Assessment of factors determine farmers adoption behavior of soil and water conservation practice Libo Kemkem Woreda

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DECLARATION

I, Solomon Birhanu Tadesse Registration Number GSK/0899/04 do here by declare that this thesis is my original work and it has not been submitted partially or in full by any other person for an award of a degree in any other University.

Name of the Participant Solomon Birhanu Tadesse Signature ______Date_____

This thesis has been submitted for examination with my approval as college supervisor.

Name of Advisor______________________ Signature ________Date_________

Approval

The undersigned hereby certify that they have read and hereby recommend to Addis Ababa University College of Social science studies Department of Geography and Environmental studies to accept the thesis submitted by Solomon Birhanu and entitled “Assessment of factors determine farmers adoption behavior of soil and water conservation practices in libo kemkem woreda” in partial fulfillment of the requirement for the award of Maters of Art in Geography and Environmental studies.

Name of Supervisor _______________ Signature________Date_____

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ABBRIVATION AND LIST OF ACRONYMS

ACS	Amhara Credit and Saving Institution
ADLI	Agricultural Development Led Industrialization.
ANRS	Amhara National Regional State
CSA	Central Statistical Authority of Ethiopian
DAs	Development Agents
ETB	Ethiopian Birr
EFWCDP	Ethiopian Forest and Wild Life Conservation and Development Proclamatin
EFAP	Ethiopian Forest Action Plan
FAO	Food and Agriculture Organization of the United Nations
FFW	Food-for-Work
GDP	Gross Domestic Product
Ha	Hectare
HHH	House Hold Head
MOARD	Ministry of Agriculture and Rural Development
PSNP	Productive Safety Net Program
SPSS	Statistical Package for Social Sciences
SWC	Soil and Water Conservation
TLU	Tropical Livestock Unit
PAs	Peasant Associations
VIF	Variance Inflation Factors
WFP	World Food Program

ABSTRACT

Soil is an important resource which provides the required needs for human beings. But its degradation is one of the major environmental problem challenging agricultural production and productivity in many parts of Ethiopia. Even though a number of soil and water conservation methods were introduced and practiced, the study area has been experiencing declining soil fertility. This is due to continuous cropping of farm land, high population pressure, cultivation of highly inclined and marginal lands and absence of continued use of soil and water conservation measures. The main objective of the study was to assess factors that determine the adoption of soil and water conservation practices in Libo Kemkem woreda. The data used for this study was collected via interview, focus group discussion and questionnaire from Household heads, DAs, and Agriculture and Rural Development office. 136 household head sample respondents; 111(81.6%) male and 25(18.4%) female were selected from four kebeles which have different agro-climatic zone. Among them 94(69.1%) were adopters and 42(30.9%) were non-adopters of the introduced SWC practices. The collected data was analyzed by binary logistic regression model, t-test and chi-square tests. The results of logistic regression model showed that sex of HH heads, age of HH head, slope of the farm land, plan of HH heads to continue in farming activities, training and extension services were among the major factors that positively and significantly influenced adoption of soil and water conservation measures in the study area. Whereas, farm size, engaging in off-farm activities and access to credit service were found to be negatively influencing farmers' adoption decision of SWC measures. The odd ratio result indicated that a one year increase in age of the HH heads increase adoption of SWC structures by the factor of 6.244 and male headed HHs adopt SWC structures more than female headed HHs by the factor of 3.254 times. Access to training and extension services made the study area HH heads to adopt SWC structures 1.902 and 6.292 greater times than those HH heads who had not got extension services and training. Having of plan to continue in farming activities and slope of farm land enabled the HH heads of the study area to adopt SWC structures more than those HH heads who had not plan to continue in farming and then those who had not steep slope farm plot by the factor of 1.882 and 8.978 respectively. Whereas an increasing in farm size, engaging in off-farm activities and Access to credit decrease adoption of SWC structures by the factors of (-1.187), (- 1.131) and (-3.416) respectively. From the result of the study it was possible to conclude that sex, age, slope, plan, distance, training, off-farm activities and extension services were the major factors that influenced farmers' adoption of soil and water conservation practices. Thus to effectively address issues of adoption of soil and water conservation practices, it is possible to recommended that, the study area Agriculture and Rural Development office, non-governmental organizations and other concerned bodies should take in to consideration the factors that discourage farmers adoption of SWC measures.

Key words: *Adoption, Soil erosion, Soil and water conservation, Libo Kemkem District*

CHAPTER ONE

INTRODUCTION

1.1. Background of the Study

Soil and water are the most important resources for the existence of human beings and biomass on the earth surface. The whole creations on the earths' surface are depend on soil and water. Therefore, these resources need sustainable use and management to enhance food security. The land resources such as soil, water and forest are under serious degradation due to continuous unwise use of those resources by human beings (Kibemo, 2011).

A serious environmental problem for continuous agricultural output in today's world is Soil degradation. In the last 50 years, 1/3rd of the world agricultural land has been lost by erosion at a rate of more than 10 million hectare per annum (Pimentel, 2006). According to Holden and Awdenegest 2007; Schertz *et al,*. 1989 soil erosion minimize agricultural output by reducing organic content, nutrients, depth and water retention capacity of soils. Eight percent of the world land to degrade and 15% of the production is reduced because of soil erosion. In each year, it removes 75 billion metric tons of soil from agricultural land by water and wind erosion (Hurni, 2009).

The major factors for soil degradation in most developing countries are improper and unsustainable use and management of land (Girma, 2001). Africa is one of the continents highly affected by soil erosion. It affects about 5-6 million hectare of land in each year (Stoking & Murrnaghan, 2001). Continuous cropping for long period of time, rapid population growth, cultivation of steeply and marginal lands, poor soil conservation practices and over grazing are the major causes of soil erosion in Africa (Abera, 2003).

In Ethiopia, soil erosion is a major problem facing farmers that limit their quality to increase agricultural productivity and production (Menale *et al.*, 2008). Therefore, soil erosion is the major cause for Ethiopian low agricultural production, food insecurity and rural poverty. Soil erosion is the result of human, physical and socio-economic factors such as continuous cultivation with little improvement of SWC practices, wide spread use of manure and crop residues for household consumption (Woldeamlak & Sterk, 2002; Aklilu, 2006). According to (Kruger *et al*., 1996) 50% of the high land areas of Ethiopia had affected by erosion. Twenty percent were highly washed away and 4% is seriously eroded beyond recovery. Erosion rate estimated at 130 tons/hectare/year for crop land and 35 tons/hectare/ year for all land in the high lands (Barry, 2003). Ethiopia losses nearly 2 billion tone of fertile soil per annum (Berhanu *et al*., 2009).

As a result, soil and water conservation practice is a key factor for sustainable growth of agricultural sector since the country's economy is highly depends on agriculture. The country has taken different conservation methods to alleviate the problem of soil erosion (Mulugeta *et al*., 2001). In the FFW program benefits, conservation measures on farmlands like construction of soil and stone bunds, terracing, fanaya juu, tree planting and cut-off drain on agricultural areas have been introduced.

In spite of this huge effort that have been demonstrated, farmers construct soil erosion controlling structures with incentives of FFW and destroyed the structures in the absence of incentives. They considered the conservation methods were affects their grazing land and use much space (Bekele & Holden, 1998). Currently, farmers considered the conservation mechanisms as a common activity on farm land but still there are limitations.

Libo Kemkem Woreda suffers from serious soil erosion problem. Implementation of different SWC practices is often proposed as a means to improve production and productivity. For example introduction of the newly soil conservation technology, modification of traditional conservation practices and participation of local community on soil and water conservation practices is believed to be very important to minimize the ongoing soil erosion. This study therefore, aimed to find factors that affect farmers' adoption behavior of the newly introduced SWC structures in the study area and try to recommend possible techniques for proper use technologies. In addition, it helps farmers to have detail information about effect of soil erosion.

1.2. Statement of the Problem

Agriculture is the economic activity and source of livelihoods to the majority of the population in Ethiopia. It usually shares 46% of the GDP, 80% of total employment and 60% of export items (World Bank, 2014). Eighty five percent of the country's population was engaged directly on this sector. But, severe erosion and low agricultural output affect the agricultural sector of the country (Bezabih, 1998).

The Amhara National Regional State is highly affected by soil erosion. Ninety percent of the population settled in the high land part that constitutes 66% of total land resource. Areas that are seriously affected by erosion in Amhara Regiona state are found in Waghemra and North Wollo followed by North and South Gondar, South Wollo and Northern part of North Shewa (Lakew *et al*., 2000). Among the Amhara regional state zones, South Gondar is the one which is seriously affected by soil erosion. According to South Gondar agricultural and Rural Development Department (SGARDD, 2014) annual report, average annual rate of soil loss is 45 tons/hectare/year on cultivated land and 22 tons/hectare/year on grazing land.

Libo Kemkem is part of South Gondar Zone that has been facing a serious challenge of soil erosion and land degradation. According to Woreda Agricultural and Rural Development Office (LKWARDO, 2014) 28% of the total land area is highly affected by soil erosion and more than 65% of agricultural land is prone to sheet, rill and gully erosion due to continuous cultivation for a centuries.

According to Libo Kemkem Woreda agricultural rural extension and expert workers, once SWC practices implemented, the land holders were not keeping and strengthening the structures. Trees and grasses planted on the physical structures were used for grazing purpose after crop cultivation period. Consequently, year after year new soil and water conservation practices are introduced in the study area. Although, the government introduced different conservation mechanisms but the adoption rate was very insignificant. The implemented conservation measures at the study area did not bring significant change in alleviating the problem.

Therefore, it is important to evaluate factors influencing adoption of soil and water conservation technologies. In view of this, the study was attempted to assess sustainable use of SWC measures introduced through a major soil and water conservation program. It also attempted to provide an empirical explanation as to which factors are associated with farmers' adoption behavior of soil and water conservation structures.

In the last years, there was no study conducted specifically to analyze the demographic, socio-economic, physical and institutional factors which promote the adoption of soil and water conservation practices in the study area except a discussion paper and report that was presented on retention of conservation structures. As a result, this study was attempted to assess the demographic, socio-economic, physical and institutional factors that determine farmers' decision on the adoption of physical soil and water conservation structures in the study area.

1.3. Objectives of the Study

The general objective of the study aims: to assess factors that determine the adoption of soil and water conservation practices in Libo Kemkem Woreda.

The specific objectives try to:

- ❖ Identify the physical and demographic factors that influence adoption of soil and water conservation measures in the study area.
- ❖ Analyze the existing soil and water conservation practices in the study area.
- ❖ Examine the institutional and socio-economic factors determine soil and water conservation practices in Libo Kemkem Woreda.

1.4. Research Questions

The main research questions set to address the objectives that are mentioned above were:

- ❖ What are the demographic and physical factors that influence adoption of soil and water conservation measures in the study area?
- ❖ What are the existing SWC structures in the study area?
- ❖ What are the roles of socio-economic and institutional factors on soil and water conservation practices in the study area?

1.5. Significance of the Study

Ethiopian national economy is highly depending on the agricultural sector in many ways. It needs special attention to play a major role in the economic growth of the country by the concerned bodies. However, soil erosion caused by rain water and traditional farming practice are a serious problem for Ethiopian agriculture, particularly in the highland areas.

Therefore, this study may fill the gap in relation to soil and water conservation practices at Woreda level. It may also help the extension workers, DAs and Woreda workers to design effective SWC plan. Even areas that have similar agro-ecological and socio-economic conditions may use the result to end the problems. Moreover, it may also serve as a reference for other studies in the area with similar circumstance.

1.6. Scope of the Study

Geographically, the study was conducted in Amhara National Regional State, South Gondar zone in Libo Kemkem Woreda. It was delimited to assess factors determine the adoption of physical soil and water conservation practices. It is not easy to study the whole aspects such as forests, irrigation system and other environmental protection practices within the available budget, resource and material. Therefore, it was important to restrict the study size and scope of the problem in to a manageable way. So, the scope of the study was delimited to socio-economic, physical, demographic and institutional factors that affect farmers in the adoption of physical soil and water conservation structure.

1.7 Limitation of the study

While conducting this study, there were some limitations that encountered. For example some household farmers were not willing to respond and others did not want to give the required information. On the other hand, the Woreda experts would not be cooperating to give the relevant data.

1.8. Definition of Terms and Concepts

Soil: a naturally occurring, unconsolidated, upper layer of the earth in which plants grow. It is the end product of a complex interaction of climatic, lithological, biological factors.

Adoption: is the process of accepting, implementing and sustainable use of soil and water conservation measures by the farmers of an area through experts and development agents.

Soil and Water Conservation: refers here to the various methods and measure used to regenerate or rehabilitate, preserve, and sustainable use of the soil and water resources to enhance sustainable community livelihood and environmental protection.

Adopters of SWC measures: are those farmers who put into practices a given SWC structures such as terraces (stone bund, soil bund and stone faced soil bund) introduced in their community and practiced in a sustained basis.

Non-adopters of SWC measures: are those farmers who choose not to practice SWC structures or did so but later abandoned them.

CHAPTER TWO

2. LITERATURE REVIEW

2.1. Soil Erosion and its Economic Impact in Ethiopia

During the last 45 years, nearly one-third of the world's arable land has been lost by erosion and continues to be lost at a rate of more than 10 million hectares per year (Pimentel *et al*., 1995). The problem of soil erosion in developing countries is not as parallel as in so called developed countries. Although many countries of the world suffer from the problem of accelerated soil erosion, the developing countries suffer more because of the inability of their farming populations to replace lost soils and nutrients (Erenstein, 1999, Cited in Selamyihun, 2004).

Soil Erosion is one of the most the major environmental problems among various forms of land degradation that poses serious challenge to the food security of the population and future development prospects of the country (Wagayehu and Lars, 2003). Yet, it is not a new phenomenon in the country (Hurni, 1989). It is a direct consequence of the past and the present agricultural practices in the highlands (Kassaye, 2004). The dissected terrain with nearly 70% of the highlands having sloped above 30% and the high intensity of the rainfall the highlands receive contributed to accelerated erosion. Crop production system widely practiced in the highlands of the country such as cultivation of *teff* (Eragrotis tef) and wheat (Triticum Species) which require fine tilled seed bed and single cropping of fields encouraged soil loss via erosion (Belay, 2000; Kassaye, 2004). With increasing population, development of agricultural production increasingly became enhancing land degradation through deforestation and expansion of new land to fragile and erosion prone marginal lands (Wogayehu&lars, 2003).

2.2. Farmers' Perception on Soil Erosion

The study conducted in Awassa District by Awdenegest and Holden (2006) clearly shows that 92 percent of farmers in the catchments were aware of the problem of soil erosion and believed the severity of the problem had increased in recent years and 94 percent of farmers in the catchment were aware of the problem of soil fertility decline.

The most important reasons suggested for soil erosion were: deforestation (66%), no terracing (47%), runoff (42%), no or scarcity of grazing land (17%), high rainfall rates (14%) and steep slopes (13%). From these, one can easily understand that the reason for soil erosion can vary in space (landscape) and time.

2.3. Methods of soil and water conservation practices

There are no universal conservation practices that work everywhere. Planning soil conservation is likely having a large array of techniques and practices set out each in separate. The objective of planning soil conservation is to make up a system by selecting a set of individual item which are each relevant to the condition, and which can be combined into a workable system (FAO, 1986). In Ethiopia the traditional soil conservation has been common since historical times (Hans-Joachim et al., 1996). Yet due to inefficient of traditional methods it was only after the famine of 1970s that many of the activities of soil conservation and resource degradation have been recognized to be a serious problem in high land of Ethiopia. Adoption conservation methods were diversion channels, terraces, stone bund and earth dam which are mainly practiced in high land of Ethiopia. Initially most of the soil conservation works include construction of the stones and earth embankments, which the farmer did not appreciate (Girma, 2001).

In Libo Kemkem Woreda there are soil conservation practices which are implemented today in different part of the Woreda which includes hillside, stone bund, soil bund, trench, and water ways, cut off drains, check dams are the major soil conservation methods.

2.4. Causes for the Failure of Past Soil and Water Conservation Efforts in Ethiopia

Studies conducted in different parts of the country came-up with different factors that explains the low level of success of conservation initiative. These studies attributed the low level of success of the initiative mainly to institutional and technological factors.

2.4.1. Institutional Factors

During planning soil and water conservation intervention, top-down approach was pursued where government officials tell peasant association (*Kebeles*) what to do to get the food aid. This approach gave local people little opportunity for discussion and participation on the initiative (Wood, 1990). The local people did not have a say on the design and their role was limited to provision of labor for the payment they get from the work. This made the local people see the initiative as imposition from the government and additional burden farmers are made to bear (Yeraswork, 1988).

The conservation attempt is linked to food-for-work payment. This made the conservation intervention to be concentrated in areas that are accessible (areas along the major roads). Hence the coverage by the initiative was limited. Between 1978 and 1985 when a massive conservation intervention was underway in the history of the country's soil conservation, only 7% of the highlands were provided with treatment of the conservation work. This made the initiative to be hardly able to address the problem of soil erosion. Besides, farmers construct conservation structures mainly to obtain food payment. This payment made farmers see the conservation measures belonging to the government rather than themselves. This in turn resulted in poor quality of conservation structures constructed on the farmlands. Very often, farmers destroy these structures to obtain additional food for maintaining destroyed structures (Wood, 1990).

2.4.2. Technological Factors

Conservation initiatives that have been launched mainly focused on physical conservation measures. Other conservation measures such as biological and agronomic conservation practices that could have potential to provide incentive for adoption have been overlooked. In addition to this, these conservation measures have not been linked to indigenous conservation measures for which the local people are well acquainted (Pretty and Shah, 1996). The return from these measures was in general negative at least in the short term (Wood, 1990). They take large proportion of area out of production. According to Campbell (1991), introduced conservation measures through bund and terraces took up to 10% of the precious resource of farmers. The proportion these measures take increased rapidly with increasing slope of the field (Belay, 1992). Nevertheless, the benefit these structures increase from infiltration and reduced soil loss do not outweigh the loss of land to conservation works and the reduced yields caused by vermin living in terraces, water-logging and disturbance of the soil profile (Wood, 1990).

2.5. Conceptual framework of adoption of SWC measures

The continued use of new soil and water conservation technologies in developing countries has attracted much attention from scientists and policy makers by knowing agriculture is an important sector in those countries (De Graaff *et al.*, 2008). There are several definitions for the adoption of soil and water conservation activities. Rogers, (1995) has defined the adoption process as "the mental process an individual passes through, from first hearing about an innovation to final adoption."

According to De Graaff *et al.,* (2008), there are three phases in the adoption process: the **acceptance phase**, the **actual adoption phase** and the **continued use phase**. The acceptance phase generally includes the awareness, evaluation and the trial stages and eventually leads to starting investing in certain measures. The actual adoption phase is the stage where by efforts or investments are made to implement SWC measures on more than trial basis. The third phase of continued use or final adoption is the stage in which the existing SWC measures are maintained over many years and new ones are replicated on other fields.

Integrating SWC practices with the system of agriculture is the issue of sustainability for many countries, particularly for developing countries whose economy largely depend on agriculture (Menale *et al.,* 2008; Fikru, 2009). However, the adoptions of soil and water conservation measure are not satisfactory. To these effects, many studies have been conducted in different parts of world including Ethiopia to identify the determinant factors that affect the adoption of soil and water conservation practices. These include: demographic, socio economic, institutional and physical factors (Mulugeta *et al*., 2001; Bekele & Drake, 2003).

In this study, adoption of soil and water conservation is conceptualizing as decision to invest on SWC practices. Therefore to achieve the objective of the research and to address the stated research question a conceptual frame work was developed on the basis of literature reviewed in the above.

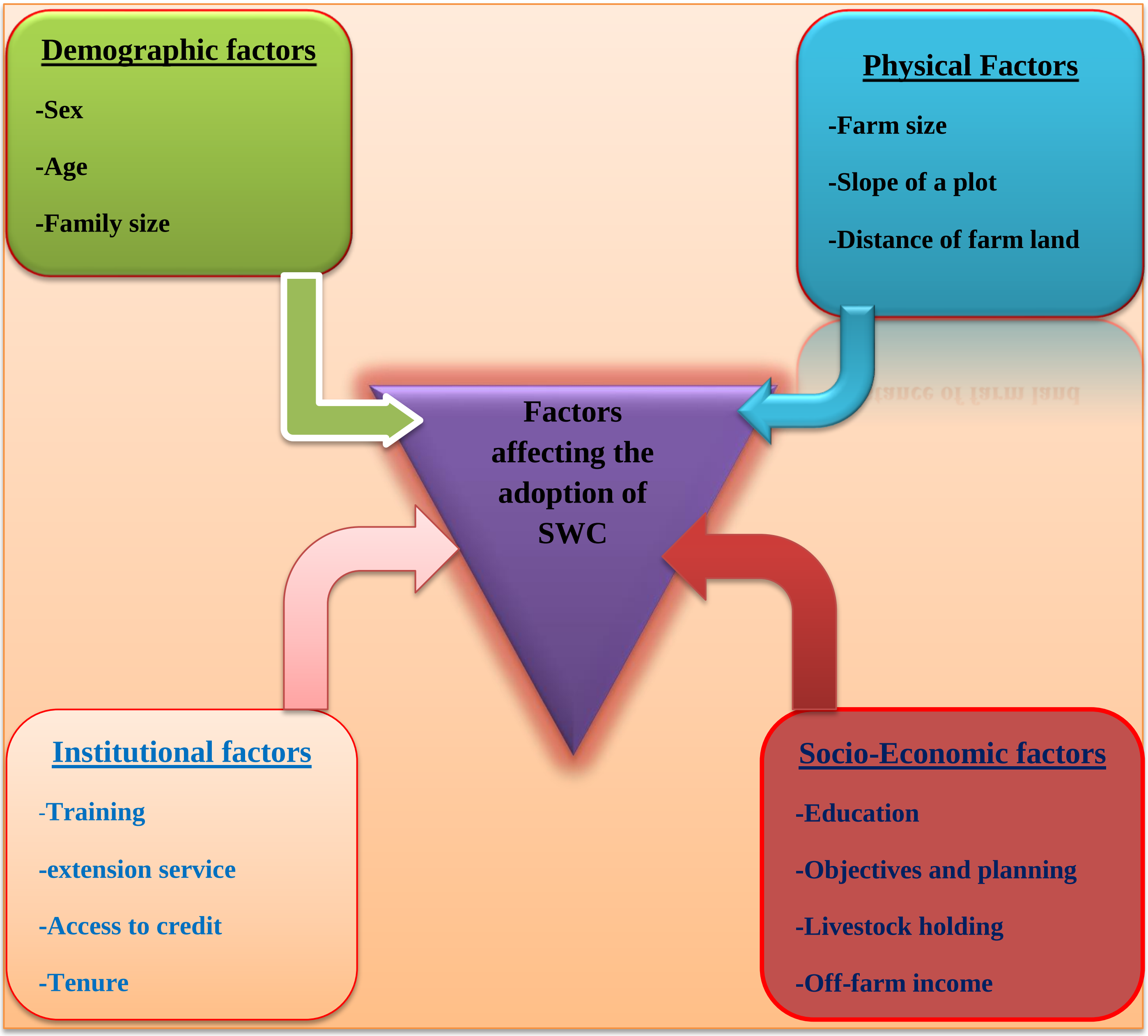

Figure 1 conceptual frame work of the Hypothesized factor that influence the adoption of SWC practice in the study area (Bekele and Drake, 2003).

2.5.1 Demographic Characteristics

Sex of the Household Head: In the researches of Krishna *et al*., (2008) and Eleni, (2008) male headed household heads have a higher chance to be involved in continued use of SWC measures than female headed households because most women spent their time in domestic activities and responsibilities. On the contrary Fikru, (2009) showed that the households headed by women have no significant differences with that of headed by men in their adoption of soil and water conservation technologies.

Age of Household Farmer: According to Mulugeta *et al., (*2001) "young farmers are often expected to invest in soil conservation practices because they often more educated, and as a result, are more aware of soil erosion problems and solutions", therefore age of household and adoption of SWC in general have inverse relationship. The same result obtained by Goulson and Dill man, (1983) as the negative correlation of age and adoption of erosion control practices, it is also true for Bekele and Drake, (2003) because older farmers are more likely to reject conservation practices.

Eeleni, (2008) in her research on solution Ethiopia indicate that age of the HHs heads has negative, but not significant influence on the adoption of SWC technology. On the other hand Chomba, (2004) found the age of HH heads has a positive and significant relation with cut off drain type of soil and water conservation adoption, similar research result is obtained by Fikru, (2009) in research conduct in Koga water shade, North high land of Ethiopia.

Family Size: Physical conservation measures are labor intensive technologies. Studies conducted in Ethiopia indicated that, for installation of recommended physical conservation measures, about 70 and 50 person days per ha for soil and stone bunds, respectively, were estimated to be required (Wagayehu and Lars, 2003). Household size influences the decision of farmers to undertake the conservation measures. Household labor is the whole supplier of the required labor for undertaking the farming and soil and water conservation operation. This was supported by Geoffer (2004), who found that household size was associated positively with adoption of conservation practice. He indicated that, large family size will be able to provide the labor requirement for maintaining SWC practices. Yet, studies conducted in Ethiopia indicated the reverse. Bekele, (1998) and Wagayehu and Lars, (2003) found negative and significant association between household size and adoption of conservation measures. Wagayehu and Lars, (2003) indicated that in the large families with greater number of mouth to feed, immediate food need is given priority and labor is diverted to off-farm activities that generate food.

2.5.2. Physical Factors

Farm Size: Different studies conducted in different parts of Ethiopia reported that conservation measures take 10-20% of cultivation land through embankment and ditches (Compbell, 1991) and land taken out of cultivation increases rapidly with increasing slope (Belay, 1992). This makes the benefit that will be obtained from conserving the soil in small farms to be less likely to compensate for the decline in production due to physical conservation measures (Wagayehu and Lars, 2003). Hence, farmers with small landholding use higher discount rate to compare benefit and cost of conservation treatment and this result in likelihood of dis-adoption decision.

According to (Long, 2003) adopting conservation measures can be expensive and risky as physical conservation measures impose higher cost in terms of the land they put out of production . In addition Chomba, (2004) found the farm size operated to be positively correlated with adoption of SWC practices. Studies made in different parts of Ethiopia also supported the above findings. Wagayehu, (2003) and Bekele, (1998) reported that existence of conservation measures is positively related to landholding size. Belay, (1992) observed that all farmers that rejected soil conservation measures were those that had farm size in the lowest categories (cultivating less than 0.33 ha).

Kessler, (2006) reported mixed results. In his study made in four villages, he found significant positive association in one of the villages but in others, it was not associated positively. On the other hand, Napier, (2001) found, no correlation between farm size and adoption of soil conservation measures. This was also supported by Traoré *et al*., (1998) and he concluded that farmers make soil and water conserving technologies adoption decision irrespective of their farmland size.

Slope of a Farm land: Slope of a field affects the rate and amount of soil loss from fields. This forces farmers to control or mitigate the impact of erosion on fields that are situated in steep slopes and hence slope influences the decision of farmers to undertake conservation measures. Wu and Babcock, (1998) observed frequent conservation practices installed on steeply sloping cultivation fields which reflect the desire of farmers to control soil loss from highly erodible soil. Saliba and Bromley, (1986) observed that farmers cultivating steep slope fields establish more effective conservation measures than farmers that cultivate level fields. Wagayehu and Lars, (2003) and Bekele, (1998) found positive association between existence of recommended type of conservation structures and concluded that slope affects farmers' decision to adopt conservation structures positively. To the contrary, farmers in less erosion prone areas (level fields) do not employ conservation measures on their farmlands. Kessler, (2006) in turn found that more sloping fields do not influence the household's decision of how much to invest in soil and water conservation. Yet, they have influence on decision where to install conservation structures.

Proximity of Farm Land: Farmers residing close to their cultivation land invest more on SWC measures than their counterparts living at distance. This is because cultivation land closer to the residences receives more attention and supervision than land that is situated at the farthest distance. Farmers also want to invest more in the field that require least effort (Kessler, 2006). He also found out that farmers invest more in soil and water conservation in fields situated near to residences. Wagayehu and Lars, (2003) found significant and negative correlation between conservation decision and distance of a parcel from the residence but positive correlation between distance of the plot and adopting conservation decision. They attributed the negative association for land tenure insecurity and the location factor that increases the labor cost due to time spent on travel.

2.5.3. Institutional Factors

Training of SWC: Farmers who know nothing about a practice cannot be expected to adopt it unless they understand its expected costs and benefits. Accurate and timely information has a positive impact on farmers' conservation adoption decision. More informed farmers better assess the impact of soil erosion on long-term productivity of their farmland and adopt SWC practices that help to resolve the problem of soil degradation (Traoré *et al*., 1998). Wagayehu, (2003) in his study indicated that if a farmer receives better information (training) from DAs, they will be willing to construct new SWC measures and to maintain the existing ones. According to the study conducted by Fikru, (2009) farmers cannot adopt technologies if they do not have access to all the relevant information, but the information they are given is often incomplete, focusing only on the technical aspects and overlooking some key criteria from a farmer's point of view.

Extension Service: Farmers who have closer contact with agricultural extension agents are expected to be aware of the severity and impact of natural resources degradation. Therefore, as Chomba, (2004) stated, extension services have positive effect on soil and water conservation practices. The research conducted by Bekele and Drake, (2003) in Ethiopia also indicated that, farmers who receives better information from agricultural extension agents will be agreeable to construct SWC practices. Eleni, (2008) in her study conducted in southern part of Ethiopia was come up with difference result. In similar conduct, (fikru 2009) stated that extension service provision to farmers have no significant effect on the adoption of SWC technology.

Access to Credit: It is the availability of credit from micro-finances. The access to credit systems increased farmers' ability to invest on his/her land. The research conducted by Bekele and Drake, (2003) in Eastern high lands of Ethiopia indicated that credit services for inputs and consumption helps to increase the adoption of conservation measures by farmers. Krishna *et al*., (2008) also found similar result. Accordingly the use of credit motivation for farmers to produce more cash crops and getting of more income led them to a better implementation of SWC measures. In contrary to the above study, Eleni (2008) concludes that access to credit is not the main factor affecting the adoption of soil and water conservation practices, because farmers who obtained money from credit may use it for purposes other than SWC practices.

2.5.4. Socio- Economic Factors

Education Status Household Heads: represent the level of formal schooling completed by the HH heads (Mulugeta, *et al*., 2001) and he founded that level of education has strong influences towards the adoption of any kind of technology, with the same manner, Krishna *et al*., (2008) and Fikru, (2009) indicate that, better education level of the HH heads has strong and positive relationship with their adoption of SWC because of their ability to find new information and their understanding of new technologies. Research conducted by Yohannes, (1992), Pender and Kevr, (1996) reveal that, level of education of farmers has positive effect on adoption of soil and water conservation practices. On contrary, the finding of Eleni, (2008), shows that there is no significant correlation between education level and adoption of soil and water conservation measures. She explains the reason for this is positive and significant correlation between education and off- farm activities.

Household Objectives and Planning: Farmers who plan to continue as a farmer are more concerned with maintaining the productivity of soil compared to farmers who intend to leave farming in the near future. A longer planning horizon tends to encourage SWC decisions by increasing the present value of expected net return and by allowing sufficient time to recoup conservation investment (Lee and Stewart, 1983). Thus, individuals cultivating land exhibiting similar land characteristics may reach different conservation decision depending on their planning horizon and individual time preference or discount rates. Gould *et al.,* (1989) predicted positive association between farmers planning to be fulltime farmer and adoption of conservation tillage. On the contrary, Kessler (2006), found no association between expectation of future stay in the village as a farmer and adoption of conservation measures.

Livestock Holding: Livestock is generally considered to be an advantage that could be used either in the production process, or be exchanged for cash or other production asset. It is also considered as a measure of wealth and increased availability of capital that makes investment in SWC practices (Geoffer, 2004) . Bekele, (1998) found positive association between livestock holding and adoption of SWC practices in the central highlands of Ethiopia although the association was not significant.

On the other hand, Wagayehu and Lars, (2003) found the reverse and negative association between livestock holding and decision to undertake conservation measures. Saliba & Bromley, (1986) attributed the low association to the fact that the less erosive nature of crops grown by dairy farm (for example, pasture and forages) and concluded that this reduces the expected long-term return from adopting conservation structures.

Off-farm Income: Increasing dependence on non-agricultural activities reduces the economic significance of soil erosion. This is because involvement in off-farm activities crowds out resources (time, labor, interest) required for installing and maintaining the SWC measures. Gould *et al.,* (1989) found negative relation between proportion of off-farm income and adoption of minimum tillage. The finding of Bekele, (1998) also supported the above finding and he predicted negative association between farmers' decision to retain conservation structures and proportion of off farm income. Nevertheless, Chomba, (2004) and Kessler, (2006) found that income from off-farm activities does not have influence on household's decision to invest in SWC measures.

2.6. Challenges and determinant factors of Adoption of Soil Conservation Measures

Lynne et al., (1988) on their study on attitude and farmers conservation behavior stated that factors such as income and nature of terrain affect conservation behavior. Farmers' attitude influences the amount of effort exerted in conservation. The author also suggested other factors including attitude towards investment risk, extension, education and percentage of cultivated land affect conservation decision. A study conducted by Wogayehu (2003) on soil and water conservation decision behavior using multinomial logic analysis showed that, plot area and slope, access to information, and project assistance have positive and significance influence on conservation decision.

2.7. Factors influencing the adoption of soil and water conservation

The problem of sustainability concerning to soil and water conservation practices with the system of agriculture is the issue of many countries, particularly for developing countries whose economy largely depend on agriculture (Menale *et al.,* 2008; Fikru, 2009). In response to the high demand of improving the productivity of farmland many countries including Ethiopia are engaging massive soil and water conservation works despite the fact that the adoption of soil and water conservation measure are not satisfactory. To the effect, many studies have been conducted in different parts of world including Ethiopia to identify the determinant factors that affect the adoption of soil water conservation.

In order to identify the prominent factors researcher employed different research methodology. Fikru, (2009) in his research employed econometric analysis model, particularly tobit regression model was used to analysis the data obtained both by primary and secondary data collection techniques for Koga Water shade. The above mentioned and other Studies identified features which determine the adoption of SWC measure for analysis. These were demographic, socio-economic, institutional and physical factors (Mulugeta *et al.,* 2001; Bekele and Drake, 2003; Tenge *et al*., 2003; Eleni, 2008; Fikru, 2009

CHAPTER THREE

RESEARCH METHODOLOGY

3.1. Description of the Study Area

3.1.1. Geographical Location

In the Amhara Regional State, Libo Kemkem is one of the Woredas in south Gondar at the North West part of Ethiopia. The town of the woreda is located 645 kilometers from Addis Ababa and 85 kilometer from the regional city of Bahir Dar. Astronomically, it is located at 37^{o}15‘36” E to 38^{o}06’36” E of logittude and 11^{o}54‘36” N to 12^{o}22‘48” N of latutude. Kemkem is bordered on the North by Semien Gondar Zone, on the South by Rib River which separates it from Fogera Woreda, on the West by Lake Tana, and on the East by Ebinat Woreda. The elevation of the woreda ranges from 1800-2850masl (woreda communication office, 2015).

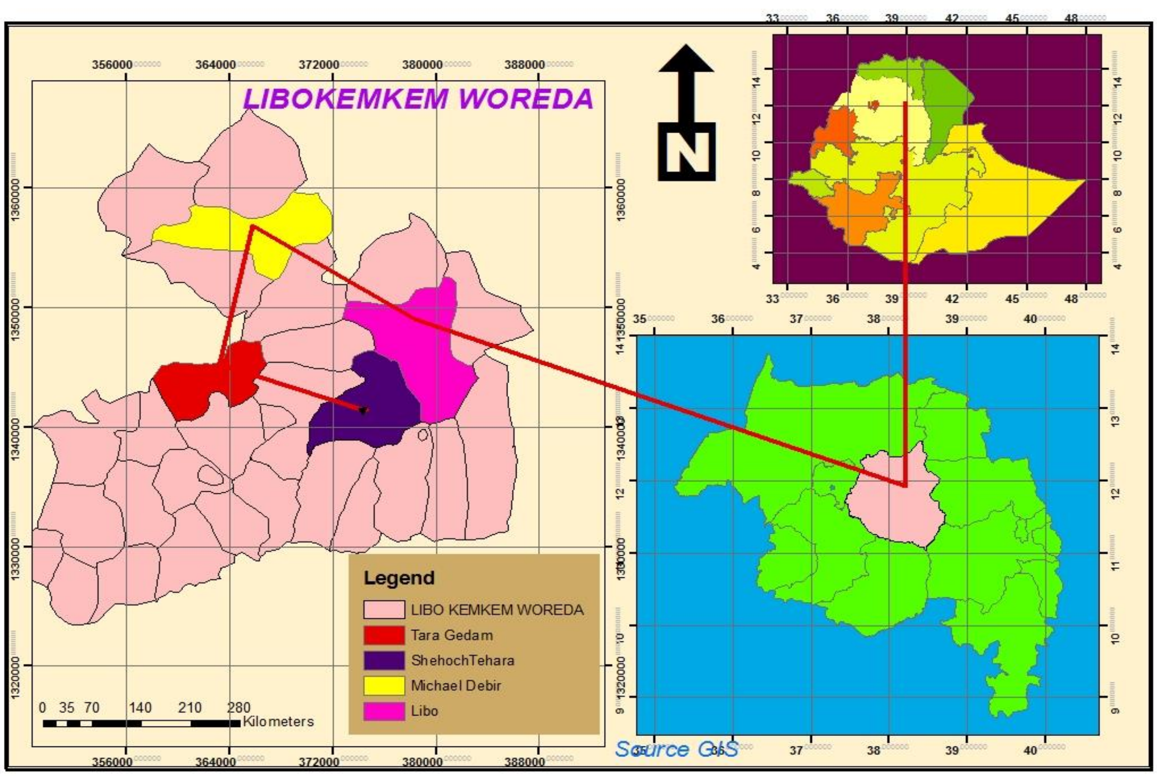

Figure 2 map of the study area

3.1.2 Climate

The agro-climatic zone of the Woreda consists 78% is Woina dega and 22% is Dega. The study area has uni-modal type of rain fall with mean annual rainfall reaches 1300mm per a year. Accordingly, it has two rainy seasons these are Kiremt and Belg. Mostly the rain received during June –September and has short rainy season from March- May. The mean annual temperature of the study area for the past ten years was 19^0c and the highest temperature received during February, March and April.

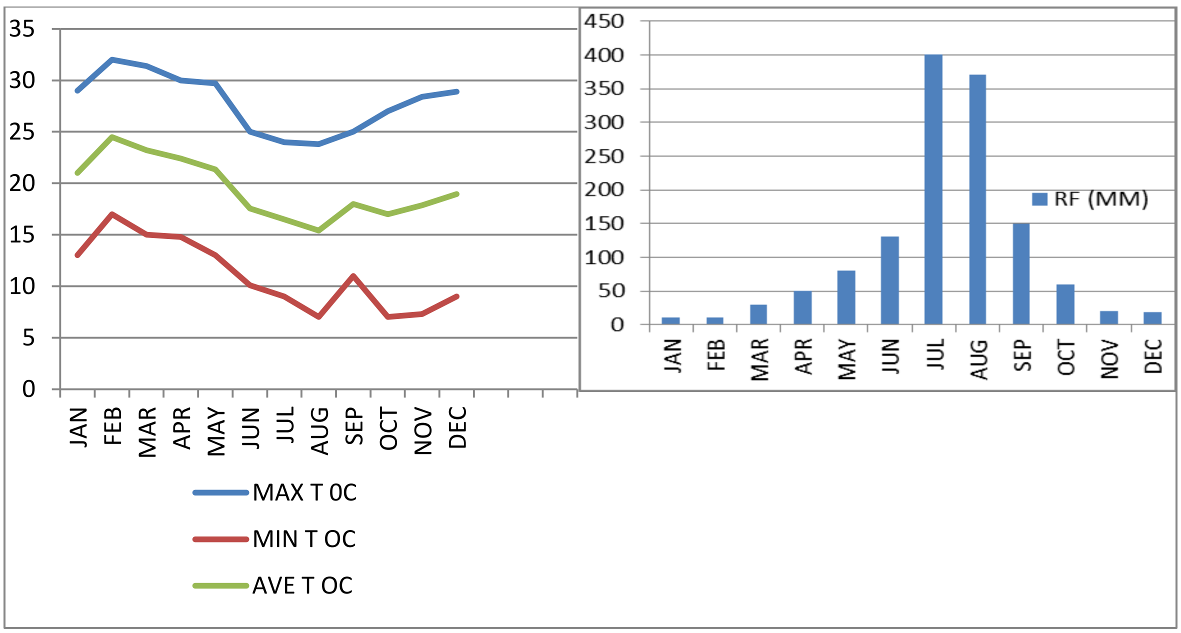

Figure. 3. Mean, maximum, minimum temperature and average rain fall distribution of Libo Kemkem (2005-2015)

(Source: Bahir Dar meteorology station2014/15)

3.1.3. Geology and Soil

The geology of the study area is mainly characterized by Basaltic rocks and Pyroclastic rocks, unconsolidated Pyroclastics (e.g. Ashes, Pumices, and Scoriae) and consolidated pyroclastics (e.g. Tuffs, ignimbrites) and also few parts of the study area is characterized by undifferentiated unconsolidated sediments (FAO SEA, 1997). The soils of the study area are predominantly Leptosols, Nithosols, Vertisols and Luvisols. Libo Kemkem is characterized by plain, mountainous, ups and down, depression and swampy areas which account 42%, 21%, 30%, 1% & 6% respectively. Arno and Rib are the major rivers in the Woreda which drain in to Lake Tana. A survey of the land in this Woreda shows that 51% is cultivated land, 8.3% is pastural land, 5.9% forest or shrub land, 17.98% covered with water and 17.3% is considered as degraded part (WADO, 2014)

3.1.4. Land use and land cover

According to the Woreda environmental protection, land administration office annual report (2014), the total area of the Woreda is about 108,157 hectares. Areas covered by bush, shrubs and natural forests are found in the mid latitude areas and specifically around the church. The general land management described as follows

Table 3.1 land use and land cover in Libo Kemkem Woreda

No	Land use	Area/hectares/	%
1	Cultivated land	55,313.07	51
2	Grazing land	8,969.6	8.27
3	Forests	6,398.9	5.9
4	Water body	19,500.9	17.98
5	Construction and other services	6507.4	6
6	Others	11767.6	10.85
Total		108,457	100

Source**:** *LKWARDO(2015)*

3.1.5. Population and Socio-Economic Conditions

According to CSA (2007), the total population of Libo Kemkem Woreda is estimated 198,435 of which 100,987 are male and 97,448 are female. From this, the urban population is 22,054 and rural population is 176,381 with a total of 45,399 households. Libo Kemkem Woreda has an estimated population density of 198.49 persons per square kilometer and average family size is 4.37. The *woreda* is totally inhabited by Amhara people and predominantly (96.19%) are followers of the Orthodox Christians and (3.69%) are followers of Muslim faith. The most important social and economic problems are the pervasive poverty and the high population growth rate with declining agricultural production.

The economic bases of the community in the *woreda* were the rain fed and irrigation farming practices and free range livestock rearing. Mixed agriculture remains to be the main livelihood activity. The dominantly growing crops in the study area include wheat (Triticum sp.), potato (Solanum tuberosum), barley (Hordeum sp.), teff (Eragrostis sp.), sorghum (Sorghum bicolor), bean (Vicia fabia), peas (Pisum sativa), Onion (Allium Cepa), Tomato (Solanum Lycopersicum) and maize (Zea mays). The average household land holding size was 1 hectare. Agriculture is an important livelihood resource that plays significant role to household sustenance, income generation. Cattle, sheep, goat, pack animals and poultry are the most common domestic animals raised in the rural area (LKWARDO, 2015). In addition there is the production of honey in the study area.

The socio-economic and political center (zone) of the Woreda is Debre Tabor. There are also other socio-economic and political centers in the Woreda are Addis Zemen, Ambo Meda, and Yifag. During the market day, the people from different localities come and exchange agricultural products, manufactured goods, clothes, different animals etc. In order to put in practice the socio-cultural activities and to solve problems, the community has different traditional social and cultural organizations like Mahiber, Eder, Ekub and Yehager Shmaglie.

3.2. Research Methodology

3.2.1. Research Design

This study is a descriptive research type for the investigation of factors determines the adoption of SWC practices in the study areas. Four Kebeles were selected randomly based on their agro-ecological location. This is valid, to identify the physical and demographic factors which influence adoption of soil and water conservation measures, to analyze the existing physical and biological soil and water conservation practices and to examine the role of institutional and socio-economic factors affecting soil and water conservation practices in the study area the research design include focus group discussion with 1 kebele administrator,1 religious leader, 1 land administrative expert, 2 farmers which has acceptable in the kebeles and 3 development agents totally 8 participants.

3.2.2 Research method

Both qualitative and quantitative data collection and analysis techniques would be employed to achieve the research objectives. Quantitative research is all about quantifying the relationships between adoption of soil conservation technologies, variables and factors affecting SWC practices such as age, sex, educational level, family size, farm size, distance of farm size, slope of farm land, extension services, access to credit and others. The qualitative data would be used to strengthens and bridge the gap of quantitative data.

3.2.3. Sampling Technique and Sample Size Determination

In this study, Libo Kemkem Woreda were selected deliberately by the researcher because of his familiarity with the area, experience to the problem of soil erosion and low adoption of physical soil and water conservation practices. The study would be use multi-stage stratified sampling procedure as the major method of sampling to select the sample household heads. The study area was stratified into Dega *(22%)*, Woina Dega *(78%)* agro-ecological strata.

Libo Kemkem Woreda has a total of 34 Kebeles, 5 of them are Urban and 29 are Rural Kebeles. From this rural kebeles, 6 Kebeles are found under Dega climatic zone and 23 Kebeles are under Woina dega agro-climatic Zone. Two Kebeles from Woina Dega (Tara Gedam and Shehoch Tehara), two Kebeles from Dega (Libo and Michael Debir) and a total of 4 kebeles were randomly selected from each class for this study.

To identify sample respondents' household farmers from each sampled Kebeles, systematic sampling technique will be employed. After selecting the sample Kebeles, researcher will try to determine the sample size using the formula of (creative research system, 2012).

The formula given as:

$$S = \frac{Z^2 \times P\,(1-P)}{C^2}$$ for unknown sample

Where: S= sample size

Z^2= value of Z score square at 95% confidence interval (1.96

P= sample proportion (% picking choice expressed as a decimal (0.1%) of the.

C^2= confidence interval expressed as a decimal square (0.05^2)

$$S = \frac{1.96^2 \times 0.1\ (1-0.1)}{0.05^2}$$

$$S = \frac{3.8416 \times 0.9}{0.0025} = 138.2976.$$ So a total of 138 samples were selected proportionally

After the researcher determine the unknown sample, the following formula will be used to calculate the known sample where family size of the kebeles is collected.

$$SS_{kp} = \frac{S}{1 + \frac{S-1}{P_k}}$$

Where: SS_{kp}= sample size for the known population

S= sample size for the unknown population

P_k= Known population size from the sample size is calculated.

Therefore, $$SS_{kp} = \frac{138}{1 + \frac{138-1}{8208}}$$

$$SS_{kp} = \frac{138}{1.016691033}$$ =135.73. Totally 136 samples were include under the study.

Table 3.2. Number of respondents in each of selected agro-ecological zone of Kebele's was

No	Sample rural Kebele's	Agro climate Zone	Total household heads	Total number of adopter	Total number of nonadopter	Total sample size	Sample size of adopters	Sample size of non-adopter
1	Libo	Dega	2215	1729	486	37	29	8
2	Tara Gedam	W.Dega	1760	1266	494	29	21	8
3	Michael Debir	Dega	2493	1851	642	41	25	16
4	Shihoch Tehara	W.Dega	1740	1169	571	29	19	10
Total			8208	6015	2193	136	94	42

(Source: LKWAED, 2015)

3.2.4. Data Source and Data Collection Method

Since the type of research is descriptive which use quantitative and qualitative approaches. To realize the stated objectives of the study and to address the research questions different data would be collected by using different data collection techniques.

I. Primary Data Sources and Collection Methods

Household farmers would be the main primary sources of data in the study. In addition to Kebele Administrator, Woreda agricultural experts, zonal soil and water conservation supervisors, DAs are the targets. Therefore, the primary data would be gathered through observation, survey method (questionnaires), focus group discussion and in depth interview of key information.

Field observation: An intensive filed survey was carried out to get detail information to understand biophysical and major terrain features such as topography, erosion status, and soil and water conservation practices such as (stone bund ,soil bund, Stone faced Soil bund, Cut of drain, Check dam and Water way). This field observation was help full to acquire use full information which would had been difficult to collect through the questionnaire and other methods of data acquisition.

Questionnaires: was a typical method to collect primary data from the sample households. A structured interview questionnaire that had involved both closed ended and open ended questions were prepared and used to generate data from the respondents. The questionnaire was translated into the local language (Amharic) to make the question simple, clear and understandable to the farmers/respondents. Household survey was conducted through face to face interview of the respondent and enumerators. Household heads were appropriate respondents for the questionnaires designed for the survey.

The survey questions covered a wide range of information which includes the cause and consequences of soil erosion, household characteristics such as (age of household heads, sex, education status, family size and HH heads plan to continue as farmer); socio-economic conditions of households (livestock holding and off-farm income); institutional factors (training about SWC, access to extension services, access to credit) and physical factors (farm size, slope of a parcel, and proximity of farm land).

In-depth Interview of key informants: was additional method that was used to collect primary data. It was used to collect in-depth information about soil and water conservation practices, supports of government in the adoption SWC measures and their perception about the problem. The information gathered through key informants' was used to harmonize and supplement the data collected from household survey through structured questionnaire. Interview was conduct with key informants such as elder people who have had lived and worked for long time in the study area, kebele leaders, SWC supervisors and Development Agents (DAs).

Focus group discussion (FGD): was another most important data collection technique used to collect qualitative data by preparing discussion questions related to cause, and consequences of soil erosion, perception and implementation of farmers towards SWC practices. FGDs were held with selected model farmers of the sample kebeles, religious leaders, agriculture extension workers and SWC supervisors. There were two focus groups. Each group had eight (8) members who were selected purposefully for the study. The farmers were selected based on their perception levels of soil erosion, plot location, soil and water conservation practices and continues use of their farmland.

II. Secondary Data Sources

Secondary data were also gathered from certain secondary information sources. Secondary sources included published and unpublished information about agricultural production, soil and water conservation activities, and statistical data about physical and socio-economic conditions of the study area. The information was collected from regional, zonal and woreda level of agricultural and information and communication offices. These were books, articles, records, journals, reports.

3.2.5. Methods of Data Analysis

The study would be using both quantitative and qualitative data analysis techniques. Concerning to the quantitative data analysis, after the data were gathered through survey questionnaire, it would be coded, edited and entered in to the statically package for Social Sciences (SPSS) version 20 software where descriptive statistics, frequencies, percentages, chi-square test, T-test, mean, standard deviations and binary logistic regressions are computed for the analysis.

T-test is employed to know the relationship between the dependent and independent variables. That was helpful to compare adopters and non-adopters of soil and water conservation measures with respect to continuous variables such as age, farm size, farm slope, farm distance and number of livestock farmers owned. Chi-square test also used to show degree of relationship between the adoption decision of farmers and the categorical explanatory variables such as sex, education status, access to extension service, and off-farm activities.

Furthermore, the binary logistic regression model is used because the dependent variables are categorical. It would a dummy variable, which takes a value of zero or one depending on whether or not a household is to adopt soil and water conservation measures. Therefore, binary logistic regression model were used to identify the determinants of adoption of soil and water conservation measures and to assess their relative importance in determining the probability of being an adopter of soil and water conservation measures. Based on survey data demographic, physical, socio-economic and institutional characteristics of sampled households were described with respect to adoption of soil and water conservation measures. Odds ratio with 95% confidence interval would be calculate to assess the association and measure the strength of the association between explanatory and outcome variables. The data which were obtained from interview, focus group discussion and field observation would be analyzed qualitatively (textually) to supplement the survey questionnaire.

3.3. Hypothesis of the Determinant Variables under the Study

Studies made on farmers' adoption of soil and water conservation measures/ adoption theories provide long list of factors that influence farmers' decision. These studies indicated demographic, socio-economic, physical and institutional factors influence the adoption of SWC measures. The lists of independent variables which include both categorical and continuous were expected to influence households' adoption of SWC structures. The following independent variables were entered in logistic regression model.

Sex of household head (Sex): (a dummy variable where F=female, M=male): sex of a household head is hypothesized to have an effect on adoption of SWC measures. Male headed households have the strength to construct soil and water conservation measures than female. Thus, sex may have positive relationship with adoption of SWC structure.

**Age of household head (Age)*: (*a continuous variable): This is number of years of the household head since birth at the time of the survey. According to most of the previous studies, as age of a household head increases, he/she becomes unwilling to retain conservation structures at most. Hence, it is hypothesized that age and adoption of conservation structures to be correlated inversely.

Educational Status of the household head (Educ): (a dummy variable where 1= illiterate, 0= literate ;): This is educational attainment of the household head. It is expected that those farmers with better educational attainment perceive the problem better and make decision to retain conservation structures. Hence education status of HH is expected to be positively significant with adoption of SWC structures.

HH Family size (Family size): *(*a continuous variable*).*This is number of household members living together. The influence of household size may go either way. As maintaining soil and water conservation structure is labor intensive, if household labor is the only source of labor, households with larger household size make decision to retain structures. On the contrary, in the families with large number of mouth to feed, most of household members can be engaged in other food generating activities and hence fail to make decision to maintain and retain conservation structures. But in this study it is hypothesized that family size has positively significant relationship.

Plan of a farmer to continue in the farming career (Plan)*:* (a dummy variable where N, if the household head does not have to plan, Y otherwise): This is a dummy variable which represents whether the household has a plan to continue in farming for the next five years or not. Farmers that have plan to leave farming career in the next five years have short planning horizon than those that plan to continue and may not be interested to invest in soil conservation. Therefore, plan to continue in farming is hypothesized to be significant positively.

Soil and Water Conservation training (Training); (Dummy variable, N if the household did not take part in trainings of SWC; Y otherwise***):*** Farmers, who attended trainings, can have the required information and perceive the problem of soil erosion very well. Thus, this variable is hypothesized to influence adoption of conservation structures positively.

Access to credit (**Credit**): (a dummy variable Y, if the household has access to credit and N if not): It is the availability of credit from micro-finances. The access to credit systems increased farmers' ability to invest on his/her land. Thus, it is hypothesized that access to credit has positive relationship with adoption of soil conservation technologies.

Farm size (farmsize):(a continuous variable):This refers to total area of land a household cultivates and measured in ha. Farmers having large farm size can bear risk of loss of cultivation land from conservation structures and hence expected to influence adoption of structures negatively.

Slope of the cultivation field (Slope): (Slope of land a household cultivates, 1, if flat; 2, gently slope; 3, moderately sloping; 4 steeply sloping). This is slope category of cultivation field according to how farmers in the study area categorize slope of the cultivation land. It is expected that slope influences farmers' decision to retain conservation structures positively. Soil erosion becomes intensified with increasing slope of the cultivation land. The steeper the slope, the more likely the land might exposed to erosion. Hence, it was hypothesized that adoption tends to be likely on steeper slopes.

Distance of farm land from residence (Farmdist): (Dummy, 1 if the household perceives cultivation land to be near to his residence, 2 if the household perceives the distance to be medium;3, if the household perceives the distance to be far). This represents how far the parcel is situated from the residence according to the ratings of farmers. According to most of literatures, farm lands situated near the residence receive attention of farmers better. Following this, it is hypothesized that distance influences farmers' decision negatively.

Livestock holding (TLU): (a continuous variable); It is total number of live stocks in TLU equivalent the household owns. Previous studies came up with mixed results and farmers' decision to retain conservation structures may go either way. But in this study it is hypothesized positively.

Off-farm activities (off-farm): (Dummy variable 1, if a household is not involved in off-farm activities; 0, otherwise): This is a dummy variable representing whether the household has involved in off-farm activities or not. Involvement in off-farm activities crowds out resources required to construct and maintain conservation structures. Therefore, negative association is expected between involvement in off-farm activities and decision to adopt conservation structures.

Access to extension services(ExtenServ): (Dummy variable Y, if a household have access to extension service; N, otherwise) **.**The importance of well-designed and participatory extension service in the adoption of conservation practices cannot be underestimated, especially in communities where soil and water conservation programs were forced on farmers. Access to extension service is expected to have positive relationship with adoption of SWC structures.

CHAPTER FOUR:

RESULT AND DISCUSSION ON FACTORS DETERMINE SWC PRACTICES

Soil erosion is a naturally occurring process. It can be a slow process and then continuous at alarming rate that affects all land form. In agricultural land, soil erosion refers to the removal of top soil by wind, water and forces related with farming activities such as tillage. Crop growth and production are directly affected by the loss of natural nutrients and fertilizers applied on farm lands. Similarly residues, manure, organic matter and pesticides are readily transported off, seeds can be removed, sediments can also be accumulated on down slope, soil stability, structure, texture and quality can be highly affected. More than 90% of house-hold respondents argued that soil erosion is a major problem facing with and their farm lands were exposed by erosion in the study area. The T-test analysis described that, the adopters and non-adopters had no significant difference in the perception of soil erosion as a problem.

4.1. Major factors of soil erosion and soil-water conservation practices

As can be seen from fig 4.1 both natural and human drivers are the major factor that contributes for the prevalence of soil erosion. More than 37% the respondents identified heavy summer rain as one of the main agent of soil erosion, 34.56% of the respondent indicates that intensive cultivation for long time and 15.44% of the respondents believed that removal of vegetation cover were the major cause for soil erosion. 8.8% and 3.6% of the house hold farmers responded that lack of knowledge and expansion of margins also contributed for the emergence of soil erosion in the study area respectively.

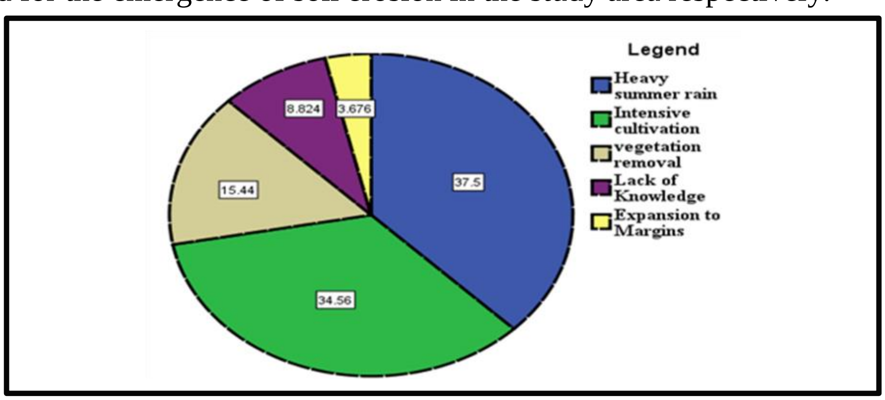

Figure: 4.1.Major factors that contribute to soil erosion in the study area

In addition, participants in focus group discussion and interview were asked to evaluate the susceptibility of their farm land for soil erosion. Accordingly more than half of them argued that, their agricultural land is highly susceptible to erosion.

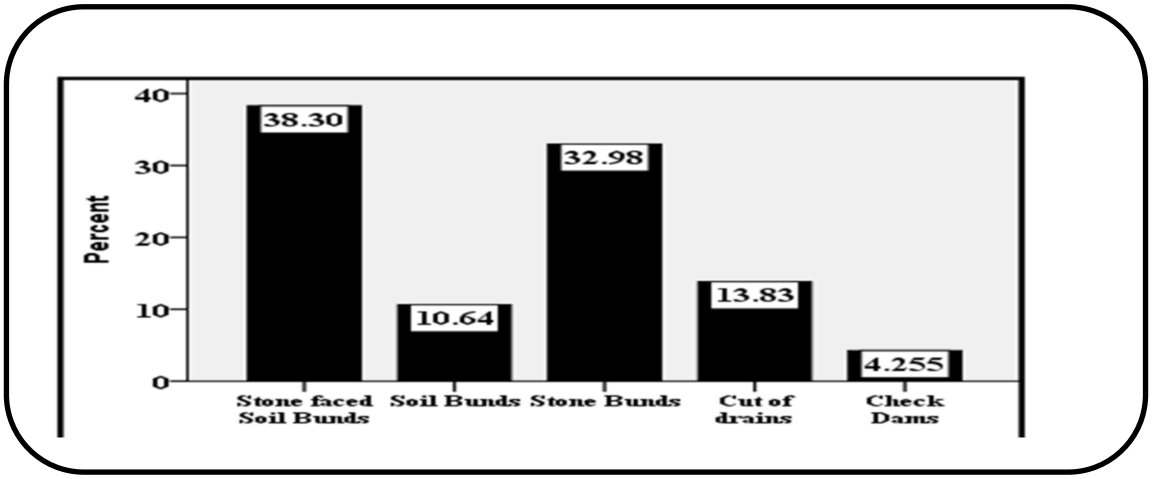

Figure: 4.2. SWC structures practiced on the farm land of the study area

Soil-water conservation practices were developed with the aim of increasing food security through increasing agricultural production and productivity, conserving and restoring degraded agricultural land (Adbacho, 1991). Based on field observation, focus group and interview made with key informants, most farmers in the study area practiced different type of SWC strategies. Soil bund, stone bund, stone faced soil bund, water way, check dam and cut of drain were the major type of conservation methods that were held in the study area.

As indicated in figure 4.2, 38.3% of the total respondents used stone faced soil bund, while 32.98% practiced stone bund, 13.83% used cut of drain, 10.64% practiced soil bund and 4.25% of the house hold farmers were practiced check dam on their agricultural land.

4.1.1. Stone faced soil bunds

Stone faced soil bund is an embankment constructed partly from stone on down slope side for reinforcing the structure and partly from soil along the contour. It is constructed in agricultural lands with a slope ranging from 3% - 30% gradient (MoARD, 2010)

According to the sample house hold respondents (figure 4.2), 38.3% constructed stone faced soil bund are employed in increasing productivity by minimizing run-off and reducing slope steepness.

Figure 4.3. Stone faced soil bund structure of the study area

4.1.2. Stone bund

Stone bunds are stone embankments constructed across the slope to slow down runoff and to retain sediments on their upslope. The purpose is to reduce soil erosion from the farm land and conserve soil moisture and their by improve land productivity. These structures are recommended to be constructed on the farm land with slope ranging between 3% up to 30% (MoARD, 2010).

According to the collected data, 32.98% of the respondents indicated stone bund conservation practice are used to maximize productivity by reduce loss of soil and conserve soil and moisture. The local farmers employed such structures in areas where there are enough amounts of stone (Figure 4.4). The focus group participants stated that, construction of stone bund contribute in alleviating soil erosion on their farm land. But most households were not voluntary to build stone bund since the conservation structure reduce the extent of the farming land, hinder grazing, oxen plowing and harbor pests.

Figure 4.4. Stone bund structure of the study area

4.1.3. Cut of drain

The cut-off drain is an open channel aided with embankment on their down slope position. This type of conservation method were constructed across a slope to intercept runoff coming from higher ground areas, which is finally entered in to a natural or anthropogenic water ways. However, according to the perception of respondent, the traditional cuts off drain structures create soil erosion after some years. As proofed by in depth interview and group discussion, the cutoff drains initiate the development gullies.

Figure 4.5 cut off drain of the study area

4.1.4. Soil bund

Soil bund is constructed with water collection channels at the upper side of the farmland along the contour. By reducing the slope length, it protects farm land from run-off.

Mainly soil bunds are constructed in fields that have slope of less than 10%. This method is important in controlling soil loss, enhancing soil moisture retaining capacity and ultimately increasing productivity of farm land (WFP, 2005).

According to the survey, 10.64% of house hold respondents said that, the implemented soil bund on their farm land used to increase soil fertility by protecting soil erosion and collecting rain water (figure, 4.6).

Figure 4.6 soil bund of the study area

4.2 Demographic, Socio-Economic, Institutional and Physical Characteristics of the respondents and adoption of soil and water conservation practices

4.2.1 Demographic characteristics

Sex: The total numbers of sample households used for this study were 136. They were categorized into non- adopters 42 (30.9%) and adopters 94 (69.1%). From the above sample households, 111 (81.6%) were male and 25 (18.4%) were female household heads (Table 4.1).

Based on the survey, 92.5% of the adopters were male headed households and 7.5% were female household heads. On the other hand, out of the non-adopters 57.1% were male and 42.9% were female headed households. Chi-square tests at 0.05% of level of significance were taken to understand the degree of assosiation between sex and adoption of SWC practices. Accordingly, there was significant relationship between adoption of SWC practices and household head sex at [x^2= 24.261(df=1,136, P=0.01)]. According to focus group discussion there were limited participation of women in the adoption of

SWC practices and had limited access to information. They were highly involved in regular household activities than men.

Eleni, 2008 and Krishna *et al.,* (2008) in their research stated that, male household heads had more chances to involve in SWC practices than female household heads. This is because most women in the study area spent their time in domestic responsibilities and activities.

Table 4.1 association between sex of Household heads and adoption of SWC practices in the study area

Sex of HH	Frequency	(%)	Adopters		Non -Adopters		DF	Chi-square test	
			N	%	**N**	%		X^2	P-value
Male	111	81.6	87	92.5	24	57.1	1	24.261*	0.000
Female	25	18.4	7	7.5	18	42.9			
Total	136	100	94	100	42	100			

Source: survey result, 2015 * significant at 0.05 significant level

Age: household age is one of the most important demographic characteristics for farmers' adoption of SWC practices. The awareness about soil erosion and controlling mechanisms is influenced by age. The respondents had an average age of 41.9 years with a standard deviation of 10.6. The majority of the headed households (53.7%) were found between 40 -59 years. There was a difference in age between adopters and non-adopters of SWC practices. The mean age of the non- adopters were about 41 whereas the adopters were about 42 years. The majority of the non-adopters (47.6%) were young aged between 20 -39 whereas the adopters (60.6%) were aged between 40-59 years old. This shows that adult household heads were more likely to adopt SWC measures than young.

The analysis of the chi-square test at 0.05 level of significance [x^2= 6.116*(df= 2, P=0.047)] indicated that, there was a significance relationship between age and adoption of SWC practices. The result obtained from the FGD and in-depth interview explained that elder farmers had better experience in the adoption of SWC practices than young age group.

Similarly, Chombo (2004) and Kebede *et al* (2013) explained that the age of the respondents had a significant relation with the adoption of soil and water conservation practices. Fikru (2009) and Young & Shortle (1984) also found that with increasing age, a farmer might get experience about their farm land and could react in favor of the application of SWC practices.

Table 4.2 association between age of household heads and adoption of SWC practices in the study area

Age of HH	Frequency	(%)	Adopters		Non -Adopters		DF	Chi-square test	
			N	%	**N**	%		X^2	P-value
20-39	50	36.8	30	31.9	20	47.6			
40-59	73	53.7	57	60.6	16	38.1			
>59	13	9.6	7	7.5	6	14.3	2	6.116*	0.047
Total	136	100	94	100	42	100			
	Mean	Std.D	Mean	Std.D	Mean	Std.D			
	41.9	10.6	42	10.5	41.8	10.93			

Source: survey result, 2015 * significant at 0.05 significant level

Family size: It is the other major factor that played a crucial role in the adoption of soil and water conservation practices. The family size of the respondents was ranging from 1-9 persons with a mean family size of 4.6 and standard deviation of 1.517. From the total respondents 66.2% of the households were had the family of 4 to 6 (Table 4.3).

As can be seen from the table 4.3, 66.2% of the adopters and 59.5% of the non-adopter has family size of 4 to 6 people respectively. The mean household family size of non-adopters and adopters of SWC practices were 4.55 and 5 respectively. Thus, it can be concluded that the adopters had relatively larger family size than non-adopters.

The t-test finding depicted that, the respondent family size is statistically significant at 0.05% of level of significance [t= 61.452*(136, P=0.49)]. Family size of household members has strong relationship with the introduction and adoption of SWC practices. Households with small number of family size were less likely to adopt SWC measures than households with more family size. The focus group finding also showed that, household heads with small family size might face problem of labor force than large family size household heads.

The study conducted by Chombo (2004) and Abera (2003) stated that, large family size were necessary to provide the labor requirement for the construction and maintenance of SWC practices.

Table 4.3 family size of household heads and adoption of SWC practices

Family size	Frequency	(%)	Adopters		Non -Adopters		T- test	
			N	%	**N**	%	t-value	P-value
1-3	26	19.1	9	9.6	9	21.4		
4-6	90	66.2	73	77.6	25	59.5		
≥7	20	14.7	12	12.8	8	19.1	1.452*	0.149
Total	136	100	94	100	42	100		
	Mean	Std.D	Mean	Std.D	Mean	Std.D		
	41.9	10.6	42	10.5	41.8	10.93		

Source: survey result, 2015 * significant at 0.05 significant level

4.2.2 Socio-economic characteristics

Education: It is one of the socio-economic characteristics of household heads playing a significant role to ensure farmers' awareness and appropriately use information to adopt SWC measures. In the study area sample respondents were categorized in to literate and illiterate based on their educational back ground. Consequently, from the total number of respondents, 40.4% were literate who only (can read and write) while 59.6% were illiterate (who cannot read and write). Hypothetically, educational status was directly related with the adoption of SWC practices. Because literate farmers were in better condition to get information and properly use it. However (Table 4.4) indicated that, there is no significant difference between educational status and SWC practices of adopters and non-adopters.

The chi-square analysis at [x^2 = 0.001*(1,136, P=0.996)] for educational status of sample households and SWC practices between the two groups was found to be insignificant at 0.05 level of significance. As a result, there was no association between the educational status of HH heads and the adoption of SWC practices which was analogous to the findings of Abera (2003), Fikru (2009) and Alemeta,A (2010).

Table 4.4 Educational status and adoption of SWC practices

Educational status of HH	Frequency	(%)	Adopters		Non – Adopters		DF	Chi-square test	
			N	%	**N**	%		X^2	P-value
Literate	55	40.4	38	40.4	17	40.4	1	0.001*	0.996(ns)
Illiterate	81	59.6	56	59.6	25	59.6			
Total	136	100	94	100	42	100			

Source: survey result, 2015 ns. Not significant at 0.05 significant level

Off- farm activities: participation in off- farm activities is common in the study area. Some of them involved in daily labor work, fire wood selling, handicrafts, metal work and petty trade. These off-farm activities served as a source of additional income to cover cost of home consumption products, for buying agriculture fertilizers, different cattle and clothes.

Based on the survey, 38.2% of household respondents participated in off-farm jobs while 61.8% did not engage in such activities (Table 4.5). Among the total respondents, 23.4% of the adopters participated in off-farm activities where as 71.4% of the non-adopter respondents participated in off-farm activities. On the other hand, 76.6% and 28.6% of the adopters and non-adopters did not involve in off- farm activities respectively. Farmers who were participating in off-farm activity had lower chance to participate in the adoption of SWC practices than those who were not participating in off-farm activities. This was the fact that, off-farm employment reduces the problem of liquidity (Anley *et al.*, 2006).

The chi-square analysis at 0.001% level of significance [x^2 = -28.35(1,136, P=0.000)] put forward, there was a negative significance relation between participating in off-activity and adoption of SWC practices. The interview with informants revealed that the benefit of involving in off-farm activities drew the negative impression on the adoption of soil and water conservation measures because of its competition for labor force.

Derajew (2013) stated that income generated from off-farm activities may be used to hire labor for social conservation. The negative relation between farmers' decision to construct conservation structures and proportion of off- farm income also supported by the findings of Bekele (1998) and Bekele & Holden, (1998). They also approved that the participation of household members in off-farm activity had a great effect on the decision behavior farmers in the adoption of SWC practices.

Table 4.5 Off-farm activities and adoption of SWC practices

Participation in off-farm activities	Frequency	(%)	Adopters		Non – Adopters		DF	Chi-square test	
			N	%	**N**	%		X^2	P-value
Yes	52	38.2	17	23.4	30	71.4	1	-28.35	0.000
No	84	61.8	77	76.4	12	28.6			
Total	136	100	94	100	42	100			

Source: survey result, 2015 significant at 1% significant level

Livestock: the most important components in farming system are the breeding of livestock for different purpose such as; farming activity, source of income, means transportation and source of food. Livestock that were found in the study area include Cattle, Goat, Sheep, Donkey, Horse, Mule and poultry were the most common. In the study area the wealth of the household heads were described by the number of livestock. In table 4.6, the number of the livestock owned by the household heads calculated in tropical livestock unit value. Therefore, the mean livestock populations of the respondents were 13.01 with standard deviation of 8.53. As compared with the number of livestock ownership the adopters have relatively more livestock (7.02 in TLU) than non-adopters (5.55 in TLU). From table 4.6 one can understand that the number of farmers participate SWC structure increase with increased livestock holding. On the contrary, the percentage of farmers that did not construct SWC structure increased with small livestock holding to household with higher livestock holding.

Table 4.6 Livestock holding of HHs in Tropical Livestock Units

Livestock	Adopters N=94		Non-adopter N=42	
	Total	Mean	Total	Mean
Cow	118	1.25	37	0.88
Ox	158	1.68	62	1.49
Goat	142	1.55	17	0.4
Sheep	21	0.22	4	0.09
Horses	115	1.22	50	1.18
Mules	52	0.56	38	0.91
Donkeys	47	0.5	24	0.57
Chickens	3	0.04	1.33	0.03
	Total	7.07		5.55

Source: Survey result, 2015

The non-adopters (40.5%) had a livestock between (5-9) while large number of adopters (44.7%) had a livestock between (5-9) number. On the other hand, the majority of the non-adopters (52.4%) had (1-5) number of livestock and the non-adopters had no livestock above 14 in number. On the contrary, the adopters (14.9%, 3.2% &2.1%) have a livestock between (10-14, 15-19 & >19) number of livestock respectively.

The result of the t-test at 5% level of significance [t= 1.763*(df =2, p= 0.025)] indicated that, there was a significant difference between the adopters and non-adopters in the mean livestock owner ship (Table 4.7). This refers that farmers with large number of livestock adopted SWC measures. It helped them to have more agricultural inputs and capital to enhance fertility of the soil. This result was supported by the findings of Genene &Wogayehu, 2010, Derajew *et al*, 2013 and Aklilu & Jande, 2016.

Table 4.7 Livestock ownership and adoption of SWC practices

Educational status of HH	Frequency	(%)	Adopters		Non – Adopters		DF	Chi-square test	
			N	%	**N**	%		X^2	P-value
< 5	52	38.2	33	44.7	22	52.4			
5-9	61	44.8	42	35.1	17	40.5			
10 – 14	15	11	14	14.9	3	7.1	2	1.763*	0.025
15 – 19	6	4.5	3	3.2	0	0			
>19	2	1.5	2	2.1	0	0			
Total	136	100	94	100	42	100			

Source: survey result, 2015   * significant at < 5% significant level

4.2.3. Physical characteristics

Farm Size: The survey result indicates that the land holding size ranges from 0 to 2 hectares. As a result of small farm size, farmers faced shortage of grazing and fallow lands. Generally, farm size was one of the physical factors that determine farmers' decision in the adoption of SWC practices.

The majority of the respondents (65.4%) had farm size between (0.5-1ha) while 21.3% and 13.2% of farmers had farm land between (1.25-2ha) and (<0.5ha) respectively (Table 4.8). The mean size of farm land owned by the non-adopter and adopter were 0.95 and 1.06 hectare respectively.

The t-test analysis at 5% level of significance [t= 2.390*(df =2, p= 0.18)] depicted that, there was significant relationship between adoption of SWC measures and farm size. That means adoption of soil and water conservation structure was influenced by the size of farm lands. Farmers having smaller farm size were more likely to remove conservation structures totally or temporarily. This was because farmers who had smaller farm land were young and lacks the required training to maintain the structures. This was also supported by Tesfaye, *et al*., 2013 concluded that farmers who had large farm size showed interest to invest on SWC measures. On the other hand, Traore *et al*., 1998 and Simon *et al*., 2012 concluded that farmers make soil and water conservation practices irrespective of their farm land size.

Table 4.8 Households farm size and adoption of SWC practices

Farm size of HH (Hectare)	Frequency	(%)	Adopters N	Adopters %	Non – Adopters N	Non – Adopters %	DF	t- test t-value	t- test P-value
<0.5	18	13.2	10	10.6	8	19			
0.5-1	89	65.4	60	63.8	30	71.4			
1.25-2	29	21.3	24	14.6	4	9.5			
>2	0	0	0	0	0	0	2	2.390*	0.18
Total	136	100	94	100	42	100			
	Mean	Std.D	Mean	Std.D	Mean	Std.D			
	1.029	0.355	1.06	0.36	0.95	0.33			

Source: survey result, 2015 * significant at = 0.05% significant level

Farm distance: one of the major physical factors that determine the adoption of SWC measure was distance between residence and farm land areas of household heads. The distance that household heads travel was classified into far, medium and near. The result indicated that the time required reaching at the farm land from their residence ranges from ≤ 10- 60 minute. The mean time needed to reach their farm land is 22 minute and 77.2% of the respondents were travel from 11-30 minute. Most of the time, farmers far from their farm land did not give much attention to visit with the exception of farming, weeding and harvesting seasons.

Table 4.9 depicts that 87.2% of the adopters' farm land was found less than 30 minute far from their residence, 61.9% of the non-adopters were also far from their residence at about less than 30 minute. On the other hand, only 11.71% of the adopters' farm land was far from their residence at about more than 31 minute, but 38.1% of the non-adopters farm lands were found more than 31 minute far from their residence. This shows that there was a difference in distance of farm land between the adopters and the non-adopters to practice SWC practices.

The chi-square test at 0.05% of significance level [t= -5.782*(df =3, p= 0.123)] shows that there was negative significant relationship between farm distance and adoption behavior of farmers. This result also supported by Tesfaye, *et al*., 2013, Kessler 2006, Simon *et al*., 2012 And Birhanu & Sewunet 2003 postulated that farm plot distance from the residence discouraged farmers to invest in soil conservation.

Table 4.9 Farm distance and adoption of SWC practices

Farm distance (in minute)	Frequency	(%)	Adopters		Non – Adopters		DF	Chi-square test	
			N	%	**N**	%		X^2	P-value
≤10	15	10.5	17	18.1	5	11.9			
11-30	105	77.2	65	69.1	21	50			
31-60	14	10.3	11	11.7	14	33.3			
>60	3	2	1	0.01	2	4.8	3	-5.78*	0.123
Total	136	100	94	100	42	100			

Source: survey result, 2015 * significant at < 5% significant level

Slope of farm land: it is another physical component that determines the adoption of SWC measures by household farmers. The survey result indicated that (30.9%) and (41.2%) of the respondents were postulated as they had gentle and moderately gentle sloping farm land (Table 4.10).

The large number of the adopters' (89.4%) farm lands were found along gentle (32.9%), moderately gentle (38.2%) and steep (18.3%) areas which need much attention. On the other hand (90.5%) of the non-adopters sample HH farm lands were found under flat (19%), gentle (28.6) and moderately gentle slope (42.9) areas that needs relatively less attention than adopters for constructing SWC structures.

The t-test result indicates that, the respondents land slope was significant at <5% of significant level [t= 1.785*(df =2, p= 0.027)]. From this point of view the farmers who had farm land at moderately gentle and steep slope understand the impact of soil erosion on their farm land. As a result, farmers decided to construct SWC structure on their farm land. The slopes of topography determine farmers' behavior by influencing the tendency and velocity of runoff, which in turn affected the economic importance of soil erosion, thus reducing the output of the cultivated land.

This result was similar with the findings Simon *et al.*, 2012 stated that farmers cultivating vulnerable lands were more likely to adopt SWC practices than those cultivating less vulnerable fields. Similarly Wu and Babcock, (1998) in their book discussed that, frequent conservation practices formulated on steeply sloping lands which showed the desire of farmers to control loss of soil from highly erodible soil.

Table 4.10 HH farm slope and adoption of SWC practices

Farm slope	Frequency	(%)	Adopters		Non – Adopters		DF	Chi-square test	
			N	%	**N**	%		X^2	P-value
Flat	18	13.2	10	10.6	8	19			
Gently sloping	42	30.9	31	32.9	12	28.6			
M. gently slope	56	41.2	36	38.2	18	42.9	1	1.785	0.027
Steeply sloping	20	14.7	17	18.3	4	9.5			
Total	136	100	94	100	42	100			

Source: survey result, 2015 * significant at 0.01 significant level

2.2.4 Institutional factors

Access to training: It is believed that farmers did not have information about SWC practice and cannot be expected to adopt it. Otherwise, farmers perceive its expected cost and benefits. Timely training and accurate information had a positive influence on farmers' soil and water conservation measures. Training made them to get relevant information in the decision of SWC measures. (Obonyo, 2000).

Table 4.11 shows that 73.4% of sample household adopters had access to training whereas, only 30.9% of non-adopters do have access to training (Table 4.11). This shows that being trained technically helped the household farmers in order to implement and construct SWC structures. The findings of chi-square analysis at < 0.05% level of significance [x^2= 21.853*(df =1, p= 0.000)] indicates that, access to training was positively related with adoption of the introduced SWC measures. This means that, an opportunity getting of training makes farmers to be well informed and be technically in implementing SWC structures. This is also supported by the findings of Simon et al., 2012 and Tesfaye *et al*,. 2013.

Table 4.11 HHs access to training related to adoption of SWC structures

HHs access to training	Adopter		Non-adopter		Df	Chi-square test	
	N	%	N	%		X^2	P-value
Yes	69	73.4	13	30.9			
No	25	26.6	29	69.1	1	21.853*	0.000
Total	94	100	42	100			

Source: survey result, 2015 * significant at 0.01 significant level

Access to extension service: one of the widely used means of addressing information to the rural part of Ethiopia is public extension service. Development agents are responsible to disseminating the information for each kebeles to provide extension services. Farmers pointed out the governments' extension service as the most important one in disclosing the information particularly about agriculture related practices. Input supply, land use and land management practices; improved cultural practices and SWC practices are among the aspects covered by the extension services.

Table 4.12 forwarded that, 63.2% of the respondents contacted with extension service workers but, 26.8% of farmers did not. From the adopter respondents 78.7% have access to extension services. On the other hand, only 28.6% of the non-adopters got extension service. This implies that, if farmers did not have enough amount of contact with extension service workers, they might not have adopted SWC practices.

The chi-square test at 1% level significant [x^2 = 31.407*(df =1, p= 0.000)] indicates that access to extension services had significant influence on the adoption of SWC practices. The finding was similar with the study of Desta (2012), Simon et al.,(2012) and Tesfaye *et al*,.(2013) stated that extension services have a positive effect on SWC practices.

Table 4.12 HHs access to extension service related to adoption of SWC structures

HHs access to	Adopter		Non-adopter		Df	Chi-square test	
training	N	%	N	%		X^2	P-value
Yes	74	78.7	12	28.6			
No	20	21.3	30	71.4	1	31.407*	0.000
Total	94	100	42	100			

Source: survey result, 2015 * significant at 0.01 significant level

Access to credit service: lack of enough access to credit had a negative impact on the adoption of new technology, agricultural productivity, health and nutrition (Diagne & Zeller 2001). Similarly Bekele & Drake, (2003) stated that credit services for inputs and consumption helped to maximize the adoption of conservation measures. But Eleni, (2008) concluded that access to credit was not a significant factor affecting farmers decision on the adoption of SWC practices, because they might use the money for different purpose other than SWC practices.

Based on the survey, it was founded that (36.8%) of household members had access to credit. The majority of the respondents (63.8%) did not get credit from any institutions. On the other hand, 35.1% and 40.5% of the adopters and non-adopters have obtained credit whereas, 64.9 and 59.5% of the adopters and non-adopters have not obtained credit from any institutions respectively. Form this point of view, it may be explained that the need to pay back credits will motivate farmers to invest more on yield enhancing activities such as SWC measures and as a result great effort will be done in adopting SWC technologies. The chi-square test analysis forwarded that there was no systematic association between adoption of SWC structure and access to credit and it is insignificant at 5% significant level [x^2=31.317 df= 1 p=0.000]. This indicated that having not access to credit by itself discourage farmers to invest on adoption of SWC technologies.

Similar to the above study, Simon *et al.*, (2012) and Fikru (2009) said that, those who have an opportunity to credit have a higher probability of adopting SWC practices than those with no credit access.

Table 4.13 HH access to credit service and adoption of SWC practices

HH access to credit service	Frequency	(%)	Adopters		Non – Adopters		DF	Chi-square test	
			N	%	**N**	%		X^2	P-value
Yes	50	36.8	33	35.1	17	40.5	1	31.317	0.000
No	86	63.2	61	64.9	25	59.5			
Total	136	100	94	100	42	100			

Source: survey result, 2015 * significant at 5% significant level

4.3. Factors affecting the adoption of SWC practices

To identify the major factors that determine household heads to adopt SWC measures of the dependent variables were analyzed with 13 explanatory variables by using binary logistic regression omnibus test of model coefficient. These shows that the binary logistic model was statistically significant at (Chi-square= 102.766, P-value=<0.000 with df=14), so it was appropriately fit for the data. In relation to the predictive efficiency of the model, the fitted binary logistic model explains that 91.2%, from the total 136 respondents included in the model were correctly predicted. In addition, it was correctly predicted by 80.7% of the non-adopters and 93.6% of the adopters' in their respective category (appendix-C).

The Cox and Snell and Nagelkerke R-square value were 0.530 and 0.731 respectively (appendix-C). The Hosmer-Lemeshow test result also showed that, the Chi-square value of 18.841 with P-value of 0.186. The P-value is greater than 0.05 level depicts that there is no difference between the observed and the predicted value and hence expected of the model value was fit the data at an acceptable level (appendix-C).

Moreover, there was no variable that was highly correlated with one or more variable on the bases of the result of the multi-collinearity diagnostics test for both continuous and dummy explanatory variables. If multi-collinearity is 1 shows complete relationship and if it is 0, no collinearity between independent variables, between 0.2 to 0.4, weak collinearity, between 0.41 - 0.7, moderate collinearity and between 0.71 - 0.9, strong collinearity among independent variables.

As can be seen from the binary logistic regression results: sex, age, distance of farmland from residence, family size, farm size, number of livestock, slope farm land, access to extension service, access to credit and training were significant and influenced household heads decision to adopt SWC practices. All the above variables had positive relationship except access to credit which had negative significant relationship. But variables like education and off-farm activities were non-significant.

Table 4.14 result of binary logistic regression model

Variables	B	S.E.	Wald	df	Sig.	Exp(B)
Sex	2.530	1.012	6.244	1	.012	3.254
Age	1.013	.046	0.083	1	.000	.987
Famly Size	1.520	.364	0.036	1	.154	.595
Farm Distance	1.016	.025	.393	1	.531	1.016
Slope	1.389	.393	8.978	1	.027	3.678
Plan	1.495	.342	1.882	2	.390	.578
Educ status	.812	.801	1.025	1	.051	2.252
Off farm	-1.131	.780	7.457	1	.006	.119
Live stock	2.169	.107	2.518	1	.113	.044
Ex.service	1.779	.709	6.292	1	.012	5.925
Ac.credit	-3.416	.906	3.206	1	.000	4.033
Ac.training	1.938	.680	1.902	1	.016	0.555
Farm size	-1.187	1.140	7.027	1	.032	.830
Constant	-15.258	28223.805	.000	1	1.000	.000

Source: SPSS version 20 result output *statistically significant at <0.05

** Statistically significant at 0.001%

4.3.1 Demographic characteristics and adoption of SWC practices

The binary logistic regression result depicts that household heads sex had its own impact on the adoption of SWC practices and statistically significant [B= 2.53; P-value=0.012] that is related with the hypothesis. The Wald statistics (6.244) indicated that female household heads were not participating in the adoption of SWC practices relatively to males. In other word, male household heads were engaged in the adoption of SWC practices by the factor of 3.254 than women.

This finding is similar to Krishna *et al*., (2008) indicates that male headed households have higher chance to participate in SWC practice. This is the fact that in most cases female headed households spent their time in domestic activities. On the other hand, Fikru (2009) states that women have no significant difference with male headed households in the adoption of SWC practices.

As can be seen from the result of binary logistic regression analysis, household head age is significant at 1% level of significant [B= 1.013, P-value= 0.000] that is, it is positively correlated with farmers adoption decision. The Wald (0.083) also assures that the significance of age of the household heads in the adoption of SWC practices is relatively similar to the hypothesis (0.987). Therefore, it is possible to say that when age increase through experience in farming, peoples' skill and attitude are developed to adopt SWC practice and increases the tendency of being adopter of SWC practices. On the contrary, young farmers were more likely to reject conservation practices.

According to Chombo (2004) and Kebede *et al* (2013) the age of the respondents had a significant relation with the adoption of soil and water conservation practices. Similarly, Fikru (2009) conducted a research in Koga water shade and Young & Shortle (1984) also found that when age increase, farmers might get experience about their farm land and could react in favor of the retention of SWC. On the contrary, Mulugeta *et al*., (2001) found that young farmers are expected to invest in SWC practices because they are educated than adult and elder household heads.

The binary logistic regression result also indicates that, there is a significance relationship between household family size and adoption of SWC practices [B= 1.52, P=0.154]. Family size was hypothesized to have positive and significant relation to farmer adoption behavior of SWC measures.

The study conducted by Chombo (2004) and Abera (2003) state that large family size was necessary to enhance the labor requirement for maintaining SWC practices. In addition, Habtamu (2006) indicates that there is a positive and significant relationship between adoption of SWC practices and family size. On the other hand, Wagayehu and Lars (2003) depict that in the large family size with greater number of mouth to feed is difficult to adopt SWC practices. This is the fact that these people fulfill the need of food; large number of labor is participated in off-farm activities.

4.3.2. Physical characteristics and adoption of SWC measures

Farm size of household heads was hypothesized to have negative significant with the adoption of SWC practices. The binary logistic regression analysis indicates that farm size has negative and significant relationship at 0.05 level of significance [B= -1.187, P= 0.032]. The odd ratio result also indicated that large farm size reduces the adoption of SWC by the factor of 0.032. Farmers having smaller farm size were more likely to remove conservation structures totally or temporarily. This was because of farmers who had smaller farmland was young and lack of required training to maintain structures.

This idea was also supported by Tesfaye, *et al*., 2013 that farmers who have large farm size show interest to invest on SWC measures. On the other hand, Traore *et al*., 1998 and Simon *et al*., 2012 that farmers make soil and water conservation practices irrespective to their farm land size.

Regarding to distance of farmland from the residence of farmers, there is statistically positive significant with the adoption of SWC practices [B=1.106, P<0.031]. The Wald statistics (6.848) also shows that there is strong relationship between farm distance and adoption of SWC practices. This means, farmers farmlands near to their residence have higher probability of adopting SWC by a factor of 1.016 times greater than farmers with their farmlands are far from their residence.

This result is supported by the finding of Kessler (2006). He suggests that farmers invest more in SWC activities suited near to their residence. Fikru (2009) also suggests that longer distance between residence and their farm land is positively significant with the adoption of SWC structures. The scattered and far away field is one of the factors that discourage farmers. On the contrary, Alemante (2010) suggests that there is insignificant relationship between adoption of SWC measures and farm distance.

Concerning to slope of farmlands, it is directly associated with adoption of SWC practices and it is significantly and positively at < 0.05 of significant (B= 1.389, P<0.027). This is similar to the Wald statistics and the hypothesis (8.978) that is strongly correlated with the finding. Farmers cultivate higher sloping areas use conservation measures than farmers who cultivate lower sloping areas. This implies that farmers who cultivate vulnerable land are more probably use conservation structures. The odds that using conservation structures is above 3.678 times greater areas of higher slope than fields on lower slope areas.

Wagayehu and Lars (2003), Habtamu (2006) and Bekele (1998) show that there is positive association between slope and adoption of SWC measures and they concluded that it affects farmers' decision in the adoption of SWC practices. To the contrary of the above finding, Kessler (2006) states that more sloping fields do not influence farmers' decision of adoption of SWC.

4.3.3. Socio-Economic characteristics and adoption of SWC practices

Education can increase farmers' management capacity and understanding of the newly introduced SWC measures. The binary logistic regression analysis result [B= 0.0812, P<0.051] of the data of educational status indicates that there is no significant relationship between the SWC practices and education level. The result of positive logit coefficient shows that educated farmers have more chances to adopt SWC measures than non-educated one.

The finding of Abera (2003), Fikru (2009) and Alemeta (2010) show that there is no significant relationship between educational level and adoption behavior of SWC practices. It is also supported by the finding of Eleni (2008).

Livestock size was considered to have a positive significant impact on household heads decision to adopt SWC structures. The binary logistic regression model result indicates that livestock size is significant at 5% level of significant [B=2.169, P< 0.044]. The result of positive logit coefficient shows that farmers who have more livestock size have more probability to adopt SWC practices than those who have small number of livestock.

This finding was supported by Genene &Wogayehu (2010), Derajew *et al*., (2013) and Aklilu & Jande (2016) indicate positive relationship between adoption of SWC practices and number of livestock. But Wagayehu and Lars (2003) found that there is negative relation between number of livestock and adoption of SWC practices.

The major sources of income for sample households were farming. But some farmers participate in off-farm activities to get additional income to support their life. The binary logistic regression analysis indicates that off-farm activities are negative and insignificant relationship at 5% level of significant [B= -0.131, p< 0.06). The odd ratio result also suggests that participating in off-farm activities reduces the rate of adoption of SWC practices by the factor of 0.114.

Derajew (2013) states that income generated from off-farm activities may be used to hire labor for social conservation. The negative relation between farmers' decision to construct conservation structures and proportion of off-farm income are also supported by the finding of Bekele & Holden (1998). They approve that the participation of household members in off-farm activities has a great effect on the decision behavior of farmers in the adoption of SWC practices. As a result, farmers who were participating in off-farm activities were likely to put less effort in retain of conservation structure.

4.3.4 Institutional characteristics and adoption of SWC measures

The major component that facilitates the adoption of SWC measures are extensional agents by providing accurate and reliable information to farmers. The close contact with extension agents have great role on agricultural output. Thus, access to extension services had a positive significance at <0.05 level of significance [B=1.779, P <0.021] which is analogous to the hypothesis. The odd ratio result depicts that those farmers who have access to extension service are 5.925 times greater than those who do not have contact with extension service to adopt SWC structures.

The finding was similar with the study of Desta (2012), Simon *et al*. (2012) and Tesfaye *et al*., (2013) state that extension services have a positive effect on SWC practices. Benin (2002) also indicates that access to extension agents related with the use of more fences and stone terraces refers that farmers built for long term land improving techniques.

Conversely, Fikru (2009) found that access to extension service did not affect significantly the adoption rate of SWC practices.

As can be seen from the regression result, access to training is positively significant at 0.05% level of significant [B=1.938, P<0.016] with the adoption of SWC practices. The Wald statistical result (1.902) also indicates that training is important to the adoption rate of SWC measures. In other words, farmers having access to training adopt soil and water conservation practices 0.555 times greater than those farmers who have no any chance to train.

This is also supported by the findings of Simon et al., 2012 and Tesfaye *et al*., 2013 in their study they found that training makes farmers conscious to use conservation measures by providing adequate and recent information and technical support about the significance of newly adopted SWC mechanisms as well as their cost effective implementation. Fikru (2009) also suggests that having access to training have positive significant relation to the adoption rate of SWC practices.

As can be seen from the result of binary logistic regression analysis, household head age is significant at 1% level of significant [B= -3.416, P-value= 0.000] so, it is negatively correlated with farmers adoption decision. The Wald (3.202) also assures the significance of access to credit in the adoption of SWC practices. This means farmers who have access to credit implement adoption of SWC practices 4.033 times higher than those who have no any access to credit

Similarly, Simon *et al*., (2012) and Fikru (2009) said that those farmers who have an opportunity to credit have a higher probability of adopting SWC practices than those with no access to credit.

CHAPTER FIVE: CONCLUSSION AND RECOMMENDATION

5.1. Conclusion

Soil is the most important resource for the existence of human beings. But soil degradation is a prominent agricultural and environmental problem that human beings are facing in today's world. Soil erosion becomes a challenge of food security by minimizing the ability to improve agricultural production and productivity. The study area is characterized by steep and undulating terrain which is vulnerable to soil erosion. It is also one of the Woreda in Amhara regional state, known by food insecurity. In order to solve erosion problem and enhance the production potential of agricultural land, different type of SWC measures and approaches were introduced by governmental and non-governmental institutions. However, the efforts implemented towards the practices of the newly adopted technologies so far seem to have limited impact in increasing the sustained use of SWC measures.

This study was targeted to screen out types of SWC measures practiced in the study area; identify demographic, institutional, socio-economic and physical factors that determine farmer adoption of SWC practices and investigate the role of socio-economic and institutional factors for the adoption rate of soil and water conservation practices at Libo Kemkem Woreda.

The study result depicts that a number of SWC structures were constructed and implemented by farmers on different farm lands to maximize agricultural output. These structures include cut-off drain, water way, check dam, soil bund, stone bund and soil faced stone bund. In this study, 69.11% of household heads participated in the adoption of SWC practices. The majority of the respondents (38.3%) practiced soil faced stone bund followed by stone bund (32.98%) and cut-off drain (13.83%) respectively.

The Chi-square test result indicates that sex, age of household heads, distance of farmland from their residence, access to training, extension service and access to credit had significant relationship with the adoption of soil and water conservation practices. But education and participation of farmers in off-farm activities have no statistically significant relation. In addition, the t-test result depicts that family size, number of livestock, farm size and slope of farm land had significant relation to the adoption of soil and water conservation measures.

Finally, binary logistic regression model was used to analyze the main factors that determine farmers' adoption of SWC strategies. As can be seen from the binary logistic regression model sex, age, distance of farmlands from residence, family size, farm size, number of livestock, slope farmlands, access to extension service, access to credit and training were significantly influence household heads decision to adopt SWC practices. All the above variables had positive relationship except access to credit that had significant negative relationship. Variables like education and off-farm activities had no significant relationship.

To sum up, it is logical to confirm that high attention for the above variables may have huge contribution to maximize the wise use and widespread adoption of introduced SWC practices in the study area.

5.2. Recommendations

A number of factors that contribute to soil erosion, land degradation and their by negatively affect the improvement agricultural production are investigated. Based on the finding of this study, the following recommendations have been forwarded by the researcher.

Farmers should be made aware that they need to know the various aspects of their farming conditions, constraints and opportunities for the improvement and sustainable management of their farmlands.

The participation of the community in planning, designing and implementing the process of SWC conservation activities should insure farmers' in making use of existing local knowledge and integrate with the newly introduced one's to overcome the problem of soil erosion and land degradation.

To increase the participation of female and young household heads on the adoption of SWC activities, the agricultural and rural development office of Libo

Kemkem Woreda, NGOs and the concerned bodies could create awareness and encourage farmers' collaborations in adoption and maintenance of SWC practices. Because farmers collaboration can mitigate labor shortage.

Distance of farmlands from residence and household heads participation in off-farm activities are significant factors that adversely influence farmers' practice of SWC measures. Farmers who are involved in off-farm activities and farm lands located far from their homestead face the constraint of time and labor to maintain SWC activities. Therefore, farmers have to find to such problem in the adoption of SWC measures.

Different types of SWC measures are employed on both individual and communal farm land to improve agricultural production. Introduced soil and water conservation methods; stone bund, soil faced stone bund, soil bund and water way are complained by farmers since they occupy farm space, harbor rat, rodent, difficult to traditional oxen ploughing and grazing. Hence the concerned government bodies of different level (nation, region and/or woreda) should help farmers by showing appropriate conservation mechanisms by considering environmental condition and cost effective methods based on research findings. Different studies should be under taken on the effectiveness of SWC measures.

One of the influential factors for the adoption of SWC practices is training. This implies that the intervention will be successful if it incorporates and make use of training on soil and water conservation. Nevertheless, in order to make training more successful, adult education methods need to be employed during the training. The training should focus on scientific and technical practice of SWC measurements. The extension agents should regularly contact with farmers as much as possible. It is also advisable that extension services agents should live within the farming community they are serving.

This study is just a step to pave a way for further study, presenting the above recommendations for more research to validate and expand the result of this study. So, the present researcher invites other researchers to undertake further studies on this area and recommend other possible ways to alleviate barriers of soil erosion and land degradation constraints.

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APPENDICES

Appendix-A

Questionnaires for surveying Farmers Adoption of Soil and Water Conservation Practices in

Libo Kemkem woreda

Part I. General Information

1.1 Date of interview: Day ________ Month ______________ Year ______________

1.2 Name of kebele____

1.3 Region: ____

1.4 Zone: ____

1.5 Woreda: ____

Part II: Household Characteristics

2.1 Age _____________________

2.2 Sex: A/ Male B/Female

2.3 Family Size of the household A/ 1-3 B/4-6 C/>7

2.4 Marital status A/. Married B/. Single C/ Divorced D/. Widowed

2.5 What is the educational status of the household head?

A/ Literate B/ Illiterate

2.6 If it is literate, what is the level of education of the household head?

A/ Illiterate B/ Read and write C/ Primary education

D/ Secondary education E/ tertiary education

2.7 Farming experience of household heads?

A/ <5 years B/5-10 years C/ 10-15 years D/>20 years

2.8 Do you have a plan to continue as a farmer in the coming years?

A/ Yes B/ No

Part III. Land holding and farm Characteristics

3.1 Do you have your own agricultural land?

A/ Yes B/ No

3.2 If your response is yes for Q (3.1), what is the size of landholding of the household in hectare? A/ < 0.25 B/ 0.26-0.5 C/0.6_1 D/ 1.1-1.5

3.3 How could you get the land you are cultivating currently?

A/ through renting B/ Inherited from the parents C/ Allocated by the Keble heads

3.4 How many parcel/s of land have you cultivated?

A/ One B/ Two C/ Three D/ Mort than three

3.5 How do you perceive the distance of your cultivation land from your residence?

A/ Near B/ Middle C/ Far

3.6 What is the distance of your cultivation field from your residence?

A/ <10 minutes walk B/ 10 to 25 minutes' walk

C/ 25 minutes' to 1 hour walk D/ 1to 1and 25 minutes' walk E/ >1and 25 hours

3.7 If your response is decreasing for Q(3.10), what measures are you taking to improve up your production?

A/ Using SWC measures B/ Using manure C/ using fertilizer

D/ Crop rotation E/ All F/ Others, specify_______________

3.8 On which farm land slope ,you construct Soil and Water conservation Structures?

A/ Flat B/ Gentle slopping C/ Moderately sloping D/ Steeply sloping

Part IV. Soil and Water Conservation

4.1 Do you think that your farm lands/plots is/are prone to soil erosion?

A/ Yes B/ .No

4.2 What do you think the major cause of erosion?

A/ steepness of slope B/ erratic and showery Rainfall C/ nature of soil

D/ Runoff from up slope areas E/ Other specify,_____________

4.3 What do you think is the consequences of soil erosion?

A/ Land productivity (yield) decline B/ Change in type of crops grown

C/ Reduces farm plot size D / All E/ Others (specify) _____

4.4 Do you know the existence of improved soil and water conservation structures? A/ Yes B/ No

4.5 If your response is yes for Q (4.5), where did you get information about the soil and water conservation measures?

A/ Traditionally (learnt by self) B/ From neighboring farmersC/ From media

D/ From DAs E/ NGOs F/ Other source, specify

4.6 What have you done with the soil and water conservation technologies introduced to the area?

A/ Never applied the technology in the field B/ Applied but removed them completely

C/ Applied but removed them selectively D/ Applied and maintained the conservation measures introduce

4.7 How many times do you contact with soil and water conservation experts (DAs experts) Per a month?

A/ None B/ = once C/ two times D/ = three times

4.8 Do you participate in Soil and Water conservation practices?

A/ Yes B/ No

4.9 If yes for Q (4.9), Which family members participate in soil and water conservation works?

A/ Men B/ women C/Both of them participate D/ No one has participate

4.10 Do you think that soil erosion can be controlled?

A/ Yes B/ No

4.11 If you say yes for Q (4.11), which type of soil and water conservation measures do you construct?

A/ Traditional measures B/ Modern measures C/Both D/ None of them

4.12 If you say no for Q(4.11) , What is/are the reason/s?

____

____.

4.13 What kind of modern soil and water conservation measures are you using most in your farm land? (You can choose more than one)

A/ Stone bunds B/ Soil bunds C/ Soil faced stone bunds

D/ Check dams E/ Cut of drains F/ water way G/ Others, specify----------

4.14 Which type of traditional conservation measures do you use?

A/ Traditional ditches B/ Traditional ditches C/ Both D/ None of them

4.15 Are the constructed SWC structures effective in controlling soil erosion?

A/ Yes B/ No

4.16 What is the present status of the SWC technologies?

A/ In good condition B/ Partially Damage C/ Completely damaged

4.17 If any of these is completely/ partially damaged, what are the problem/reasons?

A/ Design problem B/ Structures by its own

C/ Purposefully D/ Run off E/ Others, specify……

4.18 If the damage is purposefully, for Q (4.20), what is the reason?

A/ Harbor pest B/ Hinder oxen plowing

C/ Take more productive land D/ others specify……

4.19 How frequent do you maintain SWC structures?

A/ Every year B/ within two years C/ When damage happens D/ I don't maintain

4.20 What major problems do you face regarding SWC structures recommended by the *woreda* agricultural office?

A/ Putting up conservation structures B/ Labor competition with other farm activities

C/ Enforcement without willingness D/ Nothing I do

4.21 How do you construct SWC structures technologies/?

A/ With group B/ Family labor C/ *Debo / wonfel* D/ With public participation

E/ I don't construct

4.22 Why do you construct SWC structures on your land?

A/ Forced to participate B/ To get aid

C/ Voluntarily, b/c of its benefit for us D/ I don't construct

4.23 What advantages do you observe most from SWC structures constructed on your land ?

A/ Reduce soil erosion B/ Increases water availability

C/ Increases crop yield D/ Control flooding E/ Nothing it gives to me.

part V. land tenure, Institutional and technical support

5.1 For how long have you been with your farm land ?

A/ 1-5 years B/ 6-10 years C/ 11-15 years D/ 16-20 years E/ over 20 years

5.2 Do you think that you have the right to inherit the land to your children?

A/ Yes B/ No

5.3 Do you expect that you will use the land throughout your life time?

A/ Yes B/ No

5.4 Did your entire farm plot registered and get certificate?

A/ Yes B/ No

If your answer is yes, what do you fill ?___________________________________

5.5 Do you perceive a risk of loss of your plot(s) of land in the future?

A/ Yes B/ No

5.6 Have you ever attended trainings related to soil and water conservation?

A/ Yes B/ No

5.7 Do you have access to credit and saving institutions?

A/ Yes B/ No

Part VI. Livestock Production

6.1 Describe the livestock you own

No	Type of livestock	Number
1	Cow	
2	Ox	
3	Goat	
4	Sheep	
5	Horses	
6	Mules	
7	Donkeys	
8	Chickens	
9	Beehives	

Key Informants Interview for DAs, SWC experts and agricultural Experts concerning to SWC

1. What are the major causes of soil erosion in your woreda ?
2. How do you describe the extent and severity of your woreda's soil erosion?
3. What is the perception of farmers towards soil erosion problems in the study area.
4. What type of conservation measures are being implemented?
5. Who undertakes the conservation measures?
6. Who designs the conservation structures?
7. What is the role of the DAs, SWC and agricultural experts in the conservation intervention?
8. How do you evaluate the efforts being done by your office with regard to SWC measures?
9. How do you get the effectiveness of soil conservation SWC measures in controlling soil erosion problems?
10. What are the major factors affecting the farmers for the adoption of SWC practices in the study area?
11. How do you see the participation of farmers in SWC works in individual farm lands as well as communal lands?
12. Which class of the community is more responsible in the SWC works?
13. What comments do you have on the planning, implementation and evaluation of SWC measures in your *wereda* and the study area?

Focus Group Discussion Questions for Farmers, religious leaders DAs and SWC

supervisors who involved in the discussion concerning to SWC

1. What are the major causes of soil erosion in your farm land ?
2. How do you describe the severity of soil erosion on your farm land ?
3. What is your perception towards soil erosion problems ?
4. Do you apply SWC measures on your farm? If not, why?
5. If yes for Q(4), what type of conservation measures are being implemented?
6. Do you have enough labor to accomplish your farm activity?
7. Who are more involved in SWC works?(Are they youngsters, adults, elders, male or female) and why ?
8. Why you remove SWC measures form your farm plots?
9. Do you get adequate support concerning to SWC from agricultural experts? What are those?
10. What benefits do you get from SWC measures implemented on your farm?
11. What limitation do you face from these SWC measures implemented on your farm plots?
12. Do you think that SWC is the responsibility of farmers?
13. What do you think about land registration and certification with SWC?

Appendix -B

Conversion factors used to estimate tropical livestock units (TLU)

Animals	TLU equivalent
Calf	0.25
Cows	1.00
Oxen	1.00
Horse	1.10
Mule	1.10
Goats	0.13
Sheep	0.13
Donkey	0.70
Chicken	0.013

APPENDEX –C: Binary Logistic Regression Model Analysis Result

Block 1: Method = Enter

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	101.361	14	.000
	Block	101.361	14	.000
	Model	101.361	14	.000

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	66.778[a]	.525	.740

a. Estimation terminated at iteration number 20 because maximum iterations has been reached. Final solution cannot be found.

Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	5.546	8	.698

Contingency Table for Hosmer and Lemeshow Test

		Adoptor and Non Adoptor = Adoptor		Adoptor and Non Adoptor = Non Adoptor		Total
		Observed	Expected	Observed	Expected	
Step 1	1	14	13.986	0	.014	14
	2	14	13.899	0	.101	14
	3	14	13.735	0	.265	14
	4	14	13.543	0	.457	14
	5	13	12.918	1	1.082	14
	6	10	12.137	4	1.863	14
	7	10	9.062	4	4.938	14
	8	3	3.717	11	10.283	14
	9	2	.930	12	13.070	14
	10	0	.072	10	9.928	10

Classification Table[a]

Observed			Predicted		
			Adoptor and Non Adoptor		Percentage Correct
			Adoptor	Non Adoptor	
Step 1	Adoptor and Non Adoptor	Adoptor	88	6	93.6
		Non Adoptor	9	33	78.6
	Overall Percentage				89.0

a. The cut value is .500

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	Sex(1)	2.530	1.012	6.244	1	.012	3.254
	Age	1.013	.046	.083	1	.000	.987
	FamlySze	1.520	.364	.036	1	.154	.595
	FarmDis	1.016	.025	6.393	1	.531	1.016
	SlpFrmLand	1.389	.393	.978	1	.323	.678
	PlnHusHld			1.882	2	.390	
	PlnHusHld(1)	17.784	28223.805	.000	1	.999	52912980.674
	PlnHusHld(2)	19.506	28223.805	.000	1	.999	295918423.175
	EducLvl	.812	.801	1.025	1	.051	2.252
	OFFrmActy	-.131	.780	7.457	1	.006	.119
	TtNLSTK_TLu	2.169	.107	2.518	1	.113	.844
	AcExSrce(1)	1.779	.709	6.292	1	.012	5.925
	AcCrdt(1)	-3.416	.906	14.206	1	.000	.033
	AcTrg(1)	1.938	.680	1.902	1	.168	2.555
	Farmsze	-1.187	1.140	7.027	1	.032	.830
	Constant	-15.258	28223.805	.000	1	1.000	.000

a. Variable(s) entered on step 1: Sex, Age, FamlySze, FarmDis, SlpFrmLand, PlnHusHld, EducLvl, OFFrmActy, TtNLSTK_TLu, AcExSrce, AcCrdt, AcTrg, Farmsze.