of agriculture is a primary condition for the industrial revolution.

The arguments for these economists are: first as the productivity of agricultural production is enhanced, therefore, it is possible for a nation to feed the growing population in the industrial sector. There will be more food produced with lesser

amount of labor; labor will then be released for the manufacturing employment. The second argument is that a higher level of income is generated from the agriculture sector so that this will boost domestic demand for manufacturing and industrial goods. Finally, as agricultural productivity is enhanced, this will lead to the improvement in the amount of domestic savings required to establish and finance industrialization (Meier & Rauch, 2005; Matsuyama, 1992).

The major economic objective of the current Ethiopian Government is to maintain and achieve a broad based and accelerated economic growth in order to reduce poverty (MoFED, 2010). According to the MoFED evaluation report, during 2005/2006- 2009/2010 the economy had grown by 11 percent on average.

Following the previous PASDEP five year economic growth plan, the 2010/11 to 2014/15 'Growth and Transformation Plan of Ethiopia' was designed with the aim of sustaining economic growth to achieve the MDG targets by 2015, and to attain the national vision of transforming Ethiopia from the less developed nation to a middle income country by 2020-2023 (MoFED, 2010).

Figure 4.1: GDP Growth Rate of Ethiopia

Source: World Bank Data (2011) and Own computation

As indicated in figure 4.1 above using the World Bank data, for the last three decades, the Ethiopian economy has been growing inconsistently with ups and downs that are justified mainly by being the economy is rain based and highly reliable on weather shocks and droughts. In addition to the weather shocks, long civil wars before 1991 and the war against Eritrea during the late 1990s also contributed to the inconsistency in GDP growth rate of the nation.

However, beginning from 1991 when the socialist regime of Ethiopia gave power to the current government, the country undertook several economic reforms through the policy prescription of the Bretton Wood Institutions, World Bank and IMF, of the Structural Adjustment Program (SAP). Free market oriented policies through removing price and cost distortions, promoting the private sector, encouraging export sector, and progressive liberalization and privatization of the economy with a

corresponding reduction in the role and size of the government were among the principal economic reforms.

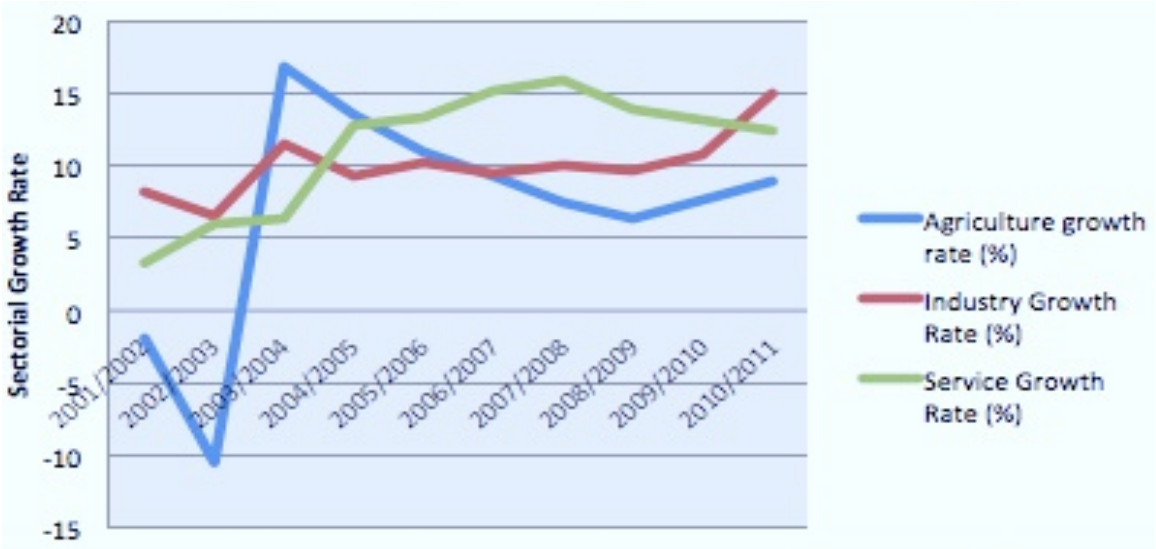
The economy has shown relatively better performance especially between 1991 and 2011, due to the national and international involvement efforts of multinational cooperation. Keeping other things constant and had there not been occasional drought and the Ethiopia-Eritrean war, the growth performance of GDP would have been expected to be higher (Befekadu & Nega, 2000).

4.2 Agricultural Productivity in Ethiopia

4.2.1 Sectorial Economic Growth and Value Share

According to the 2012 World Development Indicator report of World Bank, in year 2000 data survey, 45.4 percent of the rural population and 36.9 percent of urban population were found to be below the national poverty line. However, the numbers of poor that live under the level of the national poverty line has declined according to 2005 data survey year. The rural population who live under the national poverty line declined to 39.3 percent while in urban areas, the poor people who live below the poverty line declined only to 35.1 percent. In the national level, the numbers of poor that live below the national measure of poverty line have declined from 44.2 percent to 38.9 percent. This indicates the majority of the Ethiopian population is rural based, and poverty incidence is much higher in the rural areas (World Bank, 2012).

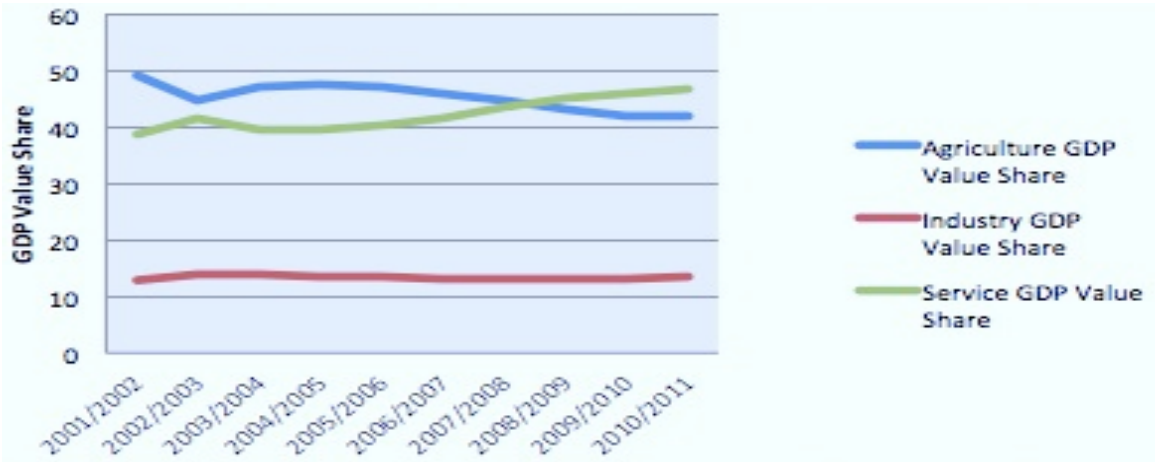
Figure 4.2: Sectorial Economic Growth Rate



Source: MoFED (2011) and Own Computation

As we see in Figure 4.2, for the first decade, the growth rate of agriculture has increased with inconsistent trend. That indicates the agricultural sector is vulnerable to shock, and it is mainly dependent on rain fed production system. On the other hand, the service and industrial sectors are growing much greater than 10 percent for the last 7 years. Compared to the service and industrial sectors, the growth rate of agriculture is the lowest, even though it is still greater than 5 percent on average growth rate for the last 8 consecutive years. However, this growth rate of agriculture is mainly coming from the expansion of agriculture land and not from the improvement in productivity and efficiency of the sector.

Figure4.3: The Sectorial Value Share of GDP



Source: MoFED (2011) and Own Computation

Likewise, as described by MoFED (2011), Ethiopia's GDP share of the agriculture sector from 1960/61 – 2005/06 was 56.09 percent on average, followed by the service sector 33.01 % and industrial sectors 10.90 %. On the other hand, as indicated in Figure 4.3, the longtime agriculture dominance in the share value of national GDP is taken by the service sector starting from 2008/09 Ethiopian budget year. The paradox is that the livelihood of more than 80 percent of the labor force in Ethiopia is still dependent on the agricultural sector. Only less than 20% of the gross labor force is supported by the service and industrial sectors jointly. This indicates the labor efficiency of the agricultural economy is lower than the service and industrial sectors within the same nation as mentioned by Meier and Rauch (2005) theoretically and empirically.

Researchers like Johnston and Mellor (1961) mentioned the typical features of the

agricultural sector in less developed countries. First, in almost all economies of less developed countries, the agriculture sector is an existing industry of major proportions, in which 40-60 percent of their GDP comes from this sector and 50-80 percent of the labor-force is supported by the agriculture sector. Even though, large quantities of inputs mainly land and labors are committed to agriculture, the productivity level is very low. Second, as the economy continues to grow the relative size of the agricultural sector is declined secularly.

These researchers mentioned at least three facilitating factors responsible for the transformation of the economy from farm to the non-farm sectors. These are: the income elasticity of demand for agricultural products and food is less than 1 and will continue to decline as agricultural production continue to expand even with a fixed or declining farm labor-force, and relatively modern technologies help for the reduction of costs in the manufacturing sector and other non-agriculture sectors. However, these scholars also remark that as a country has a comparative advantage in exporting agricultural products, the relative value share decline of the farm sector will not continue as quickly without limit (Johnston & Mellor, 1961).

Contrary to the recent empirical findings, Johnson (1997, p.9) mentioned in that 17 out of 18 industrial countries from 1967-68 to 1983-84, the labor productivity growth in the agricultural sector had been far greater as compared to other economic sectors, including industry and service. Then, the un-weighted average yearly growth rate for

non-agricultural economies was 2.6 while it was 4.3 percent for the agriculture sector. There is a partial substitution of non-farm inputs for labor. Because agriculture in industrial nations becomes capital-intensive, just like in the United Sates, the capital-to-labor ratio of the agriculture sector is six times higher than that of the manufacturing sector. Similarly, during the past quarter century or more the total factor productivity growth rate of agriculture in OECD has been greater than that of the manufacturing sector. For instance, from1960 to 1990, the total factor productivity growth was approximately 2.7 percent in agriculture compared to 1.5 percent in the manufacturing sector (Johnson, 1997).

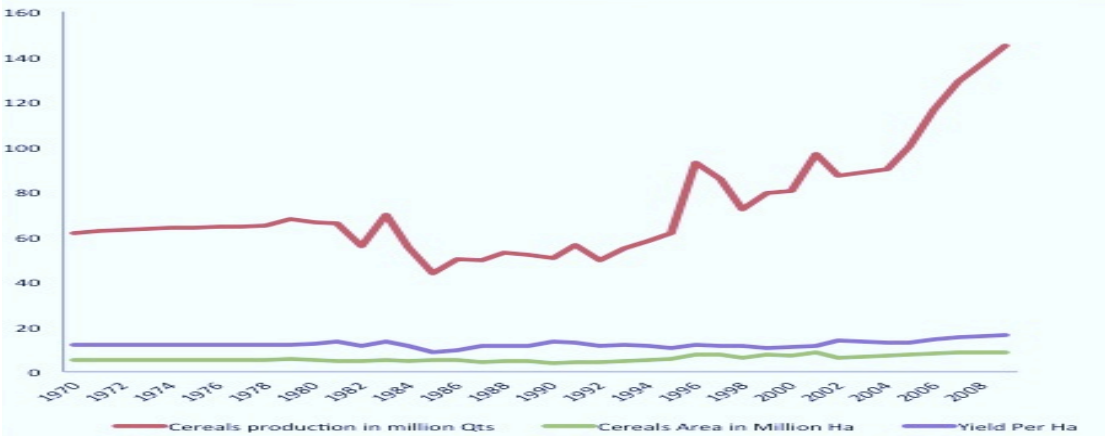
4.2.2 Trends in Selected Agricultural Crop Productivity in Ethiopia

Agriculture sector in Ethiopia, in addition to the domestic source of food supply, is the principal source of foreign exchange by supplying exportable commodities like coffee, sesame, horticulture, and livestock products to the world market. The main agricultural crops that have been produced, mostly for domestic consumption, are grouped into three. These are cereals, pulses and oilseeds. The production, cultivated land and yield trends of these agricultural commodities are indicated in figures 4.4, 4.5 and 4.6 below, respectively.

Ethiopia produced various types of cereal products, which mainly include corn, barley, wheat, teff, sorghum, millet and oats. As indicated in figure 4.4 below, for the last four decades since 1970, the production of cereals in Ethiopia shows increasing

trend. However, the production trend of cereals faces consistent ups and downs, specifically in 1984 when drought in Ethiopia was severe.

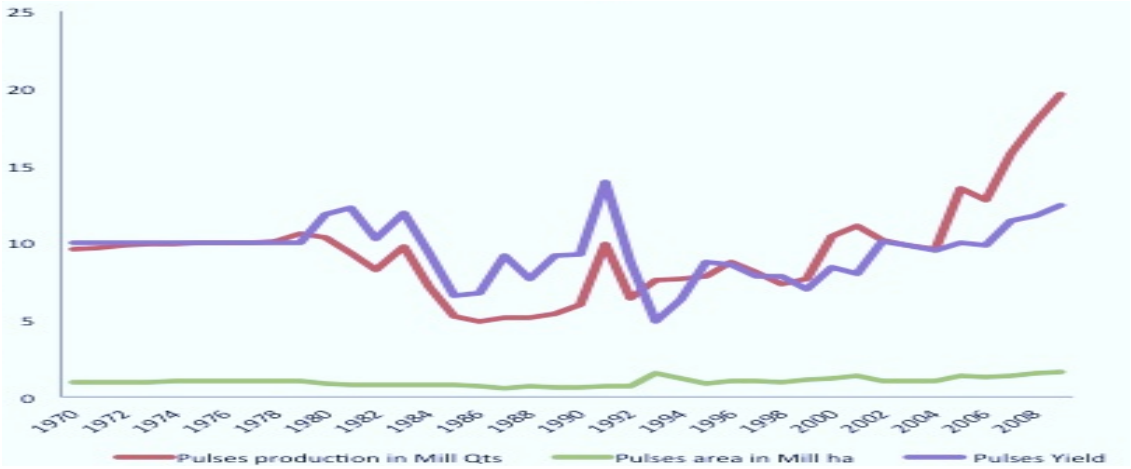
Figure 4.4 Production, Cultivated land and Yield Trends of Cereal Products



Source: MoFED (2011) and own computation

On the other hand, the yield (production per hectare) of cereals has not shown any change for the last four years. There are various reasons for the stagnant growth of the yield of cereals in Ethiopia. Among them are low farm technology usage, which is related to scale factor in that small-scale farm households face financial and skill limitations in using the technologies. Other factors for the consistent stagnation of the yield growth rate of cereal crops include: low rate of national irrigation coverage, marketing problems of farm inputs and outputs, institutional factors, recurrent drought and whether change that lead to persistent crop failure.

Figure 4.5 Production, Cultivated land and Yield Trends of Pulse Products

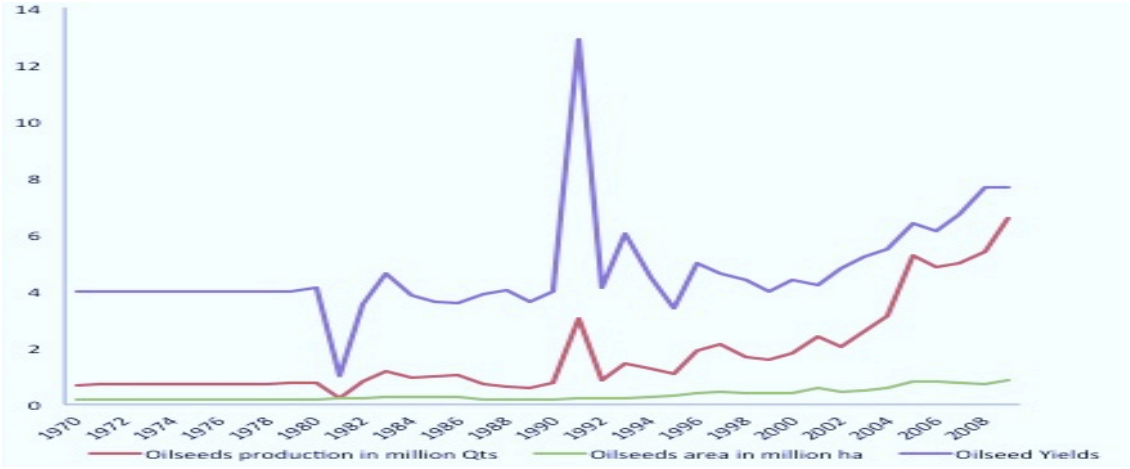


Source: MoFED (2011) and own computation

Similarly, Ethiopia produced pulse products that include chickpeas, field peas, lentils, vetch, soybean, haricot beans and so on. As indicated in figure 4.5 above, the national production of pulses shows inconsistent growth rates .The production constraints for cereals are also applicable to pulses agricultural products. However, against cereal crops situation, starting from the end of 1990s the yield of pulses shows increasing trend; although, there is also an increase in area of cultivation for pulse products.

Figure 4.6 below indicates; the production amount, areas cultivated and yield of oilseeds in Ethiopia. Oilseeds that are produced in Ethiopia include sesame, 'noug', sunflower, and so on.

Figure 4.6 Production, Cultivated land and Yield Trends of Oilseeds Products



Source: MoFED (2011) and own computation

As figure 4.6 indicated, the production of oil seeds show tremendous growth. Against cereals and pulses, oilseeds yield growth rate shows better improvement since the beginning of 2000s. The possible justification for yield growth rate improvement for oilseeds is because the production of oilseeds in recent years has become export oriented, specifically, production in the sesame crop. Large farms with better farm technologies engage in the production process of these crops. The second justification will be government incentives

for large farms to produce intensively export oriented agricultural crops. For instance, the government of Ethiopia has been given productive and frontier forest areas for large farms, including for international agriculture companies, which engage in the production of oilseeds and other agricultural commodities.

4.3. Agricultural Policies of Ethiopia

Agricultural policies are initiated and designed based on the interests and objectives of the stakeholders in the sector. According to Ellis (1992, p.8), "policy is defined as the course of action chosen by government towards an aspect of the economy, including the goals that the government seeks to achieve, and the choice of methods to pursue those goals."

Different scholars in various ways have explained the rationales for the necessity of agricultural policy. The justification mentioned by most scholars is the existence of market failure that is explained by: the existence of externalities, competition failure (existence of monopoly), failures of provision, existence of common property resources, incomplete markets, and failures of information (or information asymmetry), macroeconomic problems, poverty and inequality (Stiglitiz &Brown 1988, p. 90; Killick 1989, p.25; Ellis 1992, pp.8-10). Similarly, Cafiero (2002, pp.43-45) described the rationale for agricultural policy as "to minimize or eliminate transaction costs (that includes transportation, administrative, information gathering

costs, etc.); to balance the trade-offs of efficiency versus equity; and environmental situations".

Some of the liberal economists and scholars have not agreed on the existence of market failures. They see it as a temporary and irrelevant subversion of free markets. Rather the government intervention in the agriculture sector may create rent-seeking behavior of the officials, motivation failures, implementation failures, complex side effects, and may lead to information failures. It is concluded that the costs of "government failure" might be higher than those of market failures (Ellis, 1992).

Ellis (1992) categorized agricultural policies in developing countries into three. These are price policies, which is the intervention in farm outputs and inputs price levels and trends; institutional policies, which is the intervention of the institutions relating to the marketing facilities of agricultural products or it may be the provision of farm input or technologies; and finally, technology policies, which involves the intervention in technology creation, transformation, and adoption to farmers. Therefore, the specific sectorial policies that aim to influence the socio-economic development of agriculture based on the interaction of policy decisions and farm production is grouped into eight categories. These are:

a) Price policy: the policy that aimed to influence the level and stability of agriculture output prices,

b) Marketing policy: which influence the transfer of agricultural output from the farm gate to the domestic consumer or to ports of exportation,
c) Input policy: a policy concerned to influence the delivery system and prices of purchased variable agricultural inputs,
d) Credit policy: a policy mainly related to the supply of working capital for the purpose of purchasing variable agricultural inputs,
e) Mechanization policy: a policy that influencing the speed and direction of mechanical technologies or farm fixed capital,
f) Land reform policy: a policy that influencing the ownership distribution or condition of access to land resource,
g) Research policy: diffusion and development of new farm technologies for productivity increase, and
h) Irrigation policy: influencing the provision of water for agricultural production (Ellis1997, pp.3-4).

According to Chambers (1992) for his study on the US agriculture sector, the policy mechanism depends on the objective of the government. The researcher added that the agricultural policy mechanisms might be either "supply control mechanisms" that are supposed to favor inefficient (high-cost) producers, or it may be "overproduction policy mechanisms" to support efficient (low-cost) producers.

On the other hand, depending on their objectives Norton (cited in Cafiero 2002, p.46) classified agricultural policies in to three broad categories. First, policies that may change producer's benefits (includes trade and exchange rate policies, agricultural output price policies); second, agricultural policies that reward producers access to resources includes "food policy and food security, land tenure policies, water access policies and irrigation, agricultural technology policies"; and third, "agricultural policies that influence access to factors' markets" (mainly labor and credit markets).

In Ethiopia small-scale farmers, who fundamentally employ traditional agriculture technologies and adopt lower quantity and quality of inputs, dominate the agriculture sector. The sector is rain-fed dependent and highly vulnerable to weather shocks and changes. Though the country has 3.7 million hectare irrigable land, only 3 percent of the total potential land is exploited (Dowa, Noel, Shonne, Barron & Soussan, n.d).

Before 1974, the free market economy was implemented by the Imperial regime of Ethiopia. In this period, the then Imperial government had promoted the private sector and foreign direct investment. Trade policy was biased first towards being export-oriented (until 1960s) and then changed to an inward looking strategy using tools like overvaluing exchange rate, increased tariff rates, exchange control, and increased tax on export (Abdella & Ababa, 2002). During the Imperial era, agricultural sector only got attention in the "Third Five Year Development Plan of 1968 to 1973".

However, the plan mainly favored large-scale commercial farms and state programs of comprehensive packages like Chilalo Agricultural Development Unit (CADU), Wolamo Agricultural Development Unit, and then Wellaita (WADU), and Ada District Development Project (ADDP). These comprehensive package programs were mainly supposed to integrate agricultural researches, diffuse and disseminate research results, supply advanced farm inputs that demand huge capital and lumpy modern technologies. The fact is these packages and modern farm technologies were found to be too costly to be transferred to other parts of the country (Degene, 1990; Geremew, 2009).

In 1974, the Imperial Regime was overthrown by the military and socialist Derg Regime, which lasted until 1991. In this period of 1974-1991, the private sector was restricted, and the free market system was changed to command system. All sectorial polices, including the agricultural sector, were geared towards collective and public management through the central command planning system. However, similar to the late periods of the Imperial era, the Socialist Regime levied higher protective tariffs and quota restrictions, had implemented inward looking system (Abdella & Abeba, 2002). The private commercial farms were confiscated without equivalent compensation by the socialist regime by proclamation.

Therefore, CADU transferred to Arsi Rural Development Unit (ARDU) and after that to Bale-Arsi Rural Development Unit (BARDU). As with other state farms, all these agricultural state packages named to Peasant Agricultural Development Program (PADEP). Even though, the Ethiopian Peoples Revolution Front overthrows the Derg Regime in 1991, the Derg Regime designed the Ten Year Perspective Plan (1984/85-1993/94) supporting cooperative farms and "villagization" by promoting mechanized and large-scale farming. These required immense capital while on the contrary the country is a labor-endowed nation. More importantly, the plan deliberately excluded the majority small-scale farmers from technology and any other support just intended to push them as members of cooperative farming (Degene, 1990).

The then Ethiopian agricultural policy constraints were described as flawed since the policies were not fair (Dejene, 1990). Technological bias was noted wherein commercial and state farms got more support while the majority were small-scale farms, so spatial bias in that modern farm concentration was just in small areas. Decisions were made from top to bottom indicating bias in the approach. Women were neglected, which indicated gender bias among the basic constraints of the sector. Therefore, during these two regimes, the Imperial and the Socialist Derg, agricultural policies were both capital intensive, on the other hand, differed in ownership entitlements of private versus state, respectively.

In 1991, the Ethiopian People's Revolutionary Democratic Front took power from socialist and military Derg Regime. The new government took the fundamental shift in the economic policy from command system to more free market economy than the previous regime. However, the Ethiopian government still has been involved in some key economic sectors, like in banking, insurance, and in electricity supply. The then transitional government immediately designed and implemented the Agricultural Development Led Industrialization (ADLI) indicating giving policy priority for agricultural development. The two fundamental assumptions behind ADLI strategy were: first, farmers are living a subsistence level and, therefore, cannot enhance their demand for agriculture and other economic sector products, second, farmers do not save (Abdella & Ababa, 2002; Tsegaye, 2003).

Agriculture can have two main important contributions to the economic development: supply side and demand side contributions. It provides food, industrial raw materials, and export products so that it boosts supply. On the other side, agriculture helps to provide markets that create domestic demand for the industries. In Ethiopia, ADLI's major strategy focus is in the improvement of productivity for farm households, pastoralists, and large-scale farms.

The strategy was to provide institutional and technical support to farmers, for its objective to boost food production through intensive cultivation (Amin, 2003; Tsegaye, 2003). Specifically, it includes fertilizer supply and distribution, improved

seed supply, developing small-scale irrigation schemes, protection and conservation of natural resources, agriculture research and extension work, and designing marketing and price policies. The basic target of the agricultural extension package was to assist in improving farm productivity of small-scale farmers via appropriate research and farm technologies essentially (MoFED, 2006; Abdella & Ababa, 2002; Tegenu, 2004).

However, researchers criticize ADLI's effectiveness of implementation in three dimensions: the ever rising purchasing cost of key agricultural inputs like fertilizer and improved seed, the effectiveness and suitability of inputs themselves, and small-scale land holding nature of farm households (Dadi, 2003).

In 2003, the Government of Ethiopia designed the "Rural Development Policy and Strategies" with the aim of bringing sustained and rapid economic development, assuring higher benefits to the general population (in this case the rural community), minimizing dependency on foreign aid and facilitating and promoting market-oriented economy (MoFED, 2003). This strategy has at least 5 sub-strategies in relation to the development of the agriculture sector. These are:

i. Labor-intensive strategy- the rationale of this strategy is that being the country is capital scarce while labor is relatively abundant, and more than 77percent of labor forces' livelihood is dependent on agriculture
ii. Proper utilization of agricultural land

iii. A foot on the ground- using the resources at hand and built on existing productive capacity, and then assessing or stepping the new sources of productive growth

iv. Taking different agro-ecological zones into account- that is designing appropriate strategies according to various ecological zones of Ethiopia; and

v. Follow an integrated development path (MoFED 2003, pp.15-17).

In 2005/06 Ethiopia's budget year, a strategy called Plan for Accelerated and Sustained Development to End Poverty (PASDEP) was formulated for a specific period of 2005/06-2009/2010. The core objectives of the PASDEP strategy is to promote the transformation of small-scale agriculture from subsistence to commercial by increasing farm productivity, increased the share of market-oriented production than subsistence, and support pro-poor agriculture within the package of the national food security program. Under this general objective, PASDEP has contained five basic principles that seem to have similarity with the previous rural development strategy.

These principles include: improve the capacity of farmers through training, efficient and proper utilization of agricultural land, employ compatible paths with different agro-ecological zones throughout the country, adopting appropriate and labor-intensive strategy, and adopting a coordinating approach. The PASDEP program has much detailed and specific programs for various packages with the agriculture sector

itself. For instance, increasing crop production and productivity through adopting highly productive technologies and strengthening agricultural research and extension service delivery system, improving pest management system, improving natural resource management system, etc. (MoFED 2006, pp.2-50).

After the PASDEP strategy plan was implemented, Ethiopia formulated the optimistic "five-year (2010/11-2014/15) Growth and Transformation Plan (GTP)". The sectorial country vision of GTP is to "build an economy which has a modern and productive agricultural sector with enhanced technology and an industrial sector that plays a leading role in the economy, sustaining economic development and securing social justice and increasing per capita income of the citizens so as to reach the level of those in middle-income countries" (MoFED 2010, pp.21-22). In this government plan that has seven strategic plans in it; agriculture gets higher priority than the other economic sectors and one of the pillars as "maintaining agriculture as a major source of economic growth".

The strategic objectives of the five-year GTP have some similarity with the previous PASDEP. However, the key strategic direction of GTP is to give more priority to ensure the main growth source of agriculture to be smallholder farmers by scaling up the intervention. This plan emphasizes that productivity can be increased by efficiently utilizing the smallholder farmers' land efficiently; labor, and adopting and employing less capital intensive farm technologies. The strategic directions to

accelerate smallholder agriculture includes; scaling up best practices, promoting irrigation development, protecting natural resources and engaging on the production of high value agricultural crops. The plan also has formulated strategies to develop pastoral regions in the country and gives policy priority for water development for the people and community in these areas. Finally, the plan gives strategic direction for the participation of private sector in the agriculture sector like in Sesame and horticulture production. For the effective implementation of the GTP, the government has been expanding rural infrastructure across the regional provinces (MoFED 2010, pp.45-47).

In conclusion, Ethiopian agriculture's productivity is found to be low and in a trap due to low adoption rate of farm technologies, low level of irrigation infrastructure, institutional and structural problems of the sector, existence of farm input and output market failures, higher soil and mineral erosions, low level of farm diversification, and vulnerable to weather changes and shocks. Even though the country has formulated and implemented various agricultural policies, the productivity of agriculture cannot improve as expected. All agricultural policies in Ethiopia that had been formulated and implemented so far do not incorporate non-agricultural livelihood strategies under their policy frameworks clearly. The previous agricultural policies had focused just in the on-farm agricultural development and strategies, like to increase farm productivity; rather than diversifying agriculture to non-farm and off-farm activities.

CHAPTER 5: ANALYSIS ON DETERMINANTS OF LIVELIHOOD DIVERSIFICATION

5.1 Descriptive Analysis

Among the total farm households, 71.52 percent of them have participated on the non-agricultural livelihood diversification activities. In addition, as the descriptive summary statistics of table 5.1 indicates, 72.19 percent of the sample households are male. The mean age of the sample farm households is 44.36 years with 5.25 average family sizes.

In terms of the farm households' educational status, 68 percent has no formal education, and the remaining 20 and 11-percent of the sample households has attained their primary and secondary educational level, respectively. On average, 35 percent of the households' family members have been attending their school during the survey period. The average nearest market distance from home is about 16.73 kilometers. The average land size of the sample household is 1.16 hectare, and on average each household has 2.4 numbers of labors between the ages of 15 to 65 years, inclusive. Each sample household has on average 30150ETB[2] livestock value using an estimated market value of 2012 production year.

[2] *1USD=18 Ethiopian Birr during the survey season of 2012.*

Table 5.1 Descriptive Summary Statistics of Sample Farm households

Variable	*Description*	*Mean*	*Standard Deviation (SD)*
hhsex	*Dummy of gender, 1 if male; 0 otherwise*	*0.72*	*0.45*
hhage	*Age of the farm household head*	*44.36*	*12.39*
fam_siz	*Family size of the household*	*5.23*	*1.62*
noformal_edu	*Dummy of education, 1 if no formal education*	*0.68*	*0.47*
elem_educ	*Dummy education, 1 if elementary education*	*0.20*	*0.40*
secon_educ	*Dummy education, 1 if secondary education*	*0.11*	*0.32*
stud_prop	*Proportion of students in the household*	*0.35*	*0.24*
mrkt_dis	*Distance of home from the nearest market (km)*	*16.73*	*1.56*
land_ha	*Land size owned by the household*	*1.16*	*0.45*
labor	*Number of labor (between age of 15 and 65)*	*2.40*	*0.76*
land_right	*Dummy, 1 if household secured for his land*	*0.89*	*0.30*
coop_mem	*Dummy, 1 if a household is a member of the cooperative*	*0.64*	*0.47*
credit_serv	*Dummy, 1 if a household has access for credit*	*0.49*	*0.50*
exten_serv	*Dummy, 1 if household participated in agri-extension*	*0.72*	*0.44*
livestockY	*Market value of livestock (in ETH currency 1$=18Birr)*	*30150*	*15154*
wage	*Wage of labor (Annual wage)*	*4663*	*1398*
cropy	*On-farm income*	*20177*	*9798.9*
offarmy	*Off-farm income*	*1235*	*1355*
nonfarmy	*Non-farm income*	*1971*	*2519*
total_inco	*Total income*	*23371*	*11191*
vill_leqleq	*Location dummy, 1 if Leqleqit*	*0.33*	*0.47*
vill_weynma	*Location dummy, 1 if Weynmager*	*0.33*	*0.47*
vill_addisgult	*Location dummy, 1 if Addis-gulit*	*0.33*	*0.47*

Source: Computed from Own Survey Data

During 2012 crop season, the farm households have generated a mean income of 20177ETB, 1235ETB and 1971ETB, from on-farm, off-farm and non-farm livelihood diversification activities, respectively. The households' average total income during the same year was 23371ETB. Finally, the sample households have been selected proportionally from 3 peasant villages located in North-East Ethiopia of Gozamin District namely: Leqleqit, Weynmager and Addis-Gulit from which 33 percent of the total sample households have been selected.

5.1.1 Household and Socio-Economic Characteristics

The sample households and socio-economic characteristics of livelihood diversification participants have shown in table 5.2 below. For the descriptive analysis purpose of the mean value of non-agricultural livelihood diversifiers and non-diversifiers, the study employs t-statistics and chi-square (χ^2)-statistics for the comparison purpose of continuous and discrete variables, respectively.

Accordingly, the gender composition indicates that the farm households who engage in livelihood diversification of off-farm and non-farm activities, 72 percent are male headed and among which 75 percent of them have participated in livelihood diversification activities while the rest of the diversifiers were female-headed households, and the difference is statistically significant (at 10%).

On the educational level of the farm households, among the diversifiers 68% have not attended formal education at all while the remaining 22% and 9% of them have attended their primary and secondary education, respectively. On the other hand, of the non-diversifiers of livelihood activities, 65% of them have no educational background, while 16% and 18% have attained their primary and secondary educational levels. However, using chi-square statistical test there is no significant difference between diversifier and non-diversifier households in all of the 3 educational categories.

Of the total livelihood diversification adopters, 94 percent of farm households feel more secure about their land right, which is among the institutional determinant factors and the variation between diversifiers and non-diversifiers is statistically significant (at 5%). Similarly, among the farm households 76% of the diversification participants are members of cooperatives and the difference is statistically significant. Regarding to access for credit service, 50% and 46% of the diversifiers and non-diversifiers have access to credit service, respectively. However, the mean difference between these two groups is not statistically significant. Finally, among the institutional factors, 86% of the diversifiers and 37% of the non-diversifiers have participated in the agricultural extension services, and the difference is statistically significant.

Table 5.2: Household and Socio-Economic Characteristics of Farm Households

The χ^2 test and percentage for discrete variables				
Variables	***Combined mean***	***Farm households Livelihood***		***χ^2-statistics***
		Diversifier	*Not-diversifier*	
hhsex	*0.72*	*0.75*	*0.62*	*2.6428**
noformal_edu	*0.67*	*0.68*	*0.65*	*0.1624*
land_right	*0.89*	*0.94*	*0.76*	*10.1713***
coop_mem	*0.64*	*0.76*	*0.34*	*23.7797****
elem_educ	*0.20*	*0.22*	*0.16*	*0.6658*
secon_educ	*0.11*	*0.09*	*0.18*	*2.5582*
credit_serv	*0.49*	*0.50*	*0.46*	*0.2397*
exten_serv	*0.72*	*0.86*	*0.37*	*36.6305****
vill_leqleq	*0.33*	*0.36*	*0.25*	*1.5396*
vill_weynma	*0.34*	*0.34*	*0.32*	*0.0398*
vill_addisgult	*0.33*	*0.29*	*0.41*	*2.0773*
t-statistics test and percentage for continuous variables				
hhage	*44.36*	*43.69*	*46.04*	*1.0526*
fam_siz	*5.23*	*5.25*	*5.16*	*-0.3287*
stud_prop	*0.35*	*0.34*	*0.36*	*0.5600*
mrkt_dis	*16.73*	*16.41*	*17.54*	*4.2138****
land_ha	*1.16*	*1.13*	*1.22*	*0.9929*
labor	*2.403*	*2.38*	*2.44*	*0.3817*
livestockY	*30150*	*29350*	*32159*	*1.0280*
Wage	*4663*	*4752*	*4440*	*-1.2411*
cropy	*20177*	*19806*	*21108*	*0.7355*
total_inco	*23371*	*24271*	*21110*	*-1.5740*

Source: Computed from Own Survey Data

Among the farm households; 36%, 34% and 29% of the livelihood diversifiers; and 25%, 32% and 41% of the non-diversifiers have been living in Leqleqit, Weynmager and Addis-Gult peasant villages, respectively. However, household location has no descriptive statistical difference in participating decision of farm households in livelihood diversification activities. The mean age of diversifiers is 43.69 years while, for the non-diversifiers it is 46 years; however, the mean age difference between the groups is not statistically significant. Similarly, the average family size and proportion of students in the household have no statistically significant variations in among the diversifiers and non-diversifiers.

On the other hand, the average distance to the proxy market, Debre Markos town, for diversifiers and non-diversifiers is 16.41 and 17.54 kilometers, respectively. The distance difference among the groups is statistically significant (at 1%). The average land holding size for diversifiers is 1.13 hectares while, for the non-diversifiers it is 1.22 hectare; however, the land size difference between the groups is not statistically significant. Similarly, there is no statistically significant difference between diversifiers and non-diversifiers in variables including labor amount, the current market values of livestock, wage, on-farm income and total income of the farm households.

5.1.2 Demographic and Socio-Economic Characteristics of Simultaneous on-farm, off-farm and non-farm Income Diversifiers

Under the section, 5.1.1 above we describe the household and socio-economic characteristics of farm households who participate in the livelihood diversification of either off-farm and/or non-farm activities only. However, this does not show the extent of diversification that incorporates all possible sources of farm households' income, which is measured by Herfindahl-Hirschman diversity index (IHHD). As indicated below under table 5.3, male-headed households generate higher income than female-headed counterparts in all the 3 income categories of on-farm, off-farm and non-farm livelihood diversification activities, in addition in all of the 3 income categories, the mean incomes have statistically significant differences between the gender groups.

On the other hand, there is no statistically significant difference in the mean incomes of the 3-income diversification categories among households who have no formal educational background. Similar results were observed among farm households who attained secondary educational level. On the contrary, there is statistically significant difference in generating on-farm income among the households who have elementary educational background, but there is no statistically significant difference in this variable, in the mean income of off-farm and non-farm livelihood diversification activities.

Table 5.3: Household and Socio-Economic Characteristics

Using t-statistics test

Variables	***Response***	***On-farm income (Mean= 20177Birr)***		***Off-farm income (Mean=1235Birr)***		***Non-farm income (Mean=1971Birr)***	
		Mean	*t-statistic*	*Mean*	*t-statis*	*Mean*	*t-statis*
hhsex	*1=male*	*21553*	*2.84****	*1415*	*2.67****	*2404*	*3.50****
	0=female	*16605*		*770*		*857*	
noformal_edu	*1=yes*	*19411*	*1.39*	*1228*	*0.09*	*1931*	*0.27*
	0=no	*21771*		*1251*		*2053*	
elem_educ	*1=yes*	*23616*	*2.22****	*1390*	*0.71*	*2445*	*1.17*
	0=no	*19288*		*1195*		*1847*	
secon_educ	*1=yes*	*18594*	*0.73*	*1011*	*0.74*	*1377*	*1.06*
	0=no	*20391*		*1266*		*2052*	
vill_leqleq	*1=yes*	*18476*	*1.50*	*1295*	*0.37*	*2351*	*1.30*
	0=no	*21019*		*1206*		*1781*	
vill_weynma	*1=yes*	*16071*	*3.84****	*1375*	*0.90*	*2220*	*0.86*
	0=no	*22270*		*1164*		*1843*	
vill_addisgult	*1=yes*	*26065*	*5.71****	*1033*	*1.29*	*1324*	*2.28***
	0=no	*17262*		*1336*		*2285*	
land_right	*1=yes*	*20066*	*0.40*	*1311*	*2.01***	*2132*	*2.30***
	0=no	*21109*		*595*		*618*	
coop_mem	*1=yes*	*20742*	*0.96*	*1482*	*3.13****	*2381*	*2.79***
	0=no	*19130*		*779*		*1199*	
credit_serv	*1=yes*	*17362*	*3.64****	*1105*	*1.17*	*2030*	*0.28*
	0=no	*22954*		*1364*		*1914*	
exten_serv	*1=yes*	*20705*	*1.06*	*1437*	*3.01****	*2491*	*4.28****
	0=no	18805		713		634	

Source: Computed from Own Survey Data

Farm households that located in Addis-Gult village have generated more income from on-farm agricultural activities than farm households who live in Leqleqit and Weynmager rural villages. On the other hand, households who live in Weynmager village have generated least average income from on-farm livelihood activities. The difference in both cases is statistically significant (at 1%). On the other hand, there is no statistically significant variation in generating incomes from off-farm livelihood activities among the households in all the 3 rural villages. Compared to the 3 villages, farm households who live in Addis-Gulit generate least average income from non-farm income diversification activities and the difference is statistically significant (at 5%).

Among the institutional determinant factors, land right security perception has not resulted in a significant difference in the mean of on-farm income activities between diversifiers and non-diversifiers. On the other hand, farm households that perceive more secured about their land holding right have generated higher mean income in off-farm and non-farm income diversification activities, and the difference is statistically significant (at 5%). Similar results have been observed in farm households between members and non- members of cooperative associations, at 1% and 5% level of significance for off-farm and non-farm income diversification activities, respectively.

The theoretical contradictory descriptive result is that, farm households who have access to credit service generate lower average on-farm income than non-credit service users, and the difference is statistically significant. Similarly, farm households who have access to credit service generate lower average off-farm income while they generate higher non-farm income, even though; the difference is not statistically significant. Finally, farm households who participate in government extension service programs have generated higher average on-farm income, but the difference from non-participants is not statistically significant. However, there is significant and positive difference between diversifiers and non-diversifiers of extension service users in generating income from off-farm and non-farm activities.

5.2 Regression Analysis of Livelihood Diversification

In the regression analysis section, the study analyzed the determinant factors of livelihood diversification in Gozamin district, the study area. First, the determinant factors for non-agricultural livelihood diversification activities will be analyzed using univariate Probit regression output. Second, the determinants for simultaneous livelihood diversification decision to participate the on-farm, off-farm and non-farm activities of the farm households have also been discussed and analyzed in section 5.2.2.

5.2.1 Determinants of Livelihood Diversification

The decisions of farm households' participation in livelihood diversification activities can be determined by factors such as, individual household characteristics, asset endowment of the farm household and socio-economic characteristics. To analyze the determinant factors of livelihood diversification by the farm households in Gozamin district, the study used the univariate Probit regression model. However, the logit regression is indicated for comparison purposes in annex 2.

The possibility of multicollinearity problem is checked by the Pairwise Correlation Coefficients, and except variables of family size and number of labor in the household, there is no other significant multicollinearity problem detected. Therefore, the family size is dropped out from the regression analysis. Similarly, being the data is cross-sectional, the problem of heteroscedasticity is detected and it is corrected by taking the robust-standard errors for the estimated Probit model.

5.2.1.1 Household-Characteristic Determinants of Livelihood Diversification

In this section, the household characteristic determinant factors for participation decision of farm households in livelihood diversification in Gozamin District have been analyzed. As indicated in table 5.4 below, keeping other factors constant, an increase in the household age will lead to the decrease in the probability of participation of livelihood diversification activities by the farm households in the

study area. As the age of the household increased by 1 year, it leads to a decline in the probability of livelihood diversification by 36 percentage units at the margin.

There may have been many possible explanations for this regression result in the study area. First, it is related to the natural factors in that as age of the farm household increases, the farmer will be getting older and older and may not be capable of diversifying as many livelihood activities as possible and may concentrate only to the on-farm agricultural activities for the purpose of maximizing subsistence consumption needs. Second, there is higher rural population growth rate in Ethiopia, greater than a national growth rate of 2.5% (CSA, 2012), which may be led to the continuous involvement of so many young farmers to the agriculture sector.

With limited resources that may lead to the decline in rural resource endowments for each newcomer young farmers, this may push them to diversify their livelihood activities to maximize their income to smoothing out their yearly consumption. The third possible explanation, which may be recently happening in Ethiopia is that, the service and physical infrastructure sectors have been growing and expanding in a significant rate more than the industrial and agricultural sectors (MoFED, 2010). That may give better opportunity for the younger rural farm households to engage in the service and industrial sectors higher than the older counterparts.

A similar study by Bremen (1996) in India found consistent result in that young households found to be more livelihood diversifier than old age counter parts. Likewise, a study by Kimhi and Lee (1996) found that age of the farm household first increasing then declined with the livelihood diversification and shows a non-linear relationship. On the other hand, opposite results were also found by the studies of Barrett and Reardon (2000), and Block and Webb (2001). The researchers argued that aged household head may have a larger family size and expected to have extra and unemployed labor, which will lead them to allocate some proportion of their labor outside the agriculture sector. This may be because the study areas heterogeneity in resource endowment and socio-economic characteristics may justify the differences. In addition, it may be because due to the difference in research methodology, for instance, a study conducted by Block and Webb (2001) in Ethiopia used Least Absolute Deviation (LAD) for their regression estimation.

Location of the household is another determinant variable for livelihood diversification. As we move from Addis-Gult (reference village of this study) to Leqleqit and Weynmager peasant villages, the probability of participation in livelihood diversification activities will decline by 37.24 and 44- percentage units at the margin, respectively. That is, being the household is located in Leqleqit and Weynmager will lead to the decline in the probability of farm households' engagement in livelihood diversification activities compared to the farm household who live in the Addis-Gult village.

Table 5.4: Determinants of Diversification in Gozamin District using Probit model

Variable	*Coefficients*	*Marginal Effect (dy/dx)*
Dependent:		
Livelihood Diversification		
Explanatory Variables:		
hhsex	*0.3434(0.2722)*	*0.0978(0.0807)*
lnhhage	*-1.3531**(0.6224)*	*-0.3616**(0.1597)*
vill_leqleq	*-1.2306*(0.7596)*	*-0.3724(0.2341)*
vill_weynma	*-1.4302**(0.5813)*	*-0.4406**(0.1741)*
elem_educ	*0.01014(0.4425)*	*0.0027(0.1175)*
secon_educ	*-1.1085**(0.4052)*	*-0.3797***(0.1480)*
stud_prop	*-0.7708(0.8116)*	*-0.2060(0.2057)*
lnmrkt_dist	*-11.8644***(3.2794)*	*-3.1713***(0.8226)*
land_ha	*-.2438(0.4012)*	*-0.0651(0.1097)*
labor	*-0.1264(0.2078)*	*-0.0337(0.0548)*
land_right	*1.1474**(0.4383)*	*0.3992**(0.1614)*
coop_mem	*1.0756***(0.3289)*	*0.3228***(0.1031)*
credit_serv	*0.0973(0.2901)*	*0.0259(0.0769)*
agri_exten	*0.6382(0.3850)*	*0.1985(0.1421)*
lnlivestock	*0.0983(0.2527)*	*0.0262(0.0677)*
lnwage	*0.2496(0.7716)*	*0.0667(0.2042)*
_cons	*35.5674***(11.5279)*	*0.0978(0.0807)*
Number of obs = 147 *Wald chi2 (16) = 37.01* *Prob > chi2 = 0.0021* *Log pseudolikelihood = 51.164* *Pseudo R2 = 0.4182* *Figures in parentheses are robust standard errors.* *-vill_addisgult (base) is the reference village* *- noformal_edu is the reference for educational level for household head*		*-dy/dx is for discrete change of dummy variable from 0 to 1* *-***, **, and * indicate significance level at 1%, 5% and 10%, respectively.*

Source: Computed from Own Survey

The possible justification may be the resource endowments differences between the villages that create variations in diversification incidences among villages. A similar result observed by Beyene (2008) in a study conducted in Ethiopia in that farm households who live in drought- affected areas participated in off-farm activities higher than households who live in a relatively food surplus areas.

Educational level has a negative impact on the livelihood diversification decisions of the farm household. Farm households who attended secondary and higher educational level has a lower probability of diversifying in livelihood activities compared to farm households who do not have any formal educational background. As we move from farm households who does not have formal education to farmers who attained secondary and higher educational level, the probability of livelihood diversification will decline by 38 percentage units at the margin and keeping other things constant.

The possible explanations may be farm households who attained secondary and higher educational level may engage in specializing in on-farm activities by employing better farm technologies and will increase their food crop productivity. However, the household that has attained the elementary level education has no significant difference compared to households who had no formal educational background in the probability of participation decision to the livelihood diversification activities.

A consistent result indicated by the study of Bryceson (2002) in rural Sub Saharan Africa countries. The study concluded that higher educated farm households found to be fewer participants in livelihood diversification activities compared to the uneducated farm households. On the other hand, the studies conducted by Kimhi and Lee (1996) and Barrett et al. (2001) found opposite results in that educational level of the farm household has a positive impact for livelihood diversification. For the contradict result, Ellis (1998) argued that livelihood diversification activities that required higher skilled labor attracts the more educated and the one that require lower skilled labor attracts the uneducated household members.

5.2.1.2 Social and Institutional Determinants for Livelihood Diversification Incidences

The most powerful determinant and statistically significant variable is the home distance of farm households from the nearest market place. Keeping other things constant, a 1-kilometer unit increase in the home distance of farm households to the proxy market place, in this case Debre-Markos town will lead to the decline in the probability of engaging on non-agricultural livelihood diversification activities by more than triple times at the margin. The possible explanations include: first, during the slack period farm households may engage in selling-out their labor to the nearest market to maximize their income and to smooth their annual consumption.

Second, markets will promote the rural-urban linkages like vertical linkages, in which the farm household may supply the rural resources and products to the nearest market place where small-scale agro processing industries located and that use predominantly rural row materials. In return, backward-linkages may also be facilitated in that some farm households may have been involved in the merchandizing processes of buying urban products for their rural villagers. Third, being nearest to the market places may lead to the development of the entrepreneurial skill of farm households that will motivate them to involve in various livelihood diversification activities that the market demanded.

A consistent result observed in Ethiopia a study by Sisay (2010) using a panel data of 2004 and 2008. Similarly, a study by Abdulai and Delgado (1999) conducted in Northern Ghana using a bivariate model confirmed that distance to the market area has a negative impact for participation decision on livelihood diversification activities.

The institutional factor that determines the farm household decision in engaging to the livelihood diversification activities is the perception of the right on land security. Land right is an important determinant variable because the government controls the land in Ethiopia. As a result, potential selling and buying of land is not possible, and farmers have use-right of the land only. Therefore, keeping other things constant and at the margin, as farm households feel more secure about their land, their probability

of participation in livelihood diversification activities will increase by 39.9 percentage units.

The likely justifications include, as farm households feels secured about their land right, they will diversify agriculture to agroforestry practices in the study area that include planting vegetables, coffee production, and eucalyptus tree cropping rather than just specializing in seasonal food crop production only. The second justification is that as farm households feel secure about their land right, they may rent-out their land so that they may use the rent income to engage in more feasible livelihood diversification activities that may reward them higher return than food crop production, like in trading activities and selling their own labor to collect wage.

Finally, being the member of the cooperatives increases the probability of participating in livelihood diversification activities significantly. Ceteris paribus, being a farm household becomes a member of cooperatives increased the probability of engaging in livelihood diversification activities by 32.2 percentage units, at the margin. The possible explanations include; first as households become a member of the cooperatives including member of informal institutions in the study area like 'Equb'[3] their financial constraint will be minimized so that they will have the opportunity to participate in off-farm and non-farm income generating activities.

[3] *'Equb' is a traditional and informal saving mobilizing financial institution in Ethiopia, that the member villagers collects money every week or month and using the lottery system (random probability method) the winner will be selected and will take the mobilized saving and the process*

The second justification is that as farm households become a member of the cooperatives, their social capital and entrepreneur skill will be increased and there will not be information asymmetry in accessing feasible livelihood diversification activities that can boost their income. Third, being the member of cooperatives increases the bargaining power of farm households in selling and buying their resources and products or in other related collective actions and decisions.

5.2.2 Seemingly Unrelated Regression Analysis of Simultaneous Livelihood Diversifications of On-farm, Off-farm and Non-farm Activities

As we can see in table 5.5 of the Seemingly Unrelated Regression (SUR) result, the correlation matrix of residuals is indicated and all with positive values. That is:

$$Cov(\varepsilon_{lncropy}, \varepsilon_{ln\ offarmy}) = \rho_{lncropy,ln\ offarmy} = 0.1100 \neq 0$$

$$Cov(\varepsilon_{lncropy}, \varepsilon_{ln\ nonfarmy}) = \rho_{lncropy,ln\ nonfarmy} = 0.2400 \neq 0, and$$

$$Cov(\varepsilon_{ln\ offarmy}, \varepsilon_{ln\ nonfarmy}) = \rho_{lnoffarmy,ln\ nonfarmy} = 0.5685 \neq 0$$

Then, $Var(\varepsilon_{lncropy}) = Var(\varepsilon_{ln\ offarmy}) = Var(\varepsilon_{ln\ nonfarmy}) = 1$,

That indicates the assumption (explained in the methodology part) is holding true. Therefore, the Wald tests of $\rho = 0$ rejected that gives evidence on the correlation

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continues till the last member takes the saving mobilized by the member mates. It helps to fill the failures in financial market in rural Ethiopia.

possibilities between the unobserved explanatory variables of the 3- livelihood diversification equations.

Therefore, the Breusch-Pagan test rejects the null hypothesis of independence between on-farm, off-farm and non-farm residual series at the 1% level of significance. As a result, the joint estimations of the simultaneous equations of the 3 income diversification equations using the SUR model is justifiable. Since the value of ρ (rho) in all the correlation matrix of residuals are positive that indicates the unobserved variables that affect one of the livelihood diversification activities will also simultaneously affect the other activities in the same sign of direction.

5.2.2.1 Household Characteristic Determinants of Simultaneous Participation in On-farm, Off-farm and Non-farm Income Diversifications

Keeping other things constant, gender difference will likely lead to the simultaneous increase in the chance of participation of on-farm, off-farm and non-farm income diversification activities in the study area. That is as we move from the female household heads to male household heads; income generated from on-farm, off-farm and non-farm activity will be increased by 37%, 71.8% and 96.9 percent on average, respectively. The possible explanations include; first, in rural Ethiopia specifically in the study area of Gozamin District, men mostly control resources, and that will give access for male household heads in higher participation of income diversification activities.

Table 5.5: Seemingly unrelated regression Model of On-farm, Off-farm and Non-farm Diversification Activities

Seemingly unrelated regression

Equation	Obs	Parms	RMSE	"R-sq"	F-Stat	P
lncropy	98	18	.429952	0.4726	4.01	0.0000
lnoffarmy	98	16	.8711199	0.3252	2.44	0.0020
lnnonfarmy	98	16	.8899564	0.4394	3.97	0.0000

Variables	*Lncropy*	*lnoffarmy*	*Lnnonfarmy*
Dependent Variables:			
-lncropy			
-lnoffarmy			
-lnnonfarmy			
Explanatory Variables:			
hhsex	*0.3712***(.1174)*	*0.7180***(.2202)*	*0.9695***(.2250)*
lnhhage	*0.0850(2070)*	*-0.5622(.3957)*	*-0.1516(.4043)*
vill_leqleq	*-0.5104*(.2771)*	*-0.4341(.54747)*	*0.6800(.5593)*
vill_weynma	*-0.4550**(.2111)*	*-0.3840(.3939)*	*-0.0218(.4024)*
elem_educ	*0.1121(.1206)*	*0.0745(.2439)*	*0.2239(.2492)*
secon_educ	*-0.1037(.1715)*	*-0.2841(.3343)*	*-0.3136(.3415)*
stud_prop	*-0.0472(.2239)*	*-0.9305**(.4461)*	*-1.0264**(.4558)*
lnmrkt_dist	*-1.1765(1.1135)*	*-4.588**(2.1279)*	*-3.0306(2.1739)*
land_ha	*0.3036**(.1080)*	*0.2169(.2143)*	*0.3553(.2190)*
land_right	*-0.0223(.2459)*	*-0.3333(.4957)*	*-0.0918(.5064)*
coop_mem	*0.0664(.1419)*	*0.9641***(.2809)*	*0.4067(.2870)*
credit_serv	*-0.0436(.1038)*	*-0.4272**(.2036)*	*0.0484(.2080)*
exten_serv	*-0.0806(.1768)*	*-0.5715(.3535)*	*0.3130(.3611)*
lnagri_tech	*0.2094**(.0957)*		
lnlivestock	*0.0560(.1276)*	*0.2923(.2250)*	*0.5644**(.2299)*
lnwage	*-0.2048(.3803)*	*-0.2570(.6062)*	*-1.0179(.6193)*
lnoxen_manday	*0.3674(.3296)*		
Labor	*-0.0547(.0837)*	*0.0513(.1646)*	*0.2047(.1682)*
_cons	*10.4444**(4.1240)*	*0.0513***(.1646)*	*17.2662**(8.3088)*

Correlation matrix of residuals:

	lncropy	lnoffarmy	lnnonfarmy
lncropy	1.0000		
lnoffarmy	0.1100	1.0000	
lnnonfarmy	0.2400	0.5685	1.0000

Breusch-Pagan test of independence: chi2(3) = 38.503, Pr = 0.0023

Source: Computed from Own Survey Data

The second explanation is related to traditions; mostly in the study area female households have been engaging on preparation of food, child growing and home management activities that are not valuated in most cases in financial terms and income generating activities in the study area. In the study area, mostly men have been involved in non-farm activities than female household like in trading and selling labor to the urban markets.

Location difference of the household does not simultaneously determine the probability of farm household engagements in livelihood diversification. Ceteris paribus and on average, as we move from Addis-Gult rural village to Leqleqit and Weynamager villages, income generated from on-farm (food crop and livestock production) will decline by 51% and 45.5%, with 1% and 5% level of significance, respectively. The difference in crop production is likely related to the rural resource endowment and the soil nutrient difference among the villages that lead to the land productivity differences. Agro ecological differences between the three villages may also result in the differences, in on-farm productivity and income.

The other determinant variable for income of the household is the proportion of family members who are currently attending their school in the rural area where their family lives or in some other urban areas, where schooling is available by leaving their family. This variable has a negative impact on non-farm and off-farm household

income levels jointly, but the effect to on-farm income is not significant. Keeping other things constant, as proportions of students increased by one unit, income level of off-farm and non-farm diversification activities will be declined by 93% and 102.6% at 5% level of significance, respectively.

The most likelihood explanation is that education withdraws rural labor force from livelihood diversification activities, so farm income of the household will definitely decline. Therefore, the shortage of family labor may push the household to concentrate only on subsistence and on-farm agricultural activities. However, in the long run investment in education may increase in remittance and migration income so that will in turn increase non-farm diversification bases.

Home distance from the market place has a negative effect to the household income. Keeping other things constant, as farm households' home distance from the proxy market increased by one kilometer, the off-farm income of the household will decline by more than four folds, on average. This is because the market could serve as a source of demand for farm household products and also a source of labor market that could help farmers to sell their labor. This indicates that urbanization and rural marketing will facilitate the diversification process of farm households.

On the other hand, farmland size has significant and positive impact for on-farm agricultural income level. That is, on average as the land size of a farm household

increased by 1 hectare, leads to a 30.3 percentage unit increase in income from on-farm activities at 5% level of significance. There are possible explanations for this regression output; first, with the same level of farm technology adoption as cropland size increased it is obvious that total agricultural crop production will be increased. However, it does not necessarily mean that there will be an increase in farm productivity.

The second justification is that as land size of a farm household increased, the ranches for livestock will increase and will lead to the increase in livestock production and on-farm income level. The third possible explanation is that in the study area as farm households have larger farmland size, they are mostly rented-out it to the other farmers who face in shortage of farmland. That will further raise their income. In the literatures there are proponent and opponent arguments on land size versus efficiency relationship and opponents argue that small-scale landholders are more efficient than larger farms.

5.2.2.2 Social and Institutional Determinants of Simultaneous Participation in On-farm, Off-farm and Non-farm Income Diversifications

Keeping other factors constant, being the household becomes a member of the cooperative leads to an increase in the off-farm income level by 96.4 percentage units on average. The justifications are mentioned in detail in section 5.2.2.1 in that

cooperative membership, will increase social capital and entrepreneurship skill of the farm household that lead to the increase in participation rate of farm households in livelihood diversification. On the other hand, access to credit service, on average, will result to the decline in the off-farm income of the household by 42.7 percentage units at 5% level of significance.

This is most likely because credit service in the short run will solve the subsistence and related budget constraints of the household that will make it as a substitute of the off-farm income generation efforts. The other related justification will likely be since credit service can solve cash constraints of the household and that may lead farm households to shift from off-farm activity (like selling out his own labor) to the intensification of on-farm activities by purchasing and adopting better farm technologies.

However, being this study is not dynamic, and the effect of being current credit service user may not have an impact for the current on-farm production and productivity of farm households. Since, this study employs only cross-sectional survey data; it cannot fully estimate the effects of current credit on the current farm households' income level.

For improvements in farm household productivity and income, the role of farm technologies, like use of fertilizer and improved seeds, plays an important role. As

hypothesized, and keeping other things constant if agricultural technology adoption of farm household increased by one unit, the on-farm production income will be increased by 20.5 percentage units on average. In the study area, the use of farm technology is found to be in the low rate, justified by the lower supply of farm technologies and the lower purchasing power of farm households. However, currently due to high erosion rate and declining soil quality, without farm technologies, the farmland could not give the expected agricultural output that pushes farmers in recent days to use fertilizers and genetically-improved seeds.

Finally, current livestock value has positive and significant impact for non-farm income of the farm household in the study area. That is, on average, as the value and amount of livestock owned by the farm household increased, ceteris paribus, it results to an increase in non-farm diversification income by 56.4 percentage units.

This may be because the stock of livestock in the study area is considered as the principal store of asset of the farm households. The household may sell some of the livestock as their market value increased and may use that revenue in expanding the non-farm livelihood diversification activities, like trading and participating in small-scale rural merchandizing activities. In addition, in the study area, oxen and horse labor is used for agricultural production processes. Farm households that have many oxen and the horse may rent them out and collect non-farm income.

CHAPTER 6: ANALYSING THE EFFECTS OF LIVELIHOOD DIVERSIFICATION ON SUSTAINABLE LAND MANAGEMENT

6.1 Descriptive Analysis

6.1.1 Descriptive Summary Statistics of Sustainable Land Management Indicators

Table 6.1 below indicates how many of the sample farm households participate in either sustainable land management or livelihood diversification activities, or in both of the two activities. Therefore, 71.5 %, and 75.4% of the farm household have been participated in livelihood diversification and sustainable land management activities, to maximize their income level and to protect their farmlands from land degradation of like soil and wind erosion, respectively.

Table 6.1: Cross-Tabulation of slm_indx and ihhd_index

	ihhd_index=0	*ihhd_index=1*	*Total*
slm_indx=0	*31(83.78)*	*6(16.22)*	*37(100.00)*
slm_indx=1	*12(10.53)*	*102 (89.47)*	*114(100.00)*
Total	*43(28.48)*	*108 (71.52)*	*151(100.00)*

Source: Computed from Own Survey Data

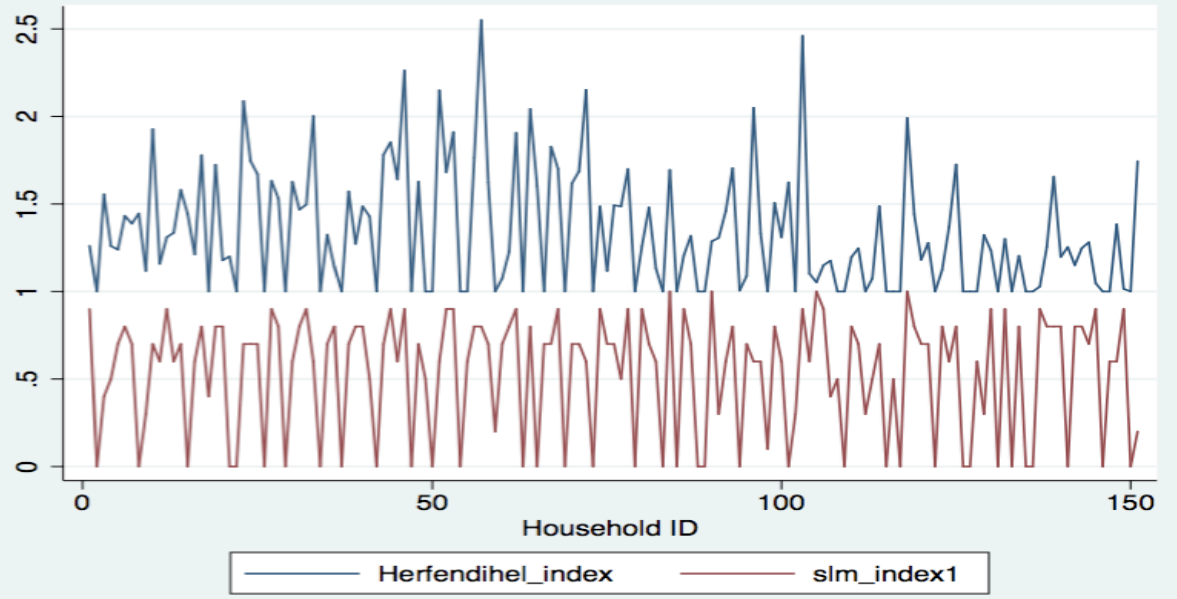
Accordingly, of the total farm households: 102 have been adopted joint, and only 12 participated in sustainable land management practices but not on livelihood diversification activities, 6 of them adopted only livelihood diversification but not sustainable land management, and 31 adopted neither livelihood diversification nor sustainable land management practices. The sustainable land management (SLM) index and the Inverse Herfindahl-Hirschman Diversity (IHHD) index are explained in the methodology chapter briefly.

As indicated in the graph 6.1 above, the value of IHHD index is between 1 and 3 inclusive indicates the number of broad livelihood diversification classifications of on-farm, off-farm and non-farm activities. Likewise, the SLM index indicates that all the summation of the dummies (for instance if the indicator is adopted by the farm household ranks to 1, otherwise ranks to 0). Then divided the sum in to 10 to find out the index and it is between 0 and 1 inclusive.

The descriptive summary of most explanatory variables has been discussed in chapter 5 of livelihood diversification; therefore, under this section only descriptive summary of sustainable land management indicators will be described in table 6.2 below. As indicated, farm households in the study area, Gozamin District, have engaged in various sustainable land management practices that mainly include fallowing, manure

and compost, terrace, soil-bund, gully-check, tree-planting, shelterbelts, contour-farming, strip-cropping and constructing fences on their farmlands.

Figure 6.1: SLM index and IHHD index of the sample farm households



Source: Own Survey Data

According to the survey data, the farm household have been practiced at the mean value of 54.9%, 62.9%, 43.7%, 51.6%, 49%, 50.3%, 56.2%, 60.2%, 49.6% and 50.3% in fallowing, manure and compost, terrace, soil-bund, gully-check, tree-planting, shelterbelts, contour-farming, strip-cropping and constructing fences; respectively. These activities are typical practices of sustainable land management to protect farmlands from the environmental degradations in the study area.

Table 6.2: Descriptive Summary of Sustainable Land Management Indicators

Variable	*Description*	*Mean*	*Standard Deviation (SD)*
fallow	*Dummy land management, 1 if fallow; 0 otherwise*	*0.549*	*0.499*
manu&compo	*Dummy land management, 1 if manure &compost; 0 otherwise*	*0.629*	*0.484*
terrace	*Dummy land management, 1 if terrace; 0 otherwise*	*0.437*	*0.497*
soil_bund	*Dummy land management, 1 if soil-bund; 0 otherwise*	*0.516*	*0.501*
gully_check	*Dummy land management, 1 if gully-check; 0 otherwise*	*0.490*	*0.502*
tree_plant	*Dummy land management, 1 if tree-planted; 0 otherwise*	*0.503*	*0.504*
shelterbelt	*Dummy land management, 1 if shelter-belt; 0 otherwise*	*0.562*	*0.497*
cont_farm	*Dummy land management, 1 if contour-farm; 0 otherwise*	*0.602*	*0.490*
strip_crop	*Dummy land management, 1 if strip-cropping; 0 otherwise*	*0.496*	*0.501*
live_fen	*Dummy land management, 1 if live-fence; 0 otherwise*	*0.503*	*0.503*

Source: Computed from Own Survey Data

The table indicates not all sample farm households have practiced with equal extent and proportion in sustainable land management practices. Some adopt all sustainable land management practices while others may adopt non or some of the practices only that determined from household, socio-economic characteristics, and institutional factors.

6.1.2 Household and Socio-Economic Characteristics of SLM Practice Participants

In this section, the study employs t-statistics and chi-square statistics for continuous variables and discrete variables, respectively for comparison and descriptive analysis purpose of the mean of sustainable land management practices among farm households. Therefore, table 6.3 indicates that 72% of the total sample households represents male and among the farm households who adopt sustainable land management practices 74% are also male-headed too while the remaining 16% are female-headed. However, the mean difference between the adopters and non-adopters is not statistically significant. On the other hand, 92% and 78% of the adopters and non-adopters respectively feels secured about their land right and the difference between these groups is significant at 5% statistical level.

Similarly, 81% and 13% of the sustainable land management participants and non-participants have become cooperative members and the difference between the groups is strongly significant at 1% statistical level. On the other hand, 68%, 20% and 11% of the SLM adopters and 64%, 21% and 13% of the SLM non-adopters of farm households have not attended formal education, attained primary and secondary educational levels, respectively. However, descriptively the difference due to educational level among the adopters and non-adopters is not significant. Similarly, 49% of SLM adopters and 51% of the non-adopters are beneficiaries of credit service.

However, the difference is not statistically significant. On the other hand, 91% of the SLM adopters and 14% of non-adopters are users of the agricultural extension services to boost agricultural productivity by introducing various farm technologies, and the difference is strongly significant at l%. Location difference of the farm household by itself has no statistically significant effect on the adoption decision of the farm household to the sustainable land management practices, unlike participations decisions in livelihood activities.

Similarly, the t-statistics test for continuous variables indicates that the mean age of the SLM practice adopters is 44 years while 45.5 years for that of the non-adopters; however, the difference is not statistically significant. Similarly, family-size, current estimated market values of livestock and wage have statistically no significant differences between the participants and non-participants.

On the other hand, the mean non-farm income of SLM participants is much higher than that of the non-participants and the difference is significant at 1% statistical level. However, there is no statistically significant variation in the average on-farm income between the groups. On the other hand, the mean off-farm income of SLM-practice participators is higher than the non-participators and the difference is significant at 5% statistical level. Similarly, there is statistically strong difference in the average total income of SLM-practice adopter and non-adopter at 5% level of significance.

Table 6.3: Household & Socio-Economic Characteristics of SLM Practice Adopters

The χ^2 test and percentage for discrete variables				
Variables	***Total (combined)***	***Farm households SLM***		***χ^2-statistics***
		Participated	***Not participated***	
hhsex	*0.72*	*0.74*	*0.65*	*1.3081*
land_right	*0.89*	*0.92*	*0.78*	*6.2889 ** *
coop_mem	*0.64*	*0.81*	*0.13*	*56.8113****
noformal_edu	*0.67*	*0.68*	*0.64*	*0.1612*
elem_educ	*0.20*	*0.20*	*0.21*	*0.0358*
secon_educ	*0.12*	*0.11*	*0.13*	*0.1184*
credit_serv	*0.50*	*0.49*	*0.51*	*0.0555*
exten_serv	*0.72*	*0.91*	*0.14*	*84.0258****
vill_leqleq	*0.33*	*0.34*	*0.32*	*0.0102*
vill_weynma	*0.33*	*0.34*	*0.32*	*0.0395*
vill_addisgult	*0.33*	*0.32*	*0.35*	*0.0905*
t-statistics test and percentage for continuous variables				
Hhage	*44.36*	*43.99*	*45.51*	*0.6477*
fam_siz	*5.23*	*5.21*	*5.27*	*0.1655*
livestockY	*30150*	*30076*	*30380*	*0.1058*
wage	*4663*	*4687*	*4591*	*0.3595*
nonfarmy	*1971*	*2520*	*1632*	*3.1410****
cropy	*20177*	*20360*	*19611*	*0.4029*
offarmy	*1235*	*1545*	*1124*	*2.3640****
total_inco	*23371*	*24426*	*20119*	*2.0557** *
stud_prop	*0.35*	*0.34*	*0.37*	*0.7798*
mrkt_dis	*16.73*	*16.57*	*17.232*	*2.2351** *
land_ha	*1.1621*	*1.1622*	*1.1621*	*0.0234*
labor	*2.40*	*2.42*	*2.35*	*0.4788*

Source: Computed from Own Survey Data

On the other hand, as indicated in Table 6.3, the proportion of students in the household of SLM-practice adopters is lower than the non-adopters at the mean value, which are 34% and 37% of the family members, respectively. However, the difference is not statistically significant. On the other hand, there is statistically significant difference in average market distance between the adopters and non-adopters of SLM-practices, in which the former group is much shorter than its counterpart. Finally, the land holding size (in hectares) of SLM-practice adopters and non-adopters is not statistically different, and on average both groups has 1.162 hectare of farmland. Similarly, on average SLM-practice adopters have 2.42 number of labor while the non-adopters have 2.35; but the difference is not statistically significant.

6.2 The Regression Analysis of Recursive Bivariate Probit Model on the Effects of Livelihood Diversification on Sustainable Land Management

Table 6.4 below indicates the estimation of the recursive bivariate Probit model, which solves the endogenous problem of the Inverse Herfindahl-Hirschman Diversity (IHHD) index regressor in the sustainable land management (SLM) index equation. There are three reasons for this possibility to happen: first it may be causal relations that come from the influence of IHHD index on the parameters of SLM index. Second, IHHD index and SLM index may both depend on correlated explanatory

variables; however, in this model we check the possible correlation problems using pairwise technique and no correlation problem of the X's detected; and third, both SLM-index and IHHD-index may depend on correlated unobserved variables.

According to the regression result, the Wald test indicates as we reject the null hypothesis that H_0: $\rho = 0$ at 1% level of significance, which clearly indicates that the recursive bivariate Probit model, is efficient and fits more to estimate than the univariate separate Probit models.

The result that $\rho \neq 0$ indicates as IHHD index correlated with the error term of SLM index and, therefore, IHHD index is endogenous (rather than exogenous) to the SLM index equation. Under this situation, a simultaneous estimation needed to find out consistent estimates of the parameters rather than a separate estimation. Since the recursive bivariate Probit model is non-linear, for this reason, the estimated coefficients cannot result in correct measure of the dependent variable determinants. Therefore, the most appropriate method is to use marginal effects rather than coefficients.

Table 6.4: The Recursive Bivariate Probit Model

Variables	*slm_indx: Coeeficients (Robust Std.Err)*	*ihhd_index: Coeeficients (Robust Std.Err)*	*Joint Marginal Effects (dy/dx)*
Dependent Variable: slm_indx			
Endogenous Variable: ihhd_index			
Explanatory Variables:			
hhsex	*-1.394(.870)*	*0.393(0.301)*	*0.096(0.077)*
lnhhage	*2.577(2.547)*	*-1.392*(0 .718)*	*-0.309**(0.146)*
vill_leqleq	*2.728***(1.139)*	*-.522(.790)*	*-0.126(0.202)*
vill_weynma	*2.385**(1.139)*	*-1.389**(0.641)*	*-0.381**(0.177)*
elem_educ	*-0.549(0.654)*	*0.036(.481)*	*0.008(0.104)*
secon_educ	*3.163*(1.818)*	*-1.264***(-1.264)*	*-0.403***(0.152)*
stud_prop	*-1.132(2.249)*	*-0.819(.862)*	*-0.182(0.178)*
lnmrkt_dist	*-1.249(8.303)*	*-12.325***(3.653)*	*-2.744*
land_ha	*0.623(0.655)*	*-0.104(0.461)*	*-0.023(0.103)*
land_right	*1.028(0.921)*	*1.230***(1.230)*	*0.397*
coop_mem	*1.998*(1.185)*	*0.705(.439)*	*0.176(0.118)*
credit_serv	*-1.736**(0 .818)*	*0.190(0.305)*	*0.042(0.066)*
agri_exten	*3.065***(1.192)*	*1.608***(0.459)*	*0.476***(0.134)*
lnagri_tech	*0.875(0.587)*	*-0.563(0.360)*	*-0.125(0.082)*
Labor	*-0.184(0.576)*	*-0.182(0.193)*	*-0.040(0.041)*
Lnlivestock		*0.369(0.411)*	*0.082(0.092)*
Lnwage		*0.411(0.856)*	*-0.096(0.195)*
ihhd_index	*1.770**(1.923)*		*0.659(0.044)*
_cons	*-17.824(19.98)*	*43.933***(13.325)*	
Number of obs = 146 *Log pseudolikelihood = -52.540*		*dy/dx is for discrete change of dummy variable from 0 to 1*	
Wald test of rho=0: chi2(1) = 3488.59		*-***, **, and * indicate significance level at 1%, 5% and 10%, respectively*	
Figure in parentheses are robust standard errors.		*-vill_addisgult (base) is the reference village* *- noformal_edu is the reference for educational level for household head*	

Source: Computed from Own Survey Data

6.2.1 Household Characteristics Determinants of Incidences of Sustainable Land Management Index and Livelihood Diversification Index

As indicated in table 6.4-regression result above, farm households who are elder are less likely to participate in livelihood diversification activities. On the other hand, age has no direct statistically significant effect on the sustainable land management decision practices. However, at the margin and keeping other factors constant, as age of the farm household increased by one year, the joint probability of adopting both livelihood diversification and sustainable land management will decline by 30.9 percentage units at 5% level of statistical significance.

That is likely because following the age category there may be a natural difference related to physical strength and health in that most non-farm diversification activities, such as labor work and trade, outside the living area mostly required higher physical strength. The second rationale may likely be the existence of resource endowment differences between the young and elders in that the latter may fulfill their annual subsistence consumption just from on-farm activities. Therefore, there may not need to diversify their livelihoods to off-farm and non-farm activities.

A study by Ersado et al. (2004) found that age of the household has a statistically significant and negative effect on the adoption of resource conserving technologies. On the other hand, studies by Amsalu and de Graff (2007), and by Nkegbe, Shankar and Ceddia (2011) in the highlands of Ethiopia and Northern Ghana, respectively

found that age and land management practices, in these study taken as soil bund and stone terraces, shown positive relationship. This may be because of location, and resource endowment differences among the study areas. Another justification may be the differences in the methodology of the study in that while Amsalu and de Graff (2007) used bivariate probit model, Nkegbe et al. (2011) used probit model for their estimation.

Location of the farm household has an effect on the probability of adopting the two activities. As we move from Addis-Gult rural village to Leqleqit village, the probability of farm households' decision to participate in sustainable land management practice found to be higher.

However, there have not been any statistically significant differences in engaging in livelihood diversification activities between Leqleqit and Addis-Gult villages. There is no significant joint marginal effect on adopting both activities due to location difference. Similarly, as we move from Addis-Gult to Weynmager village, the likelihood of farm households' engagement to sustainable land management practices have increased significantly (at 1% statistical level), contrarily, the households' participation rate in livelihood diversification activities declines significantly.

On the margin and keeping other things constant, as we move from Addis-Gult peasant village to Weynmager village, the joint probability of livelihood

diversification and sustainable land management practices will decline by 38.1 percentage units. The possible explanation is that since both Leqleqit and Weynmager are both near to Debre Markos town compared to Addis-Gult, as a result, they are planting trees (especially eucalyptus tree for fuel wood) and various vegetables and fruits for urban demand and because of these factors their land management activities will be much better than the reference village, Addis-Gult. In addition, the farmers' awareness about land management in both Leqleqit and Weynmager may likely be higher than farm households who live in Addis-Gult.

On the other hand, resource endowment difference between farm households who live in Weynmager and Addis-Gult villages may lead to the significant difference between the participation rates in livelihood diversification activities. Other socio-infrastructure differences like proximity to roads, also lead to access-differences for transportation.

Similarly, contradictory results have been observed about the effect of secondary education on livelihood and environmental activities. That is, the likelihood of farm households' who attended their secondary education participation in sustainable land management is higher than from their counter parts that do not have any formal educational background. On the other hand, the reverse is true for farm households, who attain secondary education, probability of participation in livelihood diversification. On the margin, and controlling other factors constant, the joint

participation probability of farm households' that attend secondary educational level is 40.3 percentage units less likely in joint participation probability compared to farm households who have no formal educational background.

The possible explanation is that education could increase the stock of knowledge and awareness. This may have a direct benefit for sustainable land management practices in improving land quality and increasing land productivity. On the other hand, farm households with better education may be engaged more on specialization and higher productive farm activities than diversification of livelihood activities. The previous studies by Ersado, Amacher and Alwang (2004), and Pender and Kerr (1998) found consistent results in that education has affected land management conservation positively. Similarly, a study by Pender et al. (2001) in Ethiopia concluded that educational level improved use of manure while it declines investment in terraces.

6.2.2 Social and Institutional Determinants of Sustainable Land Management Index and Livelihood Diversification Index

The market distance of farm households has a negative effect for participation probability of both sustainable land management practices and livelihood diversification activities in the study area. However, market distance has no statistically significant impact on sustainable land management practices adoption probability of farm households. On the other hand, it has negative and statistically

strongly significant effect on the farm households' decision in the participation probability of livelihood diversification activities.

The possible explanations related to market distance were already explained in chapter 5. Access to market increases demand in relation to farm products and availability of labor market in the towns. This will motivate farmers who live in nearby to Debre Markos town to diversify their income higher than those who live far from it. However, market distance has no statistically significant impact on the joint adoption decisions of farm households in both activities.

From the institutional determinant factors, land right perception of the farm household has no significant effect on the farm household participation decision in sustainable land management practices. On the other hand, in the Gozamin District the likelihood of participation decision on diversifications of livelihood activities by the farm household will be increased as the households' perception on land rights getting secured.

However, land right security perception has no statistically significant effect on the probability of joint-participation decision of the farm household in both environmental and livelihood activities. Land in Ethiopia is a public resource and farmers cannot sell and buy land they only have a land-use right. However, compared to the previous socialist regime of Ethiopia in the current government there is no

frequent redistribution of land. Therefore, farm households can hire-out their land and may sell their labor if they think it is feasible to work in other places as they feel secured about their land and may maximize their non-farm income.

Farmers who have become members of the cooperatives are more likely to participate in the sustainable land management practices than non-cooperative counterparts. This regression output seems reasonable in that as farmers organize themselves through cooperatives it is more likely that their land protection and management awareness and knowledge may be developed. Since, the government development agencies in Ethiopia have used cooperatives as a channel to give technology and environmental protection awareness for farm households. However, being a member of cooperatives does not have statistically significant impact in the joint participation decisions of farm households in both activities.

On the other hand, farm households who have access to credit service have been less likely to adopt sustainable land management practices than farm households who have no credit access. This is most likely because in the study area, only poor farmers have access to credit service and except for microcredit institutions there is no banking system for farmers that could provide credit to adopt new farm technologies.

Therefore, these poor farm households will allocate the money they got from microcredit institutions for buying fertilizer and renting-in land for subsistence food

production purpose that may lead to intensifying on-farm activities and will reduce sustainable land management systems like fallowing and other activities. The second possible justification is credit may takeout labor from the sustainable land management activities of farm households. It is most likely because, farm households' labor may be allocated for other short term and financially viable and subsistence activities, rather than environmentally sustainable works, usually which have a long-term return.

Agricultural extension service users have more likely participated in both livelihood diversification and sustainable land management practices than their counter farm households. On the margin and keeping other factors constant, farm households who are users of agricultural extension services, including training on better farming methods, are 47.6 percentage units more likely to participate in joint activities of livelihood diversification and sustainable land management practices than otherwise.

The justification is that as farm households getting agricultural services, they are more likely be motivated to maximize their household income through participating as many livelihood diversification activities as possible. Therefore, they will be motivated to protect their land and will engage on land management practices to increase their land productivity sustainably. More importantly, extension services supposed to enhance the knowledge of farm households in better farming that

includes in adopting environmentally friendly farming techniques like agroforestry and may help to motivate farmers to diversify their activities more than before.

Finally, the endogenous variable, livelihood diversification that is measured in IHHD index likely has statistically strong and significant positive effect on the adoption decision of sustainable land management practices by the farm households in Gozamin District. On the margin and keeping other things constant, as farm households' measure of livelihood diversification, Inverse Herfindahl-Hirschman Diversity index, increased by one unit, the marginal effect of sustainable land management index will be increased by 65.9 percentage units.

There are at least three possible explanations for the reliability of this result in the study area. First, in the study area some livelihood diversification activities like coffee, tree planting (for timber production) and vegetable productions can be reinforced to the sustainable land management practices. Second, as farm households diversify their livelihood activities, their personal income likely be maximized, and that will motivate farmers investing in sustainable land management practices like in building fences and protecting their land from erosion.

Third, as farm households allocate their labor to livelihood diversification activities, that will help to smooth their annual consumption expenditure through non and off-farm income sources that may help to reduce the intensity of on-farm agricultural

practices and this will help for soil protection and in adopting land management practices such as fallowing.

There are mixed results in the previous literatures of the impact of livelihood diversifications on land management practices. A study by Gebremedhin and Haile (2002) in Ethiopia, found consistent result in those farm households who had higher non-farm income were greater adopters of stone terrace land management practices. A similar study by Pender et al. (2001) in two provincial states of Ethiopia found that off-farm diversification activities increased investments in sustainable land management practices.

On the other hand, a study by Holden et al. (2004) in Ethiopia found that non-farm income diversification activities affect the land conservation practices negatively. This opposite result may be justified due to the agro-ecological differences of the study areas. In addition, Holden et al. (2004) used a calibrated dynamic bio-economic model for their econometric model estimation rather than the recursive bivariate probit model.

CHAPTER 7: CONCLUSION AND RECOMMENDATION

7.1 Introduction

Ellis (2000) argued that farm household diversification of livelihood into non-farm income diversification activities can have two conflicting outcomes for the environment. On one hand, diversification may take the stresses off those environmental resources or natural capital that comprise, for example, firewood collection, deforestation, charcoal production, and so on which are typically among the lowest returns in the rural economy. This leads to a rational decision-making wherein farm households diversify their labor to the other activities. On the contrary, the author argued that livelihood diversification may shift labor input away, for instance through migration for higher wage and income, from environmental protection activities like soil conservation practices through terracing, which demands more labor intensive works.

Small-scale farm households dominate the Ethiopian agriculture sector, whose main objective is limited with optimizing subsistence crop production rather than profit maximizing motive. The livelihood of 80% of the total population and 77% of total labor force's livelihood is supported by the agriculture sector. It has continued to be a significant source for foreign exchange through the export of Ethiopian coffee,

sesame, hides and skins and so on. In general, agriculture has contributed to the economic growth of Ethiopia in two ways, supply and demand side. It boosts the aggregate supply of the economy by providing food, raw materials and exportable products; on the other hand, agriculture creates domestic market for industry and service sectors. Therefore, agricultural growth and development is the issue of poverty reduction, rural development, and empowerment of the majority rural society in Ethiopia.

Despite these and other similar benefits the agriculture sector has contributed to the economy, the fact is that the GDP contribution has been dominated by the service sector since the year 2008. That indicates the productivity of the agriculture sector is much lower than the service sector because only less than 15% of the total labor force of Ethiopia is supported by the service sector. To solve the agricultural productivity problem, the Ethiopian government has formulated and implemented various rural development policy packages.

However, the livelihood of the Ethiopian farm households does not show significant progress. According to 2012 World Bank's development indicator report, 45.4% of the rural population in Ethiopia had been found below the international poverty line. This is because agriculture sector is rain fed dependent and highly vulnerable to weather shocks and changes. Moreover, there is little irrigation infrastructure in the country and the farm households could produce only once a year. As a result, farmers are idle and performing below their full capacity during a significant period of the

year. That is, Ethiopian farm households have not employed their major resource, labor hour, efficiently throughout the year.

To use the labor hour of farm households efficiently, there should be expansions in livelihood diversification from food crop and livestock production specializations to non-farm and off-farm activities. However, depending on characteristics of farm households, social and economic conditions the off-farm and non-farm livelihood diversifications may have either positive or negative impacts to the environment. Therefore, this study attempts to analyze the determinant factors and nature of farm households' livelihood diversification impacts to the sustainable land management practices. It intended to answer the question: "what are the determinant factors of livelihood diversification and its impacts on sustainable land management practices?" It has the following listed specific objectives:

1. To assess the agricultural development policies of Ethiopia
2. To identify factors those determine farm households' livelihood diversification on the study area
3. To describe the determinant factors for on-farm, off-farm and non-farm activities of farm households
4. To describe the effects of livelihood diversification on the sustainable land management practices of farm households
5. To suggest policy recommendations for livelihood diversification and sustainable land management practices

This research employed surveys from 151 farm households in 3 villages; namely Leqileqit, Weynmager and Addis-Gult in Gozamin District of Ethiopia. The study used multi-stage stratified and simple random sampling techniques for primary data collection purposes. In addition, secondary data were also collected and used from various Ethiopian organizational institutions such as MoFED, BoFED, BoARD, Central Statistics Agency and Ethiopian Economic Association. Finally, this study employed both descriptive method of t and chi-squire statistics to describe the survey; and econometrics tools including the Univariate Probit model, Seemingly Unrelated Regression (SUR) model and Recursive Bivariate Probit model to analyze the specific objectives.

7.2 Conclusions

7.2.1 Nature and effect of Agricultural Policies in Ethiopia

The study shows that agriculture sector in Ethiopia is the pivotal and dominant sector that still supports the livelihood of 80% of the total population. It has been a dominant source of foreign exchange by providing primary exportable agricultural commodities that have been supporting the development of other economic sectors. However, the paradox is that even though it supports the livelihood of the majority of the population, its relative share of GDP has declined since the year 2008, and in this regard the service sector takes the lead. That indicates the labor productivity of

agriculture in Ethiopia is too low.

The trend of GDP growth rate of agriculture shows frequent and pertinent ups and downs that is mainly because the sector is highly rain-fed dependent and vulnerable to weather shocks and droughts. Another justification is that even though Ethiopia has so many rivers and potential irrigation lands, only 3% of the total irrigable potential is used, and most farmers produce only once a year and that makes farmers idle and inefficient during the slack seasons.

In addition, the small-scale farmers could not significantly adopt various farm technologies that can boost productivity due to limitations in purchasing power and inadequate farm technology supply. Policy, institutional and structural problems of the sector also played major constraint of agricultural development. For instance, the key farm household resource, land, is controlled by the state. Farmers can only have rights to use it, and they cannot sell and buy it in the market.

Therefore, to solve the consistent problems of agriculture, various policies have been formulated by different regimes in the country. So far; however, agricultural policies can hardly boost the development of the sector. The current five-year Growth and Transformation Plan of 2010/11-2014/15 has the strategic direction towards agricultural growth.

This Plan gives more priority to smallholder farmers and scaling up government

intervention. To accelerate smallholder agriculture, the main strategic directions include: scaling up best practices, promoting irrigation development, protecting natural resources and make farmers engage in the production of high valued agricultural crops. However, the earlier agricultural policies do not briefly incorporate the formulation of non-farm and off-farm agricultural diversification strategies.

7.2.2 Determinants of Livelihood Diversification Incidences

The descriptive analysis of livelihood diversification in participation decision probability of a farm household is conducted using t and chi-squire statistical techniques. Using chi-squire statistics, male-headed farm households, farm households who feel secure about their land rights, households who are members of cooperatives, and households who engage in extension services have been participated better in non-agricultural (off-farm and non-farm) activities significantly than otherwise. Likewise, using t-statistics, distance from the proxy market, Debre Markos town, of the diversifiers is found to be shorter than the non-diversifiers.

According to the Univariate Probit regression result, non-agricultural activity participation probability by a given farm household is significantly and positively determined by institutional factors that include secured land-right perception and cooperative membership of a given farm household. On the other hand, age of the farm household head, being a given farm household is located in villages of Leqleqit and Weynmager (compared to living in Addis-Gult), being the farm household

attained secondary educational level, and market distance have negative and significant effect on farm households decision to participate on non-agricultural livelihood diversification activities of a given farm household.

7.2.3 Determinants of Livelihood Diversification Intensity

Based on Ellis's (2000) theoretical framework a typical farm household's income is grouped into three categories: on-farm, off-farm and non-farm income. Based on these farm income definitions, the study found out the determinant factors of each category. Using t-statistics, the on-farm income of a farm household in the study area is significantly determined by gender difference of the household head, being the head attained elementary educational level, being the household is located either in Weynmager or Addis-Gult villages, and access to credit services.

Similarly, off-farm income of a given farm household significantly determined by gender difference, land-right security perception, being a member of cooperatives, and being able to participate in agricultural extension services. Finally, variables including gender difference, being a household is located in Addis-Gult village, land-right perception, being a member of cooperatives, and being able to participate in agricultural extension services determines the non-farm income level differences significantly among the farm households.

Based on the regression result of the Seemingly Unrelated Regression model, the

determinant factors of on-farm, off-farm and non-farm livelihood diversification activities are simultaneously estimated. Therefore, it is implied that being a male-headed household, land size (in hectares), and agricultural technology determines the on-farm (crop and livestock production) income positively and significantly; while being a farm household is located in either Leqleqit or Weynmager villages have negative and significant effect on the on-farm income level of a typical farm household. Similarly, being a male-headed household and being a member of cooperatives affect off-farm income level of a typical farm household positively and significantly.

On the other hand, variables including market distance and access to credit service affect the off-farm income level negatively and significantly. Finally, being a household is male-headed and current market values of livestock determines the level of non-farm income positively and significantly. However, non-farm income level of a farm household is determined negatively and significantly by the proportion of students in the household.

7.2.4 The Effect of Livelihood Diversification on Sustainable Land Management

Livelihood diversification activities of a farm household may have either positive or negative impacts on the sustainable land management practices. In the mean value, the sample farm households adopt 54.9% on fallowing, 62.9% on manure and compost, 43.7% on terracing, 51.6% on soil bund, 49% on gully check, 50.3% on tree

planting, 56.2% on contour farming, 49.6% on strip cropping, and 50.3% on live fences of sustainable land management practices.

The descriptive analysis of sustainable land management index is estimated using chi-squire and t-statistics techniques. Accordingly, there is statistically significant difference among farm households who are participants and non-participants of sustainable land management practices in factors including land right security perception, being a member of cooperatives, access to credit service, average non-farm income, average off-farm and total income, and market distance from Debre Markos town.

The Recursive Bivariate Probit model is employed to analyze the impact of livelihood diversification on sustainable land management practices. Following Ellis (2000) livelihood diversification theoretical framework, the key endogenous variable, Inverse Herfindhal-Hirschman Diversity (IHHD) index, which is the measure of livelihood diversification, has positive and significant effect on sustainable land management index of a farm household. Moreover, being a farm household is located in either Leqleqit or Weynmager villages (compared to living in Addis-Gult), being a farm household attained secondary educational level, and being the farm household participated in agricultural extension packages have positive and significant effects on sustainable land management practices.

On the other hand, access to credit service has negative effect on sustainable land management practices. The joint marginal effects of age of the farm household and secondary educational level have shown negative sign while the joint marginal effects of agricultural extension services has positive effects on both sustainable land management index and Inverse Herfindhal-Hirschman Diversity index.

7.3 Recommendations

Ethiopian farmers produce mostly agricultural crop products just once a year during the summer season of May to September, it indicates the existence of idle rural labor force in the remaining long slack seasons. Therefore, livelihood diversification can make the rural labor force more efficient in employing their labor hour resource efficiently. Livelihood diversification practices of a farm household during the slack periods of agricultural activities will definitely boost the income level.

This will help farm households to develop the opportunity in substituting the rural financial market failure in Ethiopia and other developing nations in general. As a result, farm households can afford to buy new farm technologies that will in turn help to boost the agricultural productivity.

Most non-farm and off-farm livelihood diversification activities take labor from on-farm agricultural crop production activities. That would give relief for the farmlands by increasing for instance fallowing activities. Similarly, some livelihood

diversification activities like coffee and eucalyptus plantations could positively be reinforced with sustainable land management practices.

7.3.1 Policy Implications

There should be comprehensive rural development policy that could empower farm households. First, off-farm and non-farm rural livelihood diversification strategies need to be formulated under the rural development policies of Ethiopia. For instance, improving institutional capacities like rural credit market can help to expand rural trade. In addition, rural agro-processing industrialization that can help the integration of rural markets and boost rural income need to be promoted. This off-farm and non-farm livelihood diversification strategy needs to be reinforced, not contradicted, with the small-scale on-farm productivity improvement strategy of the country. The off-farm and non-farm rural development strategy will help farm households to employ their labor hour throughout the year efficiently. There will be no wasted idle labor hours. Second, in Ethiopia the integrated rural livelihood–sustainable land management strategy that can help to maximize jointly the rural livelihood and the land management situations of farm-households need to be formulated.

Third, one of the findings of this study, indicated that women-headed farm households participation in livelihood diversification activities less than male-headed farm households. It is recommended that the off-farm and non-farm rural development strategy needs to mainstream gender equity so as to empower women-

farmers to increase their participation probability. Fourth, institutions like cooperatives, land rights and agricultural extension packages need to be incorporated in rural development strategies so as to improve the capacity of farm households to participate in livelihood diversification and sustainable land management practices.

7.3.2 Recommendation for Gozamin District (the study area)

Gozamin District needs to formulate micro policies of non-farm and off-farm livelihood diversification and sustainable land management systems that are specific to the district and can be implemented throughout its villages including the three sample villages of Leqleqit, Weynmager and Addis-Gult. By promoting rural financial institutions the micro policies may incorporate rural agro processing industrialization and rural trading among farm households. The Gozamin District micro policy towards livelihood diversification needs to encompass empowering of women-headed farm households, institutionalizing cooperatives, and land security improvements across villages need to be formulated and implemented.

Similarly, the micro policy of sustainable land management of Gozamin District needs to incorporate and mainstream the specific strategy and micro policy of the non-farm and off-farm livelihood diversification activities in it. In addition, institutions like cooperatives of farm households need to be formulated, for instance, tree plantation cooperatives, trade cooperatives, saving cooperatives and so on. This

sustainable land management specific micro policies need to prioritize and empower women farmers' participation efforts for land management practices.

7.3.3 Recommendation for future studies

1. Broader and in-depth researches on livelihood diversification studies on other rural districts of Ethiopia need to be conducted so as to come up with comprehensive macro policy towards off-farm and non-farm activities.
2. A time series data of livelihood diversification activities of farm households in rural districts of Ethiopia need to be organized and documented so as to be able to analyze its dynamic trend and determinant factors
3. Gender equity and empowerment strategies need to be formulated for rural women farmers.
4. Detailed studies need to be conducted about the impact of livelihood diversification strategies on land management practices of Gozamn and other rural districts of Ethiopia.
5. Technical and in-depth studies about land management practices like agroforestry activities and other environmental conditions such as the extent of soil erosion, mineral depletion, deforestation and land degradation of rural districts needs to be studied.

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Annex1: Farm Household Survey Questionnaire

The purpose of this survey will be for the research with the objective "to examine the impacts of farm household livelihood strategies on the environment in North West Ethiopia" and only for the partial fulfillment of the requirements of the MSc. Degree in International Cooperation Policy (Environmental Policy & Administration) in Ritsumeikan Asia Pacific University (APU), Japan. The survey information will definitely be treated as confidential and will not be used by tax authorities or any other rents to assess the need for some other purpose. APU and I will be very grateful and thankful to you if you give reliable, suitable, and appropriate data and information.

Farm Household Village: _____

Codes: 1 =For _____; 2=_____; 3=_____;

Household number (code) _____

Date of interview: _____

I. Characteristics of the Household:

Id No.	Name	Sex	Relation to head (status)	Age (in years)	Educational status	Distance to market (in k.m)	Main occupation
1			Head				
2							
3							
4							
5							
6							
7							
…							

Codes: ♦Sex: 1 =male, 2= female

♦ Status (relation to head): 1=head, 2=husband, 3=wife, 4= son, 5=daughter; 6=brother; 7=sister; 8=grandchild; 9=hired labour; 10=other specify

♦Education: 0 =Illiterate; 1=from grades 1-4; 2=from grades 5-8; 3= Grade 9 and above

♦Main occupation: 1=crop farming; 2= crop farming& non/off-farm activity (like pity trade, hired labourer….); 3=student; 4=military; 5=dependent; 6=watch after animals; 7=house wife; 8=other specify

♦Member to cooperative: 1= Yes; 2= No

II. Income composition of the Household in (From July2011-July2012; Fiscal Year of Ethiopia)

(According to the definition of Ellis (2000:11-12))

No	Type	Quantit	Average market price during July2011-July2012		No	Type	Total Income from July,2011-July, 2012
1	**On farm (agricultural income):**				**2**	**Non-farm income:**	
	Crops:					Remittance*	
	Maize					Petty Trade	
	Teff					Sale of handicraft	
	Millet					Cart tracing	
	Wheat					Sale of eucalyptus poles, vegetables, firewood & others	
	Barley					Sale of local beverages	
	Pea					Migrant income*	

	Bean				**3**	**Off-farm income:**	
	Chickpeas					Hire/rent	
	Potato					Wage	
	Tomato					Gathering	
	Others						
	Livestock:						
	Oxen						
	Cows						
	Calves						
	Sheep						
	Goats						
	Horses						
	Mules						
	Donkeys						
	Chicken						
	Others						
	Vegetables*	====					

*For Vegetables, simply putting annual selling revenue and ignore the quantity

* Migrant income: temporary job outside community by household member

*Remittance income: money sent by relatives' permanently living elsewhere

III. Land management & Environmental Activities

Plot area in ha.	Land use right arrangement (Code A)	Description (Code B)	Fallow	Manure &Compost	Terrace	Soil Bund	Gully Check	Tree Planting	Shelterbelts	Contour farming	Strip cropping	Live Fence
----------		Have you use in your land? (Write 1=if yes; 2= if no										

Codes: ♦ Ownership arrangement (Code A):1= owner cultivated land, 2=rented-in, 3= rented-out,

♦ Description (Code B): 1= for Yes; 2=for No

IV. Social capital, technological and Health Service access during

Tenure security ranking (Code A)	Description	Are you a member to cooperatives or any associations? (Code B)	Access to credit (Code C)	Do you have land certificate? (Code D)	Have you use agricultural extension services? (Code E)	Have you use health extension services? (Code F)	Have you use agricultural technology (like fertilizer, selected seed….)? (Code G)
	If your answer in Codes (B, C, D, E, F, & G) is Yes = 1; if No = 2						

Code A (Tenure security ranking): 1= feel moderately secure,

2= feel highly insecure

V. Agricultural Input Use Amount & Price (in Local Currency Birr)

UREA (a)		DAP (b)		Seed (c)		Manure (d)		Pesticide (e)		Others (f)		Lobour (in man-days)* (g)				Oxen(in man-days) (h)			
(Kg)	Unit Price	(Kg)	Unit price	(Kg)	Unit Price	(Kg)	Unit Price	Amt.				Family	Hired	Total	Unit price	Own	Hired	Total	Unit Price

- Total farm labour man-days* include total labour man days applied to that specific plot to produce that specific crop production (i.e. it includes steps from sowing to gestation period).

VI. Cash tree crop (like eucalyptus tree) plantation

Eucalyptus tree (area in ha)	Coffee (area in ha)	Mango, avocado, and others (in ha)

Annex 2: Determinants of Diversification in Gozamin district using Logit model

Variable	*Coefficients*	*Marginal Effect (dy/dx)*
Dependent:		
Livelihood Diversification		
Explanatory Variables:		
Hhsex	*0. 5825 (0.4892)*	*0.08615 (0. 0768)*
Lnhhage	*-2.7711**(1.2228)*	*-0.3759**(0.1541)*
vill_leqleq	*-2.5089*(1.4122)*	*-0.4267(0.2482)*
vill_weynma	*-2.9063**(1.1947)*	*-0.5080**(0.1938)*
elem_educ	*0. .3743(0.8468)*	*0. 0471(0. 0947)*
secon_educ	*-2.0936**(0.7374)*	*-0.4180***(0.1562)*
stud_prop	*-1.9091(1.5320)*	*-0.2589 (0.1819)*
lnmrkt_dist	*-22.8685***(6.5343)*	*-3.1022***(0.7624)*
land_ha	*-0.2777 (0. 7686)*	*-0.0376 (0.1068)*
Labor	*-0. 3071 (0.3717)*	*-0.0416 (0.0479)*
land_right	*2.1779**(0.8601)*	*0.4451**(0.1854)*
coop_mem	*1.9734***(0. 6311)*	*0.3254***(0.1099)*
credit_serv	*0. 3253 (0.5848)*	*0. 0441 (0.0767)*
agri_exten	*1.4062* (0. 8411)*	*0. 2485 (0.1691)*
Lnlivestock	*0. 1551(0.4375)*	*0.0210 (0.0592)*
Lnwage	*0.6613 (1.43509)*	*0. 0897 (0.1912)*
_cons	*67.9569***(22.6252)*	*-*
Number of obs = 147 *Wald chi2 (16) = 28.89* *Prob > chi2 = 0.0247* *Log pseudolikelihood = 51.164* *Pseudo R2 = 0.4320* *Figures in parentheses are robust standard errors.* *-vill_addisgult (base) is the reference village* *- noformal_edu is the reference for educational level for household head*		*-dy/dx is for discrete change of dummy variable from 0 to 1* *-***, **, and * indicate significance level at 1%, 5% and 10%, respectively.*

Source: Computed from Own Survey Data