An Assessment of the Socio-economic Impact of HIV/AIDS on Agricultural production in Ethiopia: The Case of Ada’a district in Eastern Showa province in Ethiopia

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Beneberu Assefa Wondimagegnhu

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LIST OF ACRONYMS

ADLI             Agricultural Development Led Industrialization
AIDS             Acquired Immune Deficiency Syndrome
ART              Anti Retroviral Therapy
BOARD         Bureau of Agriculture and Rural Development
CACC            Central Agricultural Census Commission
FMOHE          Federal Ministry of Health in Ethiopia
HAPCO          HIV/AIDS Prevention and Control Office
HIV                 Human Immunodeficiency Virus
ILO              International Labor Organization
Ln                    Natural Logarithm
LU                   Land Use
MTCT             Mother- to- Child Transmissions
NGO                Non-Governmental Organization
NIC                  National Intelligence Council
OLS                 Ordinary Least Square
PLWA             People Living with HIV/AIDS
PMTCT            Prevention of Mother To Child Transmission
SL                    Significance Level
UNAIDS          Joint United Nations Program on HIV/AIDS
UNDP               United Nations Development Program
UNECA            United Nations Economic commission for Africa
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ABSTRACT

Acquired Immune Deficiency Syndrome (AIDS) which is caused by the Human Immunodeficiency Virus (HIV) is not only an epidemiological problem but also one of the developmental challenges in developing countries. The epidemic is severely affecting the productive part of the population (15 to 49 age range), that is believed to be ‘the motor of development’.

Ethiopia is one of the Sub-Saharan African countries whose economy is affected by the epidemic. The country is assigned along with India, China, Nigeria and Russia as the ‘next wave of HIV/AIDS’ with large populations at risk from HIV infection, that will overtake the current epidemic prevalence rate in central and southern Africa (NIC, 2002). The epidemic is also among the challenges facing the agricultural sector of the country which provides half of the country’s GDP. Although agriculture is the backbone of the economy, little effort has been made to estimate the impact of the epidemic and many existing studies focus on urban areas instead of rural areas. Therefore, the research reported on in this thesis assesses the extent and channels of the impact of HIV/AIDS on agricultural production. The research measured the extent of the impact of the epidemic on factors of production such as labor, capital stock and land use, which are the determinants of agricultural production. The research was conducted in Ada’a district in Eastern Showa province, Ethiopia, which is one of the top agricultural production areas of the country and also one of the most vulnerable areas for HIV/AIDS.

Stratified random sampling and judgmental sampling techniques were employed to identify sample cases. In addition, both primary and secondary data sources were used to gather the required data/information. The primary sources of data collection methods include PRA, individual interviews, focus groups, photographs and observations. Secondary sources include reports from governmental and non-governmental organizations, health centers, agricultural bureaus, books, newspapers, the internet, etc. The collected data was analyzed by using spread sheets-2003. The interpretation of the results was supported by graphs, tables and photos.

Two stages of ordinary least square (OLS) estimation were done. The first stage was to estimate the impact of HIV/AIDS on production factors whereas the second stage estimation was done to estimate the impact of HIV/AIDS on output (income) of farmers via the impacts on factors of production.

The findings of the analysis indicated that HIV/AIDS has been affecting factors of production significantly, i.e. by reducing labor-hours, depleting the capital stock of farmers and by its impact on the use of land (reducing the amount of land cultivated). The findings also indicated that HIV/AIDS has been decreasing the agricultural income of farmers.

Key words

CHAPTER ONE

INTRODUCTION

1.1 Background justification and statement of the problem

1.1.1 Background

Acquired Immune Deficiency Syndrome (AIDS) was first identified in 1981 among homosexual men in the United States and the virus (Human Immunodeficiency Virus/HIV) which causes AIDS was identified in 1983 (UNAIDS&WHO, 2003:3).

It is estimated that a total of 60 million people have been infected with HIV since the epidemic was recognized and about 20 million people have already died (Page et al., 2006:3). Presently, the epidemic is not only a health problem but also a developmental and humanitarian challenge (Pharoah, 2004:1). Moreover, Hunter (2003:53) indicated that the epidemic is crippling the economic and social development of Africa by undermining any conceivable development of the continent. The HIV/AIDS epidemic is severe especially in Sub-Saharan Africa and the epidemic is weakening the economies of most of Sub-Saharan Africa by attacking the working population in the age range of 15-49. According to a report by the International Labor Organization (ILO) in 2006, about 36.3 million persons of working age are now living with HIV/AIDS and the vast majority of them are found in Sub-Saharan Africa. At the end of 2005, more than 3 million labor force participants worldwide were partially or fully unable to work because of illness due to AIDS, and three-quarters of them lived in sub-Saharan Africa. Further more, Ruiz et al. (2001:14-15) maintain that the growth of AIDS cases has been dramatic in rural areas in Sub-Saharan Africa in recent years. Ethiopia is one of the Sub-Saharan African countries affected by the epidemic.

Ethiopia is found in East Africa, bordering in the west on Sudan, in the east on Somalia and Djibouti, in the south on Kenya and in the north east on Eritrea. The total area of the country is about 1.1 million sq. km (US bureau of African Affairs, 2007). According to a report from the World Health Organization (2005), the country is estimated to have an adult HIV/AIDS prevalence rate of 6.7% and about 5000 adults are estimated to be infected per week. Moreover, Ethiopia is classified as belonging to
the ‘next wave countries’ with large populations at risk from HIV infection, which will overtake the current rate of the epidemic in central and southern Africa (POST, 2003; NIC, 2002).

Ethiopia is among the Sub-Saharan African countries whose economic development is affected by HIV/AIDS (Cradock et al., 2004:1-3). Agriculture is the backbone of the economy of Ethiopia, and it contributes about half of the GNP and more than 80% of export earnings. It employs 85% of the population (US bureau of African Affairs, 2007; De Gobbi, 2006:3). Although the prevalence rate of the epidemic remains higher in urban areas (UNAIDS, 2006), the spread of HIV/AIDS is currently one of the challenges of the agricultural sector along with other challenges such as frequent drought, soil degradation, poor infrastructure, inappropriate agricultural practices, etc.

1.1.2 Statement of the problem

Although the agricultural sector plays a crucial role in the country’s economy and the livelihoods of the population (as explained in 1.1.1 above), the growing concern of HIV/AIDS in the sector is given little emphasis.

Furthermore, the existing limited studies about HIV/AIDS in the country place more emphasis on the epidemiological concerns of the disease than on the development aspects and emphasize the urban areas of the countries. This results in the existence of an information gap on the impact of the epidemic on the rural agricultural sector.

Case studies show that HIV/AIDS is considered to affect the financial and physical capital of households, the use of natural capital, such as land, and labour supply and productivity in Africa which are the determinant production factors in every sector (Mutangadura et al., 1999:14-53). Although some studies conducted in Ethiopia reveal the results of HIV/AIDS on the agricultural sector of the country, the following aspects are not presented in detail:

- The impact of the epidemic on factors of production is explained in general terms (not even including all factor inputs responsible for agricultural production) and it is not specified which production factors are affected by the epidemic.
- There is a lack of information on the magnitude and extent of the impact on each of the factors of production, and their respective impact on agricultural production.

- The available studies also fail to capture the existing impact of the epidemic by comparing HIV/AIDS afflicted and non-afflicted households.

Thus, lack of information on such specification of the existing impacts of the epidemic in the sector leads to poorly defined mitigation strategies and in turn ends up with poor policies, resulting in poor productivity of the agricultural sector, and in the continuation of the epidemic. Therefore, this case study will make its own contribution in filling the existing gap regarding the socio-economic impact of the epidemic in the agricultural production of Ada’a district in the Eastern province of Showa, Ethiopia. The study focuses on identifying the kind and extent of impact of HIV/AIDS on factors of production such as physical, financial and human capital and on the use of natural capital (mainly land) in the selected district of the country.

1.2 Motivation for the case study

The Ada’a district in Eastern Showa province of Ethiopia is one of the well-known agricultural production areas of the country. The area is located about 47 km from the capital, Addis Ababa. The area is known for its cereal production especially the famous crop \(^1\text{Teff}\) and its livestock production such as poultry, cattle fattening, and milk production. \text{Teff} is an important crop in the country and brings high income to farmers. Moreover, the area is one of the regions where agro-processing industries are found. These industries rely on the agricultural sector for their raw materials, which increases the importance of the agricultural sector in the area.

The area is also characterized as a place where a large number of people migrate due to its economic importance and closeness to towns including the capital city.

\(^1\text{Teff}\) is the most famous and common cereal crop in Ethiopia and Eritrea used to make ‘injera’ which is the unleavened bread of the Ethiopian and Eritrean staple food. For more information visit: http://ethnomed.org/cultures/ethiop/teff.html
Furthermore, the province is situated on the main road to Djibouti where truck drivers and business men rest while transporting goods from the port of Djibouti. This has made the area vulnerable to the HIV/AIDS epidemic and motivates the assessment of the HIV/AIDS epidemic impact on agricultural production.

Therefore, the case study in general will provide more detailed information regarding the impact of HIV/AIDS on the agricultural sector and will help to design appropriate mitigation strategies before the epidemic severely damages the backbone of the economy of the country. Moreover, the case study should serve as further reference material for policy makers and other concerned bodies in the country.

1.3 Aims of the research and research questions

1.3.1 Aims of the research

Againt the background of the factors outlined above, this research is aimed at assessing the impact of HIV/AIDS on the agricultural production of the Ada’a district in Eastern Showa province of Ethiopia.

The specific objectives of the research are:

- To identify the kind of impact HIV/AIDS has on factors of agricultural production and provide the required information on the rural households in the district.
- To identify factor inputs severely affected by HIV/AIDS and depict the magnitude of the impact.
- To suggest possible strategies in combating the epidemic in the research area.

1.3.2 The research question

To which extent and through which channels does HIV/AIDS affect the agricultural production in Ada’a district of Eastern Showa province in Ethiopia?
1.4 Limitations and the scope of the study

In the process of conducting this study, there were some limitations. The first one was the unavailability of recent publications on HIV/AIDS and agricultural development in Ethiopia. Information and reports available in the district bureaus and health centers were not compiled and published. In general, most publications and books about this kind of study were found in electronic forms. The other limitation was the concern of stigma and discrimination. Stigma and discrimination against people living with HIV/AIDS was not resolved totally although there have been some improvements in behavioral changes of the population. For this reason, a combination of different data collection techniques was employed while collecting data from HIV/AIDS afflicted households. Moreover, individuals like health extension workers and development agents who are close to HIV/AIDS affected individuals, have participated in the data collection process to ease the process.

The case study was conducted in the Ada’a district of Eastern Showa province in Ethiopia. Therefore, caution should be taken while generalizing and using the findings of the research for a different purpose of study.

1.5 Thesis Outline

The first chapter introduces the general problems and justifications that make it necessary for this research to be conducted in Ethiopia, particularly in the Ada’a district of Eastern Showa province. The chapter also includes the research question and limitations of the study. The second chapter will provide a literature review on the importance, challenges and favorable conditions for the success of the agricultural sector in Sub-Saharan Africa. This chapter also reviews existing literature on the impact of HIV/AIDS on factors of production and the hypothesis of the research. The third chapter discusses the theoretical framework to be used in the research and the fourth chapter presents the methodology of the research, including operationalization, sampling methods, data collection techniques, data coding and methods of data analysis & interpretation. The fifth chapter provides a description of and background
information on the research area. The sixth chapter presents the findings on the impact of HIV/AIDS on factors of production, i.e. on labor, capital stock and the use of land. In this chapter, the regression analysis results are presented in such a way that they explain the impact of HIV/AIDS on factors of production and its resultant impacts on the output (income) of farmers. The final chapter concludes the overall content of the paper and offers some recommendations for possible policy options and strategies in combating the epidemic. The reference part lists all the secondary materials and information used in the paper and the annex contains all the information and supporting documents used for the analysis purpose such as maps and pictures.
CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The agricultural sector is the backbone of most countries’ economy in Sub-Saharan Africa. Agriculture plays an important role in providing high levels of employment and a major part of these countries’ GDP. However, the sector is characterized by small scale production systems and cultivation by traditional methods. Moreover, the expansion of HIV/AIDS in these countries has aggravated the existing problems of the sector by depleting the labor force and thereby the physical and financial capital of the farming population. The following literature review discusses the importance of the agricultural sector, its characteristics and existing challenges, and the impact of HIV/AIDS on the sector.

2.2 Agriculture and the economy of sub-Saharan African countries

2.2.1 The role of the agricultural sector in the region

As was noted in the introduction to this chapter, Sub-Saharan Africa is highly dependent on agriculture. The region consists of about 700 million people of which about 80% live in rural areas. Most of those living in the rural areas can be classified as poor. The agricultural sector contributes about 30% of the total GDP, 40% of the export earnings and provides 70-80% percent of employment in the region. In addition, industrial raw materials come predominantly from this sector (World Bank, 2006).

A growing agricultural sector reduces poverty by making use of the productive capacity of poor people, i.e. their labor, by providing labor-intensive employment for the poor. It further reduces poverty by lowering and stabilizing food prices and by stimulating growth in the rural economy of Sub-Saharan Africa (Karanja, 2006).

According to a report of the twenty-fourth FAO regional conference for Africa held in Bamako, Mali in 2006, the agricultural sector plays an important role in Africa especially in achieving its responsibility to increase food and agricultural production
for the region and its contribution to sustainable food security and the economic prosperity of its people. Ellis (2000:22) also points out that redressing poverty in the rural areas of developing countries without prior development of the agricultural sector is an impossible task.

Productive agriculture plays also a significant role in the expansion of domestic agro-industries. Agro-industries take up the agricultural produce and further process it, which helps to reduce reliance on imports and increases the development of the industry sector. The Lewis-Fei-Ranis model describes how an agricultural sector can harness its agricultural surplus, leading to capital formation. According to the model, the transfer of surplus workers from agriculture to industry can create a surplus for industrial capital formation. In the same vein, the agricultural sector development is a precondition for industrialization as it helps in providing surplus labour force to the industry sector, without which labour costs rise. Moreover, the surplus income obtained out of the produce can be used as savings and for further investment purposes in other economies.

Furthermore, agriculture plays a critical role in poverty reduction strategies as it is the largest employer and source of income of the labour force in Sub-Saharan Africa. Food security attained by productive agriculture can also help in reducing food prices and improving nutrition which in turn promote productivity. In general the increase of the productivity of the agricultural sector enhances economic development and the reduction of poverty (Diao et al. 2006).

2.2.2 Characteristics and challenges of the agricultural system in Sub-Saharan Africa

Diversified agricultural farming systems are common in Sub-Saharan Africa and include small scale crop production, sedentary and nomadic livestock production and mixed crop-livestock production systems. Though land is an important input for production, only 6% of Africa’s land is cultivated. Moreover, the production system is dominated by small-scale farming and traditional cultivation methods (Biodiversity International, 2007). Furthermore, the agricultural system in the region is characterized by labor intensive farming, employing much of the labor force. It is the main determinant of output expansion. Similarly, the productivity of labor in Sub-
Saharan Africa is said to be much lower than that in Asia, with family labor being the predominant form of agricultural labor force (Karshenas, 1999).

The report from the House of Commons’ International Development Committee in 2004 also confirmed that many of Sub-Saharan Africa’s poor remain dependent on their own farms for their livelihood and the sector is pre-dominated by small scale farmers producing at a subsistent level.

The productivity of the agricultural sector is declining and resulting in very low production and food insecurity with low (subsistence) incomes in Sub-Saharan Africa. The small scale farmers are hardly able to save and have inadequate markets for their produce. Food production is limited and, apart from other food aid provided for the region, Africa currently imports food costing about 22 billion US$ per year. The number of food-insecure people in Sub-Saharan Africa has doubled in the past three years and the region faces a decline in food production per capita. The agricultural productivity of land and labour is getting weaker and the region is far from achieving food security for its people and sufficient income for the producers (CTA, 2004). According to a study carried out by the FAO (1991:67), the poor cultivation practices of farmers in Sub-Saharan African countries has led the vast majority of small scale farm households to be primarily concerned with producing food for their own consumption.

According to a report by the World Bank (2006), constraints such as famine and disease are increasing among the region’s population and contributing to the poor growth of the sector. On the other hand, lack of intensive use of land and use of inadequate and low yielding agricultural inputs contribute to the poor performance of the agricultural sector.

The seminar held by CTA International in 2004 clearly identified the challenges of the poor performance of the sector in the region: serious degradation of natural resources, the escalation of conflict in the region and the expansion of HIV/AIDS and related diseases. According to the report on the seminar, HIV/AIDS is changing the structure of the population demography, and agricultural production is severely affected by labour shortage. The pandemic is prevalent among women and the economically
active part of the population. The pandemic is also increasing the dependency ratio and vulnerability of the farming population.

2.2.3 What is needed for successful agriculture in Sub-Saharan Africa?

The significant contribution of agricultural productivity to economic growth, the reduction of poverty and increasing the income of the rural poor has already been discussed in previous sections of this chapter. Ikpi (1999) points out that Sub-Saharan Africa’s poor performance in food production and sustainability is related to low resource productivity and inadequate human intervention at various strategic points of the production and distribution processes.

A Nigerian study carried out by Ukeje (2005) contends that efficiency in production, the availability of working capital, capital allocation to the agricultural sector and the availability of technology in the production process are among the determining factors for success or failure in the sector. Moreover, Jiggins (1986:75) notes that optimum labour allocation to a particular crop is associated with an increase in production in that crop and eventually an increase in the income of farmers.

According to Diao et al. (2006), transformation from traditional farming systems to modern agriculture will increase the efficiency of production of the small scale farmers who dominate the agricultural system of the region. Their report adds that the transformation process should be from subsistence farming to market-oriented farming in order to compete in the increasingly globalized world.

On the other hand, the minutes on a workshop held in Sweden in 2006 on policy, poverty and agricultural development in Sub-Saharan Africa (compiled by Andersson, 2006), revealed that agriculture plays a growth-enhancing and poverty-reducing role. Equity-based distribution of land with access to resources, the availability of excess local labour force, the simultaneous improvement in human capital and the creation of a supportive environment with market and infrastructure improvement, play considerable roles in the development of the sector. Participants at the workshop pointed out the following important concerns for productive and successful agriculture:
- The increment of yield and productivity in agricultural produce;

- The qualified use of technology, including the efficient utilization of labour and the use of technological farm inputs;

- The availability of finance as a key factor; and

- Enhancing input-output market inter-linkages to stimulate growth within the sector; comprising efficient marketing boards, co-operatives and indigenous producer organizations.

Karshenas (1999) also provides some important guidelines which can lead to the success of agriculture in Sub-Saharan Africa. His determinant factors include organization and productivity of labor (including the ability to relieve labor constraints), increasing the average saving ratios and the availability of productive technologies.

From the above literature, one can deduce that the availability of factors of production such as labour, land, capital and technological advancement play a vital role in determining the success or failure of production in agriculture as in any other sector. Thus, any external influence on these factors of production (such as HIV/AIDS in this study) will in turn impact on the production and development of the agricultural sector.

**2.3 HIV/AIDS and its impact on agricultural development in Sub-Saharan Africa**

Africa is a continent with major health problems. About 80 per cent of all infectious diseases are found in Sub-Saharan Africa (Dione, 2002). HIV/AIDS is one of the major challenges for the population in Africa. Out of 39.5 million people living with HIV/AIDS, 72% percent reside in Africa. Sub-Saharan Africa is the most affected region, with about 25 million people living with HIV/AIDS, which is 63% of all people living with HIV/AIDS globally (UNAIDS&WHO, 2006:3). The epidemic is affecting all the economic sectors of the region. Agriculture is one of the economic sectors affected by the epidemic. The epidemic affects the sector’s development through its influence on factors of agricultural production.
2.3.1 The direct impacts of HIV/AIDS on labor and capital

2.3.1.1 Impact of HIV/AIDS on agricultural labor supply and productivity

According to a report by the International Labour Organization (ILO, 2005), about 26 million of the people living with HIV/AIDS are estimated to be between the ages of 15 and 49. This shows that the most productive age group of the population is affected. The epidemic therefore has a direct impact on the economic sectors by altering the existing labour market and employment. The Food and Agricultural Organization of the United Nation (FAO, 2006) reported that 83% of AIDS deaths are in Africa and it has killed ten times more people than war.

According to Coulibaly (2004), loss of labour and reduction of labour productivity is reflected in the agrarian sector of the African economy. The report points out, “…a reduction in the agricultural labour force has significant effects on the size of harvests and so reduces household production and income, and inability to work or diversion of agricultural labour to care for sick household members reduces labour productivity” (Coulibaly 2004:17).

In the same vein, AVERT International (2007) reports that agricultural work is neglected due to household illness in Sub-Saharan Africa. A study done in Malawi showed that HIV/AIDS is affecting the country’s agricultural produce and the current workforce is estimated to be reduced by 14% in 2020.

Labour productivity is also affected by HIV/AIDS as it causes the loss of skilled workers. Less experienced, young people and old persons without previous experience enter the labour market and affect the production process. According to a study done in Kenya, among 54 tea estate workers, the productivity of those infected with HIV/AIDS declined to less than one third of that of other healthy workers as they gradually succumbed to AIDS, especially in the last years before death (Coulibaly, 2004). Furthermore, a report from the United Nations Economic Commission for
Africa (UNECA, 2000) indicated that working time lost due to treatment and care seriously reduces the productivity of the labour force.

In addition, technological progress that plays an important role in human resource (productive labour force) development is affected by HIV/AIDS. Agricultural extension is one of the means that deals with human resource development in rural areas and technology transfer to farmers and rural households in most countries. Through technology transfer, the knowledge and skills of farmers are developed and finally results in productive labor for the sector (Baier, 1997) Thus, loss of agricultural extension services due to loss of extension personnel can also have negative effects on the process of human development.

To sum up, Stoke (2003) argues that the loss of experienced farmers (including loss of knowledge) influences both individual households and communities and is manifested by labor shortages and decline in productivity. The decline of qualified human resources (with certain agricultural knowledge and skills), in turn results in the decline of household income by reduction of the household’s own production and of the income generated by the farms.

2.3.1.2 The impact of HIV/AIDS on Physical and financial capital

Capital, in physical and financial form, is also among the inputs used in the production processes and in future investments in the agricultural sector. According to a report of the United Nations Economic Commission for Africa (UNECA, 2000), the available capital through remittances and savings will disappear because they are used to cover the costs of HIV/AIDS related illnesses and deaths. Training costs of newly hired workers to replace the lost ones, in addition, depletes the available savings.

A World Bank report (2007) cites a paper by Bell et al. (2004) about the impact of HIV/AIDS on financial resources in South Africa. According to this paper, when parents die in South Africa, orphans are threatened by financial distress and lack of care, which may lead to an increase in the incidence of child labor and/or reduced school enrollment.
On the other hand, households are forced into debt that depletes their future savings and leads to the selling-off of existing farming machines, ploughs and livestock to pay for health care and other basic needs. The selling of animals to generate cash for treatment can also affect livestock production (UNECA, 2000).

Farmers also sell their producer farm assets such as tools, equipment, and livestock (used for animal traction) in distress situations and the selling of these important inputs leave households highly vulnerable to future shocks. The disposal of physical capitals which are important for agricultural production, in addition, affects the immediate income to be generated from the farm (Stoke, 2003).

2.3.2 The Indirect impact of HIV/AIDS on the use of natural capital (mainly land)

Access and ownership of land is fundamental in the socio-economic structure of rural households. Loss in human and financial capital can affect the use and preservation of natural capital such as land and water. Land is the primary natural capital owned by farmers. The value of this natural capital will deteriorate before it is finally sold. This is because of the decline in human and financial capital to invest, maintain and improve the land base. The decline in natural assets due to HIV/AIDS includes the reduction of soil fertility, the reduction of farm conservation and irrigation practices, the return of fallow land to bush, a reduction in the quality of permanent crops, renting out or leasing part of the property and land taken from widows and orphans (Stoke, 2003).

A FAO (2006) study done in Africa also found that a widow who loses access to her husband's property can be forced into prostitution in order for her and her family to survive, given the traditional responsibilities of women to produce food and care for the sick and dying.

A UNECA (2000) report cites work by UNAIDS (2000), Guerny (2000) and Topouzis (1998) to explain that AIDS affects the agricultural production by reducing the area under cultivation. Remote areas are left fallow and even those being cultivated receive less attention for tillage, planting and weeding which, in the end, results in declining yield from the land. Furthermore, the varieties of crops under cultivation decline,
leading to a change in crop patterns, with cash crops replaced by subsistence and less
labor intensive crops. This in turn reduces the farmers’ income.

2.3.3 HIV/AIDS and its impact on social capital

Just like the impacts on other production factors, HIV/AIDS also affects the social
capital and in turn the socio-economic development of a given population. According
to the World Bank’s Social Development Department, social capital refers to the
norms and networks that enable collective action. The basic idea beyond the term
‘social capital’ should comprise some elements such as trust, social norms and social
networks and make groups or organizations work more efficiently (World Bank,
2007:2). According to Uddin (2006), social capital and economic development are
like two sides of the same coin. According to the author, high trust affects economic
growth because it increases economic efficiency by reducing transaction costs, costs
in negotiating, and costs in enforcing the contract in the event of dispute and fraud.
The World Bank publication on HIV/AIDS and Social Capital (2007:4), points out
that factors related to stigma, discrimination, and costs to care for the sick as well as
orphans, erode and put pressure on social capital. HIV/AIDS poses a considerable
burden on traditional networks and coping mechanisms to address economic shocks
particularly while caring for orphans and sick individuals. This strain on social
networks could lead to a negative impact on social capital or even to the disintegration
of the existing mechanism to address shocks.

A study done in a South African mining community by Campbell et al. (2002)
investigated a different casual relationship between social capital and health issues by
focusing on people’s membership of voluntary community or associations. According
to the study results, organizational members were less likely to have HIV and mixed
results were found that varied across age and gender.

According to a case study by Steven Robins in Guguletu, South Africa (2007:18), the
extreme state of illness due to an advanced stage of AIDS, results in the withdrawal of
the sick person from everyday social spaces. The epidemic also increases
stigmatization, resulting in avoidance and extreme social and physical isolation that
make AIDS sufferers “non-persons”.

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Therefore, one can conclude that HIV/AIDS is likely to have an impact on social capital through stigma and discrimination, through the burden it poses on traditional social networks that mitigate risks, and through increased insecurity. Thus, through this channel HIV/AIDS affects the socio-economic development process.

2.4 HIV/AIDS and its impact on agricultural factors of production in Ethiopia

The epidemic of HIV/AIDS has continued to be a threat to the development of Ethiopia where 1.3 million people are living with the virus, 744,100 are orphaned due to AIDS, and 277,800 individuals were in need of ART2 in 2005 (FMOHE, 2005).

Although HIV/AIDS was taken as an urban phenomenon and limited to high risk groups previously, the prevalence rate in the country is increasing and spreading to the rural areas (Drimie et al. 2006:20). The authors also quoted the FAO study on agricultural development that documented HIV/AIDS as a major cause of vulnerability in both urban and rural areas. The main concern of the study by Drimie et al. (2006) was the serious social and economic implications of the epidemic on the labour force.

The studies done by the World Food programme (2005) on some regions of the country such as Ambassel and Alaba were also quoted by the authors of the above case study to explain how HIV/AIDS is causing increased spending on health care and funeral costs, reducing investment on farms, shifting household-headed populations, increasing dependency ratios, reducing the labour force, reducing skilled manpower, increasing land share cropping (due to labour constraints) and reducing productive assets (commonly plough oxen) to cover health expenses (Drimie et al. 2006:11).

Stover and Bollinger (1999) describe the impact of HIV/AIDS on some zones of the country which have been most severely affected at the time of harvesting, transplanting, and ploughing. According to them the effect of AIDS deaths varies by region and the death of women makes it difficult for other household members to carry out several tasks. The death of a wife makes some of the important tasks such as weeding and levelling as well as caring for children, difficult.
The death of a family member because of AIDS also lead to a reduction in savings and investment, to the depletion of capital stock, e.g. the sale of livestock to cover health costs, the costs of mourners and other expenses. The loss of productive assets made it harder for the household to survive.

A FAO technical workshop held in Ethiopia in 2005 summarized the potential impacts of AIDS on southern and east African countries including Ethiopia. According to the report on this workshop, AIDS affects family labour in terms of both the loss of adults in the household and the reduction of productivity and cash income. Moreover, affected communities are losing their agricultural skills and local knowledge (IK) because of AIDS related diseases changing the cropping patterns (less varied crops).

Moreover, the affected members of communities engage themselves in selling of livestock, farm implements and land to cover health costs and other related expenses. This also leads the surviving families to poverty and poor production. On the other side, HIV/AIDS affects the long-term agricultural outputs through causing a decline in the value of natural capital. This is because of the reduction of investments in soil conservation practices, irrigation, and use of other agricultural technologies.

Services that help the farming population such as agricultural extension and research services are also in danger through the loss of personnel which eventually limits the information and expertise provided to rural communities and the sector (FAO, 2005).

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2 Anti-Retroviral Therapy (ART) is a combination of several (typically three or four) antiretroviral drugs. Antiretroviral drugs are medications for the treatment of HIV infection. Different classes of antiretroviral drugs act at different stages of the HIV life cycle. (source: Wikipedia online encyclopedia http://en.wikipedia.org/wiki/Antiretroviral_drug.)
2.5 The research Hypothesis

The general hypothesis of this study is: HIV/AIDS negatively impacts on agricultural production.

The specific hypotheses of the study are:

- HIV/AIDS reduces the labour force which reduces agricultural outcomes (farm income) of farmers (direct impact)
- HIV/AIDS depletes the capital stock and diminishes agricultural output (direct impact)
- HIV/AIDS indirectly affects the amount of land under cultivation via the impact on labour and capital stock resulting in the reduction of agricultural output (indirect impact)

2.6 Conclusion

In this chapter, we have discussed how the agricultural sector is vital in the economies of most countries in Sub-Saharan Africa, by employing the highest share of the labour force and contributing the greatest share of these countries’ GDP. From the above literature, it was also possible to understand that the agricultural sector is facing many challenges including the expansion of HIV/AIDS. It was also possible to deduce that HIV/AIDS has been depleting the existing labour force and capital (both financial and physical capital) and consequently affecting the production process negatively. Similarly, in Ethiopia HIV/AIDS has been found to cause the loss of adults from their households, the selling-off of their farm assets as well as a reduction of investment in natural capital, mainly land. Therefore, the different publications in this chapter revealed that HIV/AIDS affects the agricultural production process via its impact on factors of production, i.e. labour, capital and use of land.
CHAPTER THREE

PRODUCTION FUNCTION THEORY

3.1 Introduction

Production function theory in general is a widely used concept in economics to describe the relationship between the quantities of inputs used and the amount of output attained (Weintraub, 1999-2002). In other words, the theory explains the amount of product that can be obtained from each and every combination of factors in the production process. Factors of production which are vital for any production include labour, capital and land. In this thesis, the Cobb-Douglas production function theory is used to explain the effect of HIV/AIDS on factors of production and the resultant impact on the overall agricultural production.

3.2 Production and Productivity in agriculture

Production and productivity are the underlying concepts that play an important role in determining the growth and economic performance of a given sector. In this study the economic sector to be dealt with is the agricultural sector.

Production is the process by which inputs are combined, transformed and turned into outputs whereas productivity of an input is the amount of output produced per unit of that input (Case & Fair 2002:134).

The concept of productivity is also used in the context of efficiency. In agriculture the concept of productivity can be applied for example by measuring the mass of agricultural produce per unit of man-hour or per unit of capital used. Factor productivity involves the computation of an index of total output and an index of all factor inputs. In measuring productivity, it is also important to consider the combined use of resources for a given output rather than taking only a single input factor into account; i.e. the broader the coverage of resources, the better the productivity measure (Schreyer, 2007).

Therefore, an increase in productivity of agriculture implies the production of more agricultural goods and services with the same amount of resources/inputs or means of
producing the same agricultural goods and services with fewer resources. Johnson (2005) contends that the sources of productivity should include the effects of all inputs to the production such as capital, labor, land and technology. Johnson also writes that productivity can be increased by

- Increasing the stock of capital goods
- Investment in human capital for example through training to bring about more efficient production skills
- Technological advancement that enables producers to combine different production inputs to produce the same amount of goods at lower prices
- Making use of specialized labour, incorporation of new skills and the multifaceted division of labour through prior investment in human resources, and the use of more advanced technologies.

3.3 Factors of production

Factors of production are resources/inputs which are not immediately or directly used for satisfying human wants but are used for the production of other goods and services. Production factors are scarce compared to human needs and wants.

Inputs can also be complementary or substitute for each other. Therefore, the connections and relations among the inputs should be taken into account while discussing the demand for inputs. For example, a change in labour may also have an effect on the demand for capital or land (Case & Fair 2002: 205). Moreover, according to UNFAO (2001), a comprehensive agricultural investment should include development of human and physical capital as well as improvements in land and natural resources.

3.3.1 Effective Labour

Human capital/effective labour is the technical knowledge, productive skill and experience embodied in labour resources used in the process of production. Effective labour is a stock of capabilities, which depends not only on knowledge, education, training and skills but also on behavioural habits, level of energy, physical and mental health (Goodwin 2003: 5). Labour can be effective through investment in education
and training. Bosworth et al. (1996:211) argue that skill shortages not only influence economic growth but also have long-term consequences for the introduction of new technologies (limiting capacity for innovation and future growth). I have also explained that education, training and work experience are important in determining the occupation and functions of individuals. Furthermore, the explanation given by the FAO (2001:10) indicates that human capital influences agricultural production by affecting the way in which inputs are used and combined by farmers.

Marginal product of labour is the additional output produced if a firm hires one additional unit of labour (Case & Fair 2002: 205)

### 3.3.2 Physical Capital

Physical Capital is another factor of production used in the production of other goods. Thirlwall (2003:237) writes that the capital stock increases through the process of net investment and the importance of capital accumulation is that it enhances the capacity to produce goods in the future and enables it to grow faster. Physical capital should be maintained to bring sustainable development (Goodwin 2003:1). Physical capital also comprises machineries, farm equipment, tools, ploughs, buildings and infrastructure used in the production process.

### 3.3.3 Land

Land is one of natural resources available for production. According to the explanation given by Johnson (2007), land includes natural resources such as mineral deposits, wild plants and animals, soil fertility, geothermal energy and surface water that are used in the production process. It has to be taken into account that yield is expected when labour is applied to land. Land is classified under natural capital.

### 3.4 The production function

Research in the production function which relates outputs with factor inputs has a long history and is said to have started half a century ago. Economists from A.R.J. Turgot in 1767 to Knut Wicksell in the early 1900’s used the concept to explain diminishing returns and Malthus’s iron law of wages can also be mentioned. In
production function, the total product is related with input factors such as labour, capital, and land with technological advancement. Production function considers those methods that use different combinations of inputs to produce maximum yield. Production function can be applied both at micro and macro levels of an economy. At micro level, it helps in determining prices and the allocation of scarce resources whereas at macro level it helps in determining the aggregate level of income shares, to indicate the relative contribution of technological progress and factor inputs to economic growth (Humphrey, 1997).

Gregory (2005) has also explained that production function can be used to explain economic growth where the relationships between inputs and outputs are depicted in order to show how much produce might be obtained from different combinations of factor inputs in a given state of technology. In the same vein, Gregory points out that total output of a given economy is dependent on the amount of labour and capital used on a given state of technology. It is illustrated as: \( Y = F(K, L, T) \) and read as \( Y \) (output) is the function of \( K \) (capital inputs), \( L \) (labour inputs) and \( T \) (technological progress). The idea behind this function is that the increment in capital, labour and advancement in technology results in the production of more output. The increase in labour and capital in this case can be explained in quantitative and qualitative terms. The quantitative increase in labour and capital can be for instance working more hours and making use of more machines and equipment respectively. The qualitative increment of labour input can be achieved when workers acquire more skills and enjoy better health. The idea beyond this argument is that workers produce more output than before if the quality of the labour force is improved. Moreover, Gregory contends that growth can be either intensive or extensive where the former is the result of expansion of factor inputs and the latter is the result of increase in output per unit of factor input. According to the author, there is a direct relationship between effective use of inputs and increase of output. With regards to productivity, Gregory contends that output per worker increases in accordance with the increase of capital per worker and improvement in technology. This is expressed in the production function as: \( Y/L = f(K/L, T) \)

The theory of production function can be summarized by using the Cobb-Douglas production function model. The production function is named ‘Cobb-Douglas’ after
the originators of the function, Charles Cobb and Paul Douglas, who led the way to research in the area of applied economic growth in the 1920s and 1930s (Thirlwall 2003:152).

The Cobb-Douglas production function mathematically shows the reaction of output with the changes of input factors.

The Cobb-Douglas production is expressed as: \( Y_t = T L^\alpha K^\beta \),

where \( Y \) is the real output (income) at a given time \( t \), \( T \) is an index of technology or ‘total’ productivity, \( K \) is an index of the capital stock, \( L \) is an index of labor input (preferably in man-hours). \( \alpha \) is the partial elasticity (responsiveness) of output with respect to labor (holding capital constant) and \( \beta \) is the partial elasticity of output with respect to capital (holding labor constant). The changes in technology are assumed to be exogenous and independent of changes in factor inputs. \( T, \alpha, \beta \) are constants to be estimated empirically if the function is unconstrained. If the values of \( \alpha \) and \( \beta \) are assigned in advance for estimation purposes, the function is said to be constrained. The sum of the partial elasticity of output with respect to the factors of production gives the scale of returns, or the degree of homogeneity of the function. \( \alpha + \beta = 1 \) represents constant returns, \( \alpha + \beta > 1 \) represents increasing returns and \( \alpha + \beta < 1 \) represents decreasing returns and the function is said to be homogeneous of degree one, greater than one and less than one, respectively. The values of \( \alpha \) and \( \beta \) are estimated empirically on the basis of factor shares (Thirlwall 2003:152-153).

Technology (\( T \)) is subsumed with the labor force (\( L \)) and \( TL \) describes labor with technology (productive labor or human capital).

The average working time of workers and composition of the number of male and female workers can also be defined from the function as follows:

\[ Y = TL^\alpha K^\beta, \] where \( L \) is the total amount of labor supply comprising male

and female workers.
Therefore $L = (W_T) (t)$, where $W_T$ is the total amount of workers and $t_w$ is the average working time for each worker. The product of $W_T$ and $t_w$ provides the amount of the total workers working in a given time period.

$W_T$ can also further be defined as, $W_T = W_m + W_f$, where $W_m$ is the total number of male workers and $W_f$ is the total number of female workers.

Therefore, the overall function would be written as,

$$Y = T [(W_m + W_f)(t_w)]^{\alpha K^{\beta}}$$

On the other hand, the Cobb-Douglas production function can be changed to a linear function by using the principle of logarithmic function to separate and see the influence of factor inputs on output:

$$\ln Y = \ln T + \alpha \ln L + \beta \ln K + K(\text{constant}),$$

using the principle of logarithmic function.

The production function is explained in certain time index can also be shown as follows by differentiating the logarithms of the variables with respect to time as follows:

$$\frac{d \log Y}{dt} = \frac{d \log T}{dt} + \alpha \frac{d \log K}{dt} + \beta \frac{d \log L}{dt}$$

The contribution and influence of the factors of production on output can also be shown by putting in the form of growth rates. If the annual rates of change of variables are to be considered, for instance, the equation can be written as,

$$R_Y = R_T + \alpha R_K + \beta R_L$$

where $R_Y$ is the annual rate of growth of output per time period, $R_A$ is the annual rate of growth of total productivity or technical progress, $R_K$ is the annual rate of growth of capital and $R_L$ is the annual rate of growth of labor with $\alpha$ and $\beta$-elasticities of output with respect to labor and capital respectively. On the other hand, the rate of growth of output is equal to the sum of the rate of growth of ‘total’ productivity, the rate of growth of labour weighted by the partial elasticity of output with respect to labour and the rate of growth of capital weighted by the partial elasticity of output with respect to capital (Thirlwall 2003:154).
3.5 Application of the model to the research agenda

The key input factors needed for production are configured with their relationship with the final outputs in the Cobb-Douglas production function. The Cobb-Douglas production function can be put in regression function and correlation showing both the independent variables (input factors) with the dependent variable (output/produce).

Thus, the factors of production in agriculture are related with final production depicting the determinant roles of production factors.

In this research, HIV/AIDS is taken as an aspect that influences the factors of agricultural production by, for example, reducing existing labour supply and productivity (depletion of human capital), reducing physical capital and the use of natural capital, mainly land.

Therefore, having this in mind, the Cobb-Douglas production function model in this research study is used to estimate the income of farmers with and without HIV/AIDS. The values of production factors (i.e. values of labour, capital and use of land) with and without the presence of HIV/AIDS, are used to analyse the changes in output (income) of farmers due to HIV/AIDS.

3.6 Conclusion

In the above sections, it is possible to realize the concept of the Cobb-Douglas production function, which mathematically shows the reaction of output to changes in input factors. The input factors include effective labour (productive labour), capital and land. Using the Cobb-Douglas production function as the main theoretical framework, it is possible to deduce that the changes in input factors with and without the effect of HIV/AIDS can be identified. This paves a way to see the reaction of the overall output (production) with the changes in input factors.
CHAPTER FOUR
RESEARCH DESIGN & METHODOLOGICAL FRAMEWORK

4.1 Introduction
In this chapter we would see the research methods employed to take sample, to collect the required data and methods for analysis of data. The chapter also includes the operationalization part which comprises the indicators and their respective measurements while analyzing the channels and the impacts of HIV/AIDS on agricultural production. With respect to the sampling techniques the different methods used in household and research area selection would be discussed. Moreover, the methods of gathering data and information, the techniques employed to code the collected data and analysis systems used to make the data meaningful would also be discussed in this chapter.

4.2 The research design
The research process in general includes the following procedures

- Investigation of existing publications about the research problem in general and on the case study area in particular
- Stakeholder identification in the province regarding those who are important for the study. It includes, HIV/AIDS afflicted and Non-afflicted households/farmers, health centers, agricultural bureaus, micro finance and market institutions, local associations, women groups and other governmental and non-governmental organizations.
- Rapport building with the above stated institutions, determining the sampling size (for selecting individual and household cases) and taking sample
- Structuring data collection methods, making ready all materials and resources needed, and collection of data
- Data coding, feeding to the computer, processing, analysis, interpretation and presentation
### 4.3 Operationalization

In order to examine the channels and extent of the impact of HIV/AIDS on agricultural production in the research area, the following indicators\(^1\) and their respective measurements were used for the data collection process.

Table 1: List of indicators and their measurements for the study

<table>
<thead>
<tr>
<th>DIMENSION OF INTEREST FOR VARIABLES</th>
<th>INDICATORS SPECIFIC MEASURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in Income level of farmers (Dependent variable)</td>
<td>Loss of income</td>
</tr>
<tr>
<td></td>
<td>Loss of yield</td>
</tr>
<tr>
<td>Change in labor force (independent variable 1)</td>
<td>Change in working hours of the labor force</td>
</tr>
<tr>
<td>Type and composition of household</td>
<td>Change in age or sex of labor force</td>
</tr>
<tr>
<td>Preference of crops production in accordance with the requirement of labor</td>
<td>Change in the trend of crop production</td>
</tr>
<tr>
<td>Change in Physical capital (independent variable 2)</td>
<td>Availability of physical capital (farm implements and inputs, draft animals, transportation means for harvests) for investment on agriculture</td>
</tr>
</tbody>
</table>
Change in use of land  
(independent Variable 3)

Change in the use land due to losses of human and physical capital

<table>
<thead>
<tr>
<th>Trend of the amount of land cultivated</th>
<th>Area of cultivated land (in Ha) from 2001 to 2006 among HIV/AIDS afflicted and non-afflicted households.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selling, Renting or leasing out part of/whole farm land holdings due to income shortages</td>
<td>Area of land sold/rented out for each year</td>
</tr>
</tbody>
</table>

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NB1 The concept on identifying indicators and measurement of the impact of HIV/AIDS (in 4.2 above) is adopted from Stokes, CS(2003), visiting scientist, Population and Development Service, FAO Gender and Population Division, Professor of Rural Sociology, Pennsylvania State University, USA


NB2 In dealing with these indicators, caution was taken to take into account other factors (other than HIV/AIDS) that have the potential to result in the same impact on agricultural production. Such aspects include illness and deaths from other diseases, droughts, existence of conflict (especially over natural resources), etc.
4.4 Method of sampling techniques

The case study was conducted in Ada’a district in the Eastern Showa province of Ethiopia. According to Nichols (1991:13), a case study helps to look in depth at a ‘typical case’ and provide valuable insights in a particular place.

In the research both stratified random sampling techniques and judgmental sampling methods were employed.

The study area was selected using judgmental sampling techniques. Nichols (1991:67) described the method as a technique to be employed based on certain reasons and criteria of a researcher.

4.4.1 The study area selection

The reason for selecting this judgmental sampling technique was based on the identified criteria of the researcher, which are discussed in sub-chapter 1.2. The assessment of the impact of HIV/AIDS on agricultural production was not complicated because of the following additional reasons:

- Ada’a district in Eastern Showa province is a Conflict free, drought and other natural disasters free area. This helped to minimize possible bias with the impact of HIV/AIDS as they can also be causes for reduction of production.
- The experience of the researcher with the nearest agricultural research institute (knowledge of the area)

4.4.2 House holds and individual cases selection

Households were stratified as HIV/AIDS afflicted and non-afflicted firstly. The households were also further stratified as male headed and female headed households. HIV/AIDS afflicted households were used as a treatment group and the Non-HIV/AIDS afflicted households as a control group so that the assessment of the impact of the epidemic was made easy. A special caution was taken while selecting the households on some issues such as similarity in income source, similarity of soil productivity/fertility to minimize biases. The selection of HIV/AIDS afflicted households was based on whether the family has at least one member suffering from frequent or long term illness due to HIV/AIDS.
A total of 140 respondents were selected, of which 70 of them were HIV/AIDS afflicted and the remaining portion for Non-HIV/AIDS afflicted ones. Moreover, key informants of the community were selected to collect general information about the area.

The overall groups of respondents were also arranged using stratified random sampling technique. Nichols (1991:61) described that stratified random sampling is helpful to ensure that sub-groups are accurately represented in the sample. The reason for using this sampling technique in this research was to make sure that some groups of the community such as women and the youth were included in the sampling procedure. Age and sex strata have helped for comparison purposes regarding the assessment of HIV/AIDS impacts.

<table>
<thead>
<tr>
<th>Affliction to HIV/AIDS</th>
<th>Number of sample(n)</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Non-afflicted Households</td>
<td>70</td>
<td>50%</td>
</tr>
<tr>
<td>Male</td>
<td>45</td>
<td>64.3%</td>
</tr>
<tr>
<td>females</td>
<td>25</td>
<td>35.7%</td>
</tr>
<tr>
<td>2 HIV/AIDS afflicted Households</td>
<td>70</td>
<td>50%</td>
</tr>
<tr>
<td>male</td>
<td>45</td>
<td>64.3%</td>
</tr>
<tr>
<td>Females(Widows)</td>
<td>25</td>
<td>35.7%</td>
</tr>
<tr>
<td>Total</td>
<td>140</td>
<td>100%</td>
</tr>
</tbody>
</table>

### 4.5 Method of Data collection

Both primary and secondary data sources were employed in the research. Secondary data sources included books, journals, magazines, newspapers, governmental and non-governmental reports, reports from local women’s group, micro-finance institutions, marketing institutions, the population census and surveys, internet sources, etc. With respect to primary data collection methods, PRA tools, focus group discussions, informal discussions and individual interviews were employed.
The reasons for selecting these methods were to understand the real situation of the community, to see human-resource interactions, to include vulnerable groups, to make the data collection process participatory, to keep the research flexible, to include some key informant groups of the community, and other advantages. On the other hand, the individual interview method was used to ensure confidentiality and the free flow of information especially for HIV-AIDS afflicted households. Wellings and Field (1996:88) indicate that dealing with sensitive issues like HIV/AIDS is a major challenge when discussing these issues with a community. Moreover, the use of individual interviews in this regard was helpful and minimized some challenges such as stigma and discrimination. Before starting the process, a checklist of information was collected, a list of questions for interviews as well as data recording sheets and other materials were prepared. The data collection method involved the health extension workers in the district, individuals who teach about HIV/AIDS from Tesfa goh—an indigenous NGO that give support for AIDS patients, and workers from the World food program. These individuals are very close AIDS afflicted individuals as they regularly provide services and supports (such as subsistence payment for living and ARV drugs) for them. This has made easy the process of the identification of AIDS afflicted individuals and the data collection process.

4.6 Data coding

In order to prepare the collected data for analysis using computer software, some of the variables which cannot be quantified were changed to dummy variables. For instance, for the information regarding the status of HIV/AIDS, HIV afflicted individuals were recorded as ‘1’, ‘2’, ‘3’, ‘4’ … (depending on the duration of the affliction year) whereas non-afflicted respondents were recorded as ‘0’. In addition, for responses like ‘Yes’ and ‘No’, the same principle was applied (‘1’ for ‘Yes’ and ‘0’ for ‘No’).

In coding HIV/AIDS affliction, the duration of affliction was taken into account. This means that the longer the duration of affliction, the higher the value assigned. For instance, if a person was afflicted with HIV/AIDS in the year 2001, the coding was done as follows:

For the year 2001= 0 (because the duration of the year of affliction is zero)
For the year 2002 = 1 (as the person’s afflicted time is 1 year ago)

For the year 2003 = 2 (as the duration of living with HIV/AIDS since afflicted is 2 years)

For the year 2004 = 3 (duration since affliction is 3 years)

For the year 2005 = 4 (duration since affliction is 4 years)

For the year 2006 = 5 (duration since affliction for the same person is 5 years)

For non- HIV/AIDS afflicted individuals, the value assigned is 0 for all years.

By doing so, it is possible to analyze the relationship between duration of affliction and possible impact on labor force, capital stock and land use and thereby impacts on the overall yield and income of farmers.

**4.7 Method of Data Analysis**

Once data coding had been done, the data was analyzed using both descriptive and statistical analysis. The descriptive analysis included percentages, ratios and proportions whereas the statistical analysis involved regression estimates. The analyzed data was presented using graphs, tables and charts. The regression analysis was computed by spread sheets-2003. The analysis for income change due to HIV/AIDS affliction was computed using both the Cobb-Douglas and linear production functions. The results obtained from the linear production function analysis are presented in the footnotes.

The Ordinary Least Square (OLS) estimation was done in two stages:

**Stage 1.** The first part of estimation was computed by taking factors of production (each treated individually) as dependent variables with the independent variable HIV/AIDS; i.e.

1. \( \ln L = a_0 + a_1 \cdot \ln \text{HIV/AIDS} \);

2. \( \ln K = b_0 + b_1 \cdot \ln \text{HIV/AIDS} \);
3. \( \ln LU = c_0 + c_1 \ln HIV/AIDS \); where,

\( \ln L, \ln K \) and \( \ln LU \) are the natural logarithm of labor, capital and land use, respectively.

After the regression result of the above functions was obtained, the impact of HIV/AIDS on production factors was discussed.

**Stage 2.**

As the income of farmers is not directly influenced by HIV/AIDS but indirectly through the impact of HIV/AIDS on production factors, the following two-stage OLS approach was used. This approach was used to compute how HIV/AIDS affects income for each of the observation years separately and then again for the mean of the observation period. This approach is derived from the Cobb-Douglas version of the production function used to discover the impact of HIV/AIDS on income.

The second stage Ordinary Least Square estimation was computed to estimate changes in income (output) of the farmers due to HIV/AIDS affliction. The output is estimated with and without the affliction of HIV/AIDS.

First, \( \ln Y \) (income of farmers without HIV/AIDS affliction) was regressed on each production factor, i.e. \( \ln Y = f(\ln \text{Labor}, \ln \text{capital}, \ln \text{land use}). \) From the regression results, equations by taking the coefficients of each production factor and intercepts were derived, which were used to compute the income of farmers without the effect of HIV/AIDS on factors of production. For the case of income estimation without the effect of HIV/AIDS, the values of the labor, capital and land use (without the impact of HIV/AIDS) were taken from the empirical data and substituting the values to the formulated equation to find \( Y \) (income) without the impact of HIV/AIDS. Secondly, the calculated values for each factor of production with the impact of HIV/AIDS were substituted into the same equation used to calculate income with the impact of HIV/AIDS affliction, i.e. \( \ln Y = \beta_0 + [\ln L \ln HIV/AIDS + \ln K (\ln HIV/AIDS) + \ln LU (\ln HIV/AIDS)] \)
After both results (income with and without the impact of HIV/AIDS on production factors) were obtained, the difference was calculated. Then, the percentage income changes due to HIV/AIDS were computed as follows;

\[
\text{Income change (\%)} = \frac{\text{Income without the impact of HIV/AIDS} - \text{Income with the impact of HIV/AIDS})}{\text{Income without the impact of HIV/AIDS}} \times 100
\]

The presentation of the analysis part was also supported by graphs, tables, drawings, photographs, etc.

4.8 Conclusion

In this chapter, all the research methods employed in the thesis were discussed. The indicators of both the dependent variables and independent variables that show the extent and channels of the impact of HIV/AIDS were also clearly identified for ease of the analysis of the information gathered. Moreover, the types of sampling techniques used (namely judgemental and stratified sampling techniques) in the study as well as the respective reasons for choosing the methods were also discussed. In addition, different data collection methods (for both primary and secondary data sources) and reasons for using that particular method were discussed. It is also possible to take into account that the data collection methods employed in the study were designed in such a way that they enabled us to understand the real situation of the community. They also made the process participatory and kept the research flexible. Moreover, dummy variables were employed for some of the data which are difficult to quantify. This was done for simplicity of analysis. In addition, the data analysis methods i.e. both descriptive and statistical analysis, were also discussed. The Ordinary Least Square (OLS) estimations which were done in two stages were also presented as the main tool to see the impact of HIV/AIDS on production factors as well as the total production.
CHAPTER FIVE

DESCRIPTION OF ADA’A DISTRICT IN THE EASTERN SHOWA PROVINCE—THE CASE STUDY AREA

5.1 Introduction

In this chapter, a general description of the study area is provided. This comprises a description of the location of the research site with respect to the total area, population size (including the number of males and females), altitude, average temperatures and precipitation, major soil types and rivers existing in the area, crop production and animal husbandry patterns, and the existing opportunities and challenges in the agricultural production process. Moreover, the existing marketing and HIV/AIDS services delivered in the study area are reviewed.

5.2 Background information about the research site

Ada’a district is one of the districts found in the Eastern Showa province of Ethiopia. The area is located about 47 km from the capital, Addis Ababa (Annex 1&2). Ada’a is the largest district of the 12 districts in the province, covering an area of 1610.56 km² (11.5% of the province area). According to the central agricultural census (2003), the agricultural population of the area is estimated at 202,276 of which 48% of the population are females. The average family size in the district is 5.

The altitude of the district is 1800 m above sea level and it has a temperate rainy climate. The mean minimum and maximum temperature as recorded for the past 27 years ranges from 7.90°C to 28°C, respectively. The mean annual temperature for the same period was 18.5°C and the average precipitation amount is 839mm, which in some years goes up to 1400mm. In addition, there are different soil types in the area based on their origin as well as variations in the process of their formation. The major soil types in the district include Fluvisols, Luvisols and Vertisols (Source: The District Bureau of Agriculture and Rural Development).
Ada’a district has five rivers and these rivers drain into either of the two major drainage basins of the country: the Awash Basin and the Lakes basin. Although the area is rich in natural and man-made forest resources, deforestation is becoming one of the problems in the district. The district is close to main towns including the capital Addis Ababa, creating a large market for most agricultural commodities produced in the area. Regarding the development of infrastructure, the district has facilities such as telecommunication, electric power, and roads that connect the district to the nearby towns. However, for some villages of the district, the accessibility by road is difficult in rainy seasons (Source: The District Bureau of Agriculture and Rural Development).

5.3 The General Characterization of farming systems in the research area

5.3.1 Types and patterns of agricultural production

5.3.1.1 Crop production

The agro-ecology of the district is best suited to diverse agricultural production. Ada’a district is one of the main districts in the province for cereal crops production.

Crop production dominates the farming system of the district and the area is well known for its production of the best quality Teff in the country. Wheat and chickpea are also the other main cereal crops grown in the district. Of the main cereal crops growing in the area, Teff (the white variety) takes the first position followed by wheat. Chickpea is the most practiced crop for pulses. The cultivation of Teff covers about 53% of the arable land and it is clear from discussions with farmers that this will remain unchanged for the foreseeable future. This is because Teff has high market demand, brings the highest income to farmers and is also easily storable.

Oil crops like Safflower, Niger seed, Linseed and vegetables are grown in small quantities. There are two cropping seasons in the district, namely Belg (the short rainy season) which lasts from March to April, and Meher (the main rainy season) lasting from June to September. Belg rains are mainly used for the initial breaking of the soil for Meher crops and animal feed. Meher rains which account for about 74% of the
annual precipitation are the most economically important rains for crop production *(Source: The District Bureau of Agriculture and Rural Development).*

The average farm size in the district is about 2.5 ha. Total cultivated land accounts for 64,412 ha. Out of this 64,088 ha is in the rural area and the remaining share is in the urban area.

**5.3.1.2 Livestock production**

Livestock production of mainly poultry and cattle is also a common practice in the district. Moreover, the production of small ruminants such as sheep and goats is also practiced to a lesser extent. Apiculture is emerging in some pockets where there are flowering plants. Land cultivation practices are operated with the help of oxen power. Moreover, animals like horses and mules are used for the transportation of agricultural produce and people (see Annex 11). In general, the livestock production of the area is operated in a traditional way and the sector remains undeveloped (see Annex 12).

**5.3.2 Opportunities and challenges of agricultural production in the area**

**5.3.2.1 Opportunities**

Ada’a district is one of the best places for cereal crop production in the country. The area has the temperature, precipitation and soil type suitable for agricultural production. Moreover, the area is close to towns including the capital Addis Ababa for marketing opportunities. The cereal crops produced in the area, especially *Teff* and wheat, are in high demand from consumers and the nearby pasta and flour processing agro-industry. The presence of the Debrezeit Agricultural Research Center which is close to the district has also helped farmers by recommending several research findings on the improvement of seed quality. The farmers also have several opportunities to get technical support on their production practices from the research center and the district Bureau of Agriculture and Rural Development (BOARD).
5.3.2.2 Major challenges

Ada’a district faces some challenges regarding agricultural production. These challenges include a lack of sufficient credit availability, an increase in the price of improved seeds and fertilizers, post harvest pests (due to poor storage infrastructure), deforestation, the limited trade capital of cooperatives and the farmers’ union, the inefficiency of the cooperatives, trader cheating (especially during harvest time), lower prices during the harvesting period (due to forced sales for credit repayment), a shortage of working capital, a poor saving culture among the farmers and the serious challenge posed by the expansion of HIV/AIDS and inadequate health services.

5.4 Marketing

In general, the farmers’ produce is sold in two ways, through cooperatives and private traders. There are about 26 farmer cooperatives operating in the district involved in grain marketing. These cooperatives obtain credit for grain marketing from the Ethiopian Commercial Bank. Most of the cooperatives are involved in the marketing of cereal crops especially Teff due to the fact that it has more market demand and is easily storable. In addition to facilitating grain marketing, the cooperatives are also involved in providing marketing advice to their members.

The cooperatives in the area have been criticized for their inflexibility in changing market conditions such as making changes to the prices of the produce.

5.5 The challenge of HIV/AIDS

HIV/AIDS is recognized as one of the main challenges for all sectors, including the agricultural sector, in Ada’a district. Agriculture is the backbone of the economy of the rural people and HIV/AIDS is devastating the sector’s livelihoods. It is affecting family welfare, economic growth and social services. Out of the estimated 4 million (prevalence rate of 4.7%) people living with HIV/AIDS all over the country, an estimated 23,555 people are found in Ada’a district (table 3).
Table 3: The estimated number of people living with HIV/AIDS, orphans and sex workers in the district

<table>
<thead>
<tr>
<th></th>
<th>Estimated number of people living with HIV/AIDS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>23,555</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Estimated number of orphan children</td>
<td>3596</td>
</tr>
<tr>
<td>3</td>
<td>Estimated number of commercial sex workers</td>
<td>3056</td>
</tr>
</tbody>
</table>

Source: The Ada’a District HIV/AIDS Prevention and Control Office

5.5.1 HIV/AIDS status in the area

According to the information obtained from the district VCT (Voluntary Counseling and Testing) center, a total number of 20,726 volunteers in the year 2006 were tested and about 3,428 of them were found to be HIV positive (table 4).

Table 4 Voluntary Counseling and Testing (VCT) for the year 2006

<table>
<thead>
<tr>
<th>Age group</th>
<th>Volunteers counseled and tested</th>
<th>Positive cases</th>
<th>Positive rate in percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>F</td>
<td>Total</td>
</tr>
<tr>
<td>0-4</td>
<td>66</td>
<td>56</td>
<td>122</td>
</tr>
<tr>
<td>5-14</td>
<td>147</td>
<td>252</td>
<td>399</td>
</tr>
<tr>
<td>15-19</td>
<td>1097</td>
<td>3288</td>
<td>4385</td>
</tr>
<tr>
<td>20-24</td>
<td>3411</td>
<td>3270</td>
<td>6681</td>
</tr>
<tr>
<td>25-29</td>
<td>2652</td>
<td>1665</td>
<td>4317</td>
</tr>
<tr>
<td>30-34</td>
<td>1352</td>
<td>707</td>
<td>2059</td>
</tr>
<tr>
<td>35-39</td>
<td>726</td>
<td>511</td>
<td>1237</td>
</tr>
<tr>
<td>40-44</td>
<td>423</td>
<td>215</td>
<td>638</td>
</tr>
<tr>
<td>45-49</td>
<td>319</td>
<td>142</td>
<td>461</td>
</tr>
<tr>
<td>50+</td>
<td>320</td>
<td>107</td>
<td>427</td>
</tr>
<tr>
<td>Total</td>
<td>10513</td>
<td>10213</td>
<td>20726</td>
</tr>
</tbody>
</table>

Source: The District HIV/AIDS Prevention and Control Office
From the above table, it is possible to point out that about 16.5% of all tested volunteers were positive and almost 75% of positive cases were in the age group 20-39. The table indicates that almost equal numbers of males and females volunteered for counseling and testing. Moreover, among all volunteers, about 60% of HIV cases were females.

On the other hand, the VCT center of the district recorded that out of 1036 volunteer individuals who were tested (from June to September 2004), 18% were found to be positive. Similarly, out of 680 people who were tested between September 1996 and December 2004, 21% of them were found to be positive. The number of individuals who are volunteering to have the HIV test has been increasing dramatically and the number of infected people especially in the rural areas is increasing.

Among 70 individuals living with HIV/AIDS, 63% indicated that they were infected with the virus through having other heterosexual sex partners than spouses and using commercial sex workers. The rest of this group, of whom the majority (30%) was female, reported that they acquired the virus through their spouses (see Figure1). There were also a few cases of mother-to-child transmissions (MTCT) and other risks due to harmful traditional practices such female genital mutilations. It was also indicated that, especially on market days when the farmers go to the nearby urban centers to sell their produce and buy consumer goods, it is a common practice among them to abuse alcohol and then visit commercial sex workers.
Figure 1: Mode of HIV/AIDS transmission among adult respondents living with HIV/AIDS (n=70)

5.5.2 HIV/AIDS services

The district HIV/AIDS Prevention and Control Office (HAPCO) is one of the main governmental institutions rendering HIV/AIDS related services to the Ada’a district of the Eastern Shewa province. The office has been operating in the district since 2001 but with limited professional and financial resources. The district HAPCO receives its limited budget from the federal HAPCO, which further inhibits the activities of the office. The institution is mainly involved in awareness creation, mobilization of HIV/AIDS related activities of health centers, and non-governmental organizations and youth clubs.

The other governmental organization is the district health center under the ministry of Health. The health center in collaboration with the district HAPCO provides Voluntary Counseling Testing (VCT), Prevention of Mother-to-Child Transmission (PMTCT) services and distributes condoms and Anti-Retroviral (ARV) drugs. In the year 2006, the PMTCT service was provided to 2500 people in the district.

The capacity of these governmental organizations with respect to the distribution of condoms and ARV drugs is very limited and such services are mainly delivered by other non-governmental organizations.
The other NGOs operating in the area in support of HIV/AIDS affected individuals include the World Food Programme (WFP), Bishoftu Youth and Productive Health Association, local churches and especially the association ‘Dawn of Hope’ (‘Tefa Goh’ in Amharic). Dawn of Hope is an indigenous association organized by people living with HIV/AIDS. The association is one of the strongest associations operating in the area. It is involved in the care and support of people living with HIV/AIDS. The support includes ARV treatment and home care for resource poor farmers and for AIDS patients.

5.6 Conclusion

In this chapter, a physical description of the research area was provided. It is clear that the study area is suitable for agricultural production and especially for cereal production. Moreover, the proximity of the area to towns including the capital Addis Ababa provides a great market opportunity for the produced goods. On the other hand, the expansion of HIV/AIDS in the area is also creating a serious problem in the different sectors including the agricultural sector. It is also clear that measuring the impact of HIV/AIDS is relatively easy as the area is free from any sort of disaster, pest infestation and other natural calamities which might be responsible for the reduction of agricultural production in the area. This has helped to minimize possible biases while estimating the impact of HIV/AIDS on agricultural production. The impact of the epidemic on production factors as well as on total production is estimated in the next chapter.
CHAPTER SIX

THE IMPACT OF HIV/AIDS ON FACTORS OF PRODUCTION AND OUTPUT (INCOME) OF FARMERS IN ADA’A DISTRICT IN THE EASTERN SHOWA PROVINCE, ETHIOPIA

6.1 Introduction

In this chapter the impact of HIV/AIDS on production factors and thereby on production (income) of the farmers is discussed. The analysis of the impact of the epidemic is accomplished in two stages. In the first stage (the first Ordinary Least Square estimation), the direct impact of HIV/AIDS on labor and capital and its indirect impact on the use of land is analyzed. This helps with the analysis of the impact on total production in the second stage. Based on the analysis result obtained in the first stage, the second stage Ordinary Least Square estimation is carried out to estimate the impact of HIV/AIDS on the total production (income) of farmers.

6.2 Direct impacts of HIV/AIDS

6.2.1 The impact of HIV/AIDS on labor force

6.2.1.1 Characteristics of the labor supply for agricultural production

Agriculture is the main employer of labor in the district. The subsistence form of the sector relies on family labor for crop and livestock production in the investigated area. All of the respondents reported that family labor is their main source of labor in the production process. The dependence of farm households on family labor results in the occurrence of seasonal labor shortages especially at peak periods of farming such as land preparation and tillage, planting, weeding, and harvesting (see Annex15).

With respect to the quality of the labor force (human capital), agricultural production is practiced using the farmers’ indigenous knowledge, supplemented with training rendered by agricultural extension professionals of the district BOARD. Of the total number (140) of respondents interviewed, 88% of the farmers reported never having
received formal education (see Figure 2).

Figure 2: the literacy level of respondents

<table>
<thead>
<tr>
<th>Literacy level of respondents (n=140)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elementary</td>
</tr>
<tr>
<td>10</td>
</tr>
<tr>
<td>Junior high school</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>High school</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>Illiterate</td>
</tr>
<tr>
<td>124</td>
</tr>
</tbody>
</table>

It is reported that the farmers have been receiving both theoretical and practical training on crop and livestock production, pest control methods, post harvest storage and marketing subjects at different times. The farmers of the area also have an opportunity to visit the demonstration fields and to request advice (especially on the outbreak of crop and animal diseases) from the nearby Agricultural Research Institute to widen their knowledge about agricultural production techniques. Therefore, farmers and their families as the labor force for agricultural production on their farms are responsible from the very beginning of land preparation to the final marketing stage.

With respect to gender composition and division of labor, both male and female farmers are involved in the production process. Male labor is used for tillage either by hand or by the use of draft animals. Women participate in the planting, fertilizing, weeding, harvesting and threshing stages of production. Children are also engaged in helping their parents in some activities of farming such as weeding. Among all the family members (between the ages of 15 and 49) of the respondents, who are involved fully in the production process, 293 (47%) are males and the remaining 325(53%) are women. Although the proportion of female labor is higher than male labor in the overall families, the composition of women and men is different in the case of
HIV/AIDS afflicted and non-afflicted households. The proportions of women labor in HIV/AIDS afflicted and non-afflicted households are 55% and 51% respectively, showing differences in gender composition and roles in agricultural production in both groups of families (see figure 3).

Regarding the contribution of women in the farming population of the area, women who participate in farming are also responsible for household activities such as food preparation for the members of the family and taking care of children. Therefore, in HIV/AIDS afflicted households, the proportion of women in farming is greater in proportion which indicates that they are highly burdened with both farming and household activities including care-giving for HIV/AIDS afflicted members of the households.

Figure 3: The composition of family labor in HIV/AIDS afflicted and non afflicted households

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6.2.1.2 The impact of HIV/AIDS on labor: Stage 1 Ordinary Least Square estimation results

HIV/AIDS, as one of the challenges of agricultural development, was found to affect the labor-hours. The following regression results indicate the empirical findings of the study. Labor is explained in labor-hours and in order to see the effect of HIV/AIDS

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on the labor, the values of labor-hours (as dependent variable) were regressed on the determined values of HIV/AIDS affliction (as independent variable), i.e.,

\[ \text{Labor} = f(\text{HIV/AIDS}) \]

The estimation was done for 6 years (from 2001 to 2006) and as the values between years have only slight difference, only the average estimations were presented for discussion. For yearly estimate results please refer to Annex 3.1.

Table 5: First stage Ordinary Least Square estimation result; production factors regressed on HIV/AIDS, i.e. \( \ln L = a_0 + a_1 \cdot \ln \text{HIV/AIDS} \);

\[ \ln K = b_0 + b_1 \cdot \ln \text{HIV/AIDS} \]

\[ \ln LU = c_0 + c_1 \cdot \ln \text{HIV/AIDS} \]

<table>
<thead>
<tr>
<th>Average estimation results of production factors regressed on HIV/AIDS</th>
<th>( R^2 )</th>
<th>Significance of F</th>
<th>Coefficient</th>
<th>Standard error</th>
<th>Sum of squared errors (MS)</th>
<th>Mean for independent variable</th>
<th>Mean for dependent variable</th>
<th>Variance for independent variable</th>
<th>Variance for dependent variable</th>
<th>Observation</th>
<th>df</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \ln L = a_0 + a_1 \cdot \ln \text{HIV/AIDS} )</td>
<td>0.296</td>
<td>0.00</td>
<td>-0.371</td>
<td>-7.615*</td>
<td>49.19</td>
<td>14.81</td>
<td>3.33</td>
<td>0.82</td>
<td>0.35</td>
<td>0.76</td>
<td>140</td>
</tr>
<tr>
<td>( \ln K = b_0 + b_1 \cdot \ln \text{HIV/AIDS} )</td>
<td>0.575</td>
<td>0.00</td>
<td>-0.532</td>
<td>-13.682*</td>
<td>51.81</td>
<td>29.98</td>
<td>8.86</td>
<td>0.82</td>
<td>0.37</td>
<td>0.76</td>
<td>140</td>
</tr>
<tr>
<td>( \ln LU = c_0 + c_1 \cdot \ln \text{HIV/AIDS} )</td>
<td>0.093</td>
<td>0.00</td>
<td>-0.161</td>
<td>-3.771*</td>
<td>29.46</td>
<td>2.94</td>
<td>0.57</td>
<td>0.82</td>
<td>0.21</td>
<td>0.76</td>
<td>140</td>
</tr>
</tbody>
</table>

Source: Author’s estimation

Significant at 1%
According to the above regression result, on average, the affliction of an individual by HIV/AIDS reduces labor-hours by 0.37%.

On the other hand, the average estimation result shows that about 29.6% of the change in labor-hours is explained by a change in HIV/AIDS affliction.

Moreover, the regression results for each year and the average result show that the correlation coefficient of labor with respect to HIV/AIDS is negative, depicting the negative impact of HIV/AIDS on labor-hours.

The following figure shows average time allocation for agricultural activities by both HIV/AIDS afflicted and non-afflicted households. As it is shown in the figure below, there is a time-to-time reduction of labor-hours allocated by HIV/AIDS afflicted households on agricultural activities while there is no significant change of time allocation for non-HIV/AIDS afflicted households.

Figure 4: Average time allocation by HIV/AIDS afflicted and non-afflicted households.

\[ L = a_0 + a_1 \times \text{HIV/AIDS} \]

Despite the difference in the magnitude of the coefficients in the linear function estimation, the average regression result of the linear function \( L = a_0 + a_1 \times \text{HIV/AIDS} \) also indicates that affliction of an individual in HIV/AIDS in a household has caused a reduction of 3.73 labor-hours per day (in a season when agricultural activity is available). The results indicated that HIV/AIDS is affecting the labor-hours significantly. For the yearly results please refer to Annex 3.2.
Regarding HIV/AIDS and gender roles, HIV/AIDS affliction has resulted in drawing more women into farming. This has increased the burden of women as they are also responsible for household activities such as food preparation, taking care of children and caring for HIV/AIDS afflicted members of a family. During the last stages of HIV/AIDS related illnesses, other family members also reduce most of their working time on the farm to care for the sick member of the household. HIV/AIDS related illnesses have extended morbidity and divert the available labor force to a longer period of caring and supporting the sick.

6.2.2 The impact of HIV/AIDS on capital stock

6.2.2.1 The nature of capital stock

The capital stock of the farmers includes draft animals used for plowing, equines used for transporting the harvests and money invested in agricultural inputs such as fertilizers, improved seed and chemicals. The draft animals and equines are valued according to their price at that particular year. The overall sum of the capital stock is presented in Ethiopian Birr (ETB)⁴.

6.2.2.2 The impact of HIV/AIDS on physical capital - Stage 1 Ordinary Least Square estimation results

With respect to the physical capital, HIV/AIDS is also depleting the capital stock of the farmers. The information gathered in the case study indicates that the capital stock of HIV/AIDS afflicted households is exhausted from year to year and their investment in agriculture is less than that of non-afflicted households. The following regression results show the effect of HIV/AIDS on capital stock. The regression analysis was computed by taking capital stock as dependent variable and HIV/AIDS affliction as an independent variable, i.e.

\[ \ln K = b_0 + b_1 \ln \text{HIV/AIDS} \]

According to the first stage OLS estimation results (Table 5), the affliction of an individual with HIV/AIDS causes a reduction of capital stock by 0.53%. Moreover, the average result for the six years indicates that about 57.5% of the change in capital
stock is explained by a change in HIV/AIDS affliction. The yearly results differ slightly from the average. Please refer to Annex 4.1 for the yearly results.

The following graph depicts that availability of capital stock for agricultural production is increasing in non-HIV/AIDS afflicted households. The increment of capital stock is significant in non-afflicted households whereas it has a trend of insignificant increment (almost constant) for HIV/AIDS afflicted households.

Figure 5: The availability of capital stock for agricultural production in HIV/AIDS afflicted and non-afflicted households

![Graph showing capital stock and investment for agricultural production in HIV/AIDS afflicted and non-afflicted households]

---

4 Labor-hour was estimated by multiplying the number of working persons in a household by the average time they allocated in the farm per day (in a season when agricultural activities such as land cultivation, planting, weeding, harvesting and threshing are available.

5 The average currency for 1 Ethiopian Birr = 0.111 US dollars

The average regression result of the linear function \( K = b_0 + b_1 \times \text{HIV/AIDS} \) shows that affliction of an individual in HIV/AIDS has caused a depletion of capital stock valued as 815.51 Ethiopian Birr (depletion of capital estimated in monetary terms). The result indicated that HIV/AIDS is negatively affecting the capital stock of farmers in the district. For the yearly results please refer to Annex 4.2.
6.3 Indirect impacts of HIV/AIDS on land use - Stage 1 Ordinary Least Square estimation results

As in the case of labor and capital, HIV/AIDS has a negative impact on the use of land indirectly. When HIV/AIDS negatively affects the labor force and depletes the capital stock of farmers, the amount of land used/cultivated for production also decreases. The reduction of labor for farming is due to severe illness and death of members of the working labor force and the diversion of other members of the household towards care-giving for the sick member. This leads to the reduction of the total amount of land cultivated. On the other hand, the exhaustion of capital stock due to a scarcity of agricultural inputs and draft animals also causes a reduction in the amount of cultivated land. In the following regression analysis, the use of land is regressed on HIV/AIDS affliction, taking the use of land as dependent variable and HIV/AIDS affliction as independent variable, i.e.

\[ \ln(LU) = c_0 + c_1 \ln(HIV/AIDS) \]

As it is possible to see from the first stage OLS estimation results (Table 5), the average result indicates that affliction of an individual by HIV/AIDS causes a reduction in the amount of land cultivated by 0.16%.

Furthermore, the average result for all the years shows that about 9.3% of the change in land use can be explained by a change in HIV/AIDS affliction. For the yearly results please refer to Annex 5.1.

As shown in the following figure, the amount of land cultivated is decreasing from year to year in HIV/AIDS afflicted households whereas non-afflicted households have no change in the amount of land cultivated. Some non-afflicted households even start to cultivate additional hectares of land (areas which are far away from the homestead and covered by bushes).
Figure 6: The amount of cultivated land in HIV/AIDS afflicted and non-afflicted households

With respect to land cultivation, the difference between HIV/AIDS afflicted and non-afflicted households is not only in the total amount of land cultivated but also in the preference of allocation of land for different crops. HIV/AIDS afflicted households prefer to allocate larger section of their land to crops such as wheat and chickpea (which are relatively less labor-intensive) whereas non-afflicted households allocate their land to higher labor-intensive crops like Teff (Figures 7-9).

Figure 7: Land allocation for Teff production in HIV/AIDS afflicted and non-afflicted households
Figure 8: Land allocation for Wheat production in HIV/AIDS afflicted and non-afflicted households

![Average Area allocation of Households for wheat production(n=140)](image)

Figure 9: Land allocation for chickpea production in HIV/AIDS afflicted and non-afflicted households

![Average Area allocation of households for chickpea production](image)

Labor-intensive cereal crops such as Teff have a higher price and bring higher income for the farmers. Teff is in high demand as a cereal crop and its price increases
significantly from year to year. In the year 2006, the price of *Teff* was almost double the price of wheat and chickpea (figure 10). Moreover, in most of HIV/AIDS afflicted households, *Teff* is produced with poor management, resulting in poor yields (Annex 13 and 14).

Figure 10: shows the average price of cereal crops (in Ethiopian Birr per quintal)

![Average price of cereal crops from the cropping year 2001 to 2006 (in Ethiopian Birr)](image)

The average regression result of the linear function \( Y = c_0 + c_1 \times \text{HIV/AIDS} \) has also indicated that affliction of an individual in HIV/AIDS in a household has caused a reduction in the amount of land cultivated by 0.1 hectares. The result indicated that HIV/AIDS is affecting the amount of land cultivation significantly. For the yearly results please refer to Annex 5.2.

-The average land holding for respondents is 1.94 hectares

6.4 Impact of HIV/AIDS on income level of farmers: Stage 2 Ordinary Least Square estimation results

In the previous sections of the chapter, we have seen the direct and indirect impact of HIV/AIDS on factors of production, i.e. on labor, capital stock and use of land. As the aim of the study is to show the impact of HIV/AIDS on agricultural production (via factors of production), it is an important step to compute a regression analysis taking Y(income of farmers) as dependent variable and production factors as independent variables as follows. This helps to see the reaction of income with the changes in labor-hours, capital and use of land:
\ln Y = \beta_0 + \beta_1 \ln L + \beta_2 \ln K + \beta_3 \ln LU

where,

\( \ln Y \) is the income of farmers in natural logarithm

\( \ln L \) is labor force in natural logarithmic form

\( \ln K \) is capital stock in natural logarithm, and

\( \ln LU \) land use in natural logarithm (without HIV/AIDS impact)

\( \beta_0 \) is constant value

\( \beta_1 \) is the coefficient of labor

\( \beta_2 \) is the coefficient of capital stock

\( \beta_3 \) is the coefficient of land use

Table 6  Average OLS estimation result for \( \ln Y = \beta_0 + \beta_1 \ln L + \beta_2 \ln K + \beta_3 \ln LU \),

<table>
<thead>
<tr>
<th>ANOVA</th>
<th>df</th>
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<th>Capital stock</th>
<th>Land use</th>
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<tr>
<td>Significance of F</td>
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<tr>
<td>Standard error</td>
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<tr>
<td>p-value</td>
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<tr>
<td>Coefficient</td>
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<tr>
<td>Standard error</td>
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<tr>
<td>Standard error</td>
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</tr>
<tr>
<td>p-value</td>
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</tbody>
</table>

Average Results for 2001-2006

As it can be seen from the above average regression result, 1% increase in labor-hours has produced an increase of income by 0.4%. Similarly, the average result pointed out that 1% increment in capital stock has led to an increase of income by 0.32%.
With respect to land, on average, an increase in 1% of the amount of land cultivated produced a 0.23% increase in the income of farmers.

According to the above average regression result, 79.9% of change in income level is explained by the change in labor, capital stock and land use. Moreover, the correlation coefficients of each explanatory independent variable (labor, capital and land use) are positive showing that production factors affect income of farmers positively. As the yearly results only slightly differ from the average results, only the average values are presented. For the yearly estimate results please refer to Annex 6.1.

In order to estimate income with and without HIV/AIDS affliction, equations derived from the above regression result are used. Therefore, income of farmers without the effect of HIV/AIDS \( \ln Y = \beta_0 + \beta_1 \ln L + \beta_2 \ln K + \beta_3 \ln LU \) and income with the effect of HIV/AIDS \( \ln Y = \beta_0 + \beta_1 (a_0 + a_1 \cdot \text{HIV/AIDS}) + \beta_2 (b_0 + b_1 \cdot \text{HIV/AIDS}) + \beta_3 (c_0 + c_1 \cdot \text{HIV/AIDS}) \) are used. Then, the values of production factors with and without the effect of HIV/AIDS are used to calculate income with and without the effect of HIV/AIDS, respectively. This is because HIV/AIDS does not influence income directly, but has an effect on income indirectly via its effect on production factors.

The values used to calculate production factors without the effect of HIV/AIDS are taken directly from the empirical data whereas the values of production factors with the effect of HIV/AIDS are derived from the regression result of each production factor as a function of HIV/AIDS (as presented in Table 5).

After obtaining the values of production factors with and without the effect of HIV/AIDS, the next step is to compute income with and without HIV/AIDS affliction based on the results of the values of production factors.

The values of production factors with the effect of HIV/AIDS (WH/A) are calculated from the regression results of presented in Table 5. Equations for calculating the values of production factors (with the effect of HIV/AIDS) are derived from the regression results of \( \ln L = a_0 + a_1 \cdot \text{HIV/AIDS} \), \( \ln K = b_0 + b_1 \cdot \text{HIV/AIDS} \) and \( \ln LU = c_0 + c_1 \cdot \text{HIV/AIDS} \).
Thus, the derived equations (for average computation) are as follows. For the yearly results please refer to 7.1 as the values only slightly differ.

\[ L \text{ (WH/A)} = 3.64 - 0.37 \text{(HIV/AIDS value)} \]

\[ K \text{ (WH/A)} = 9.29 - 0.53 \text{(HIV/AIDS value)} \]

\[ L_u \text{ (WH/A)} = 0.7 - 0.16 \text{(HIV/AIDS value)}, \text{ where WH/A means 'with the effect of HIV/AIDS'.} \]

Once the values of each production factor with and without HIV/AIDS are obtained, the next step is to substitute the values on income equations. The equations used for both computations (income with and without the effect of HIV/AIDS) are the same except the different values of productions factors.

The following are the average calculated values for Income with and without HIV/AIDS affliction. For the yearly results please refer to Annex 8.1.

Table 7 Equations derived from the regression result of \( \ln Y = \beta_0 + \beta_1 \ln L + \beta_2 \ln K + \beta_3 \ln L_u \)

<table>
<thead>
<tr>
<th>condition</th>
<th>Derived equations to compute average income of farmers with(WH/A) and without HIV/AIDS affliction(WOH/A)</th>
<th>Income without the impact of HIV/AIDS (Natural logarithmic values are converted to actual values of income)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without HIV/AIDS affliction</td>
<td>( \ln Y(\text{WOH/A}) = 5.09 + 0.4 \ln L(\text{WOH/A}) + 0.32 \ln K(\text{WOH/A}) + 0.23 \ln L_u(\text{WOH/A}) )</td>
<td>664654.24</td>
</tr>
<tr>
<td>With HIV/AIDS affliction</td>
<td>( \ln Y(\text{WH/A}) = 5.09 + 0.4 \ln L(\text{WH/A}) + 0.32 \ln K(\text{WH/A}) + 0.23 \ln L_u(\text{WH/A}) )</td>
<td>585032.65</td>
</tr>
</tbody>
</table>

*N.B. Estimations with the above equations were done for each HIV/AIDS afflicted and non-afflicted households and the sum of the values of \( Y \) for each respondent was taken for each year*(Source: Author’s estimation)
The data used to calculate the above income are from HIV/AIDS afflicted households (n=70). This is done by taking values of production factors (without computing the effect of HIV/AIDS) to calculate income without HIV/AIDS affliction and taking the values of production function (by computing the effect of HIV/AIDS) to calculate income with HIV/AIDS affliction on the same respondents. The income of HIV/AIDS afflicted households (with and without the effect of HIV/AIDS on production factors) is taken to realize the changes in income due to HIV/AIDS affliction. Non-HIV/AIDS afflicted households have constant results and do not have values for estimating results with the effect of HIV/AIDS. Therefore, in calculating the income changes due to HIV/AIDS affliction, only the results of afflicted members are taken into account.

The increase in the price of cereal crops from year to year has helped farmers to enjoy an increasing income. Although the yield of cereal crops in HIV/AIDS afflicted households is decreasing from time to time, they are compensated for by the increase in the price of cereal crops, and their income is increasing from year to year. For the purpose of this study, the increment of price (that brought negative income difference) is neglected for the above calculation to identify the real impact of HIV/AIDS on agricultural production and thereby the income of the farmers. For the purpose of this estimation the data used is from HIV/AIDS afflicted households. As the values for HIV/AIDS estimation for HIV/AIDS afflicted households is zero and doesn’t show changes with HIV/AIDS, only HIV/AIDS afflicted households are taken into account, and changes of income with and without the effect of HIV/AIDS is computed.

Once the income of farmers with and without the impact of HIV/AIDS is estimated, it is possible to compute the change in income due to HIV/AIDS affliction using the following formula:

\[
\text{Income change(\%)} = \frac{\text{Income without the impact of HIV/AIDS} - \text{Income with the impact of HIV/AIDS}}{\text{Income without the impact of HIV/AIDS}} \times 100
\]

According to the calculations made and the figure below, on average HIV/AIDS affliction has reduced the income of farmers by 11.98%. For the yearly results please refer to Annex 9.1.
As is clear from the figure below, the percentage income change due to HIV/AIDS affliction is increasing from year to year showing the severity of the epidemic over time.

Figure 11: Income change due to HIV/AIDS affliction (%) for the years (2001-2006)

6.5 Overall Interpretation and conclusion

As is shown above, two stages of ordinary least square analysis (OLS) were done. HIV/AIDS affects agricultural production via production factors such as labor, capital and the use of land. HIV/AIDS has a direct impact on the labor force and capital stock of farmers and an indirect impact on the use of land. The labor-hours are significantly influenced by HIV/AIDS not only through increasing the morbidity rate of farmers but also by diverting the other members of the working force towards caring for a sick member of a household. This consequently results in a shortage of labor and time to fully cultivate the available land.

Moreover, HIV/AIDS afflicted households are engaged in cultivating relatively less labor-intensive crops than non-afflicted households and obtain a relatively lower income. Most of the farms of non-HIV/AIDS afflicted households are covered by labor-intensive crops such as Teff and the price for such crops has been increasing over time. HIV/AIDS has also been depleting the capital stock of farmers...
significantly, especially capital stock like draft animals, to cover the costs of treatment and medication. The overall investment on farms (including purchase of agricultural inputs) is decreasing and consequently affecting the amount of land cultivated.

After computing the impact of HIV/AIDS on production factors in the first stage OLS analysis, the next step was to do the second stage OLS to estimate the impact of HIV/AIDS on the production and income of farmers via the impact channels on labor, capital and land. The second stage OLS analysis indicated that HIV/AIDS has the potential to affect the agricultural production of farmers.

Despite the fact that HIV/AIDS afflicted households are compensated by the increase in the price of cereal crops from year to year, their production yield is clearly decreasing. Therefore, HIV/AIDS affliction has an impact on agricultural production in Ada’a district of the Eastern Showa province in Ethiopia.

The average linear function estimation result has also indicated that HIV/AIDS affliction has decreased the amount of farmers agricultural output (income) by 9.1%. For the yearly results, please refer to Annex 9.2
CHAPTER SEVEN

CONCLUSIONS AND RECOMMENDATIONS

7.1 CONCLUSIONS

In the previous chapters of the thesis, the importance of this research as well as its findings on the socio-economic impact of HIV/AIDS on agricultural production, particularly in Ethiopia, were presented. The research was conducted in Ada’a district in the Eastern Showa province of Ethiopia where both crop production and animal husbandry are practiced. The first chapter discussed the problem statement and justifications that necessitated the research. A review of the literature on the importance, challenges and potential conditions for success of the agricultural sector in developing economies followed. Literature regarding the impact of HIV/AIDS on agricultural production was also discussed, emphasizing the influence of the epidemic on factors of production. The third chapter discussed the theoretical framework of the research taking the Cobb-Douglass production function as the main model of the research. Taking into account the influence of HIV/AIDS on factors of production, the reaction/change of outcome (income) with the changes in each production factor due to HIV/AIDS was explained. The research methods used in the research were then reviewed. It included identification and ways of measuring indicators, sampling methods, data collection techniques and methods of data analysis.

Two stages of OLS analysis was done to see the impact of HIV/AIDS on factors of production which affect the agricultural income of farmers. The first stage OLS analysis indicated that HIV/AIDS significantly affects the labor-hours through increasing morbidity and by diverting the rest of the family to care for sick family members. Moreover, the impact of the epidemic was also observed on the capital stock of farmers. The capital stock is depleted from time to time.

The prolonged morbidity nature of the epidemic creates a need for much financial capital (savings). Draft animals are also sold to cover medication and treatment costs and the rate of investment in HIV/AIDS afflicted households on agriculture compared to non-afflicted households has decreased significantly.
HIV/AIDS was also found to decrease the area of farm land under cultivation indirectly by affecting the labor-hours and capital stock of farmers. The second stage OLS analysis based on the first stage analysis indicated that HIV/AIDS affects the output (agricultural income) of farmers by affecting production factors.

The second stage OLS analysis indicated that HIV/AIDS affects the agricultural income of farmers significantly through its impact on production factors. The following chart summarizes the impact of HIV/AIDS on agricultural production.
Figure 12: The general structure of the impact of HIV/AIDS on agricultural output (income)

The idea of presenting the impact of HIV/AIDS on agriculture in the above chart form was adapted from the United Nations, Department of Economic and Social Affairs, population division (The impact of AIDS)
7.2 RECOMMENDATIONS

In the above section it was concluded that HIV/AIDS negatively affects the production factors and thereby the output (agricultural income) of farmers. Therefore, to minimize and control the impact of the epidemic, particularly on the agricultural sector, the following recommendations and policy guidelines are offered:

- Mainstreaming the issue of HIV/AIDS as a fundamental part of development programs and policies. HIV/AIDS should be considered as a development challenge. The extent and channels of impacts of the epidemic should be clearly assessed and appropriate policies should be redesigned in controlling and preventing the epidemic in the country. The mainstreaming process should include resource allocation as well as enhancing the existing monitoring and evaluation mechanisms to ensure that scarce resources are spent wisely and achieve the required targets. The mainstreaming process should also address the rural people who are engaged in agricultural activities.

- Continuous programs on awareness creation about HIV/AIDS to the rural poor. Although appreciable efforts are made through awareness creation programs, the process should continue in an organized way. The misconceptions about the transmission of the epidemic among the rural people should be clearly identified and addressed in the awareness program. The media coverage about HIV/AIDS prevention and control should be increased. The program should also address the rural women as they are found to be the least informed about prevention methods. Awareness programs should also include ways of preventing harmful traditional practices. Harmful traditional practices such as female genital mutilation are still common especially among the rural population.
• Strengthening HIV/AIDS prevention programs, infrastructure as well as treatment and care for people living with HIV/AIDS (PLWA). Distribution and access to male and female condoms should be developed and made easy. The distribution process should also include usage instructions. The capacity of voluntary counseling and testing centers in the district should be increased and the population should be encouraged to go for HIV testing. Although there are improvements in the situation of stigma and discrimination towards PLWA, the problem has not been completely resolved. Therefore, education programs on behavioral change among non-HIV/AIDS affected individuals should be continued strongly. Furthermore, services on ARV therapy, care and counseling to PLWA should be expanded.

• Promotion of labor and capital saving agricultural technologies which are affordable and can be used by sick individuals. Research should be conducted on the design of less labor- and capital-intensive technologies such as animal drawn implements and tools. Improved access to agricultural inputs such as improved seed, fertilizers and chemicals should be subsidized and made affordable for farmers.

• Strengthening the agricultural extension services. The existing agricultural extension system should be reviewed and address the needs of the rural poor. Agricultural extension workers should train those who do not have the required knowledge for agricultural practices to assist HIV/AIDS afflicted households who have lost their experienced family members.

• Intervention strategies should reach the most vulnerable sectors and groups of the community. Combined intervention strategies should be used as there is no single intervention strategy that meets the needs of all the target groups.
• HIV/AIDS policies should consider some social problems such as poverty, unemployment and gender inequality as they contribute to, and cause the expansion of the epidemic. Moreover, the policies should include identification of high risk factors responsible for HIV transmission including factors that contribute to urban-rural migration and rural HIV prevalence.

• Both health-based and development-based approaches of combating the epidemic should be followed for best results. Mitigation approaches should be coordinated and implemented efficiently.

The above policy recommendations and mitigation strategies require close collaboration and involvement of all stakeholders including governmental ministries, multilateral and bilateral international organizations, NGOs, private sectors, civil societies and the community at large.
BIBLIOGRAPHY

Non-electronic books and materials


Thompson, L(Ed.) (2007). *Participatory Governance? Citizens and the state in South Africa. From Social movement to men’s support group by Steven Robins-a case study of AIDS activism in Guguletu Cape Town* African center for citizenship and democracy, University of the Western Cape, Bellville, South Africa. PP 1-23


**Electronic books, journals and other materials**


Baier,E (1997). The impact of HIV/AIDS on rural households/communities and the need for multi-sectoral prevention and mitigation strategies to combat the epidemic in


http://ase.tufts.edu/gdae/publications/working_papers/03-07sustainabledevelopment.PDF

(http://www.publications.parliament.uk/pa/cm200304/cmselect/cmintdev/602/602.pdf)

http://www.encyclopedia.com/doc/1G1-19656437.html

(http://www.aec.msu.edu/agecon/fs2/ag_transformation/atw_ikpi.pdf)


(http://www.auburn.edu/~johnspm/gloss/productivity)


US Department of state (Bureau of African Affairs). (2007). *Background Note: Ethiopia* (http://www.state.gov/r/pa/el/bgn/2859.htm#econ.)


ANNEXES

Annex 1 Ethiopian map and the location of Eastern Showa (at the center)-East of the capital, Addis Ababa

Source: UNDP Emergencies Unit for Ethiopia (March 2000)
Annex 2 The map of Eastern Showa Province and Ada’a district

Source: Office of planning and economic development for East Showa zone, 1997
Annex 3 First stage OLS yearly estimation results, labor regressed on HIV/AIDS

Annex 3.1 First stage OLS results for $\ln L = a_0 + a_1 \cdot \ln HIV/AIDS$

(Cobb-Douglass production function approach), n=140

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<td>52.23</td>
<td>16.53</td>
<td>139</td>
<td>140</td>
</tr>
<tr>
<td>2006</td>
<td>0.30</td>
<td>0.00</td>
<td>-0.344</td>
<td>-7.70*</td>
<td>52.82</td>
<td>16.14</td>
<td>139</td>
<td>140</td>
</tr>
<tr>
<td>Average</td>
<td>0.296</td>
<td>0.00</td>
<td>-0.371</td>
<td>-7.615*</td>
<td>51.81</td>
<td>29.97</td>
<td>139</td>
<td>140</td>
</tr>
</tbody>
</table>

* Significant at 1%  
Source: Author’s estimation

Annex 3.2 First stage OLS results (linear production function approach) for $L = a_0 + a_1 \cdot HIV/AIDS$, n=140

<table>
<thead>
<tr>
<th>year</th>
<th>$R^2$</th>
<th>Significance of F</th>
<th>Coefficient</th>
<th>T value</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>0.26</td>
<td>0.00</td>
<td>-5.68</td>
<td>-6.92*</td>
</tr>
<tr>
<td>2002</td>
<td>0.29</td>
<td>0.00</td>
<td>-4.76</td>
<td>-7.47*</td>
</tr>
<tr>
<td>2003</td>
<td>0.31</td>
<td>0.00</td>
<td>-4.03</td>
<td>-7.81*</td>
</tr>
<tr>
<td>2004</td>
<td>0.32</td>
<td>0.00</td>
<td>-3.45</td>
<td>-8.0*</td>
</tr>
<tr>
<td>2005</td>
<td>0.33</td>
<td>0.00</td>
<td>-3.06</td>
<td>-8.15*</td>
</tr>
<tr>
<td>2006</td>
<td>0.32</td>
<td>0.00</td>
<td>-2.67</td>
<td>-8.07*</td>
</tr>
<tr>
<td>Average</td>
<td>0.31</td>
<td>0.00</td>
<td>-3.74</td>
<td>-7.92*</td>
</tr>
</tbody>
</table>

* Significant at 1%  
Source: Author’s estimation
Annex 4 First stage OLS yearly estimation results capital regressed on HIV/AIDS

Annex 4.1 First stage OLS results for capital as a function of HIV/AIDS (Cobb-Douglass production function approach)- $\ln K = b_0 + b_1 \ln HIV/AIDS$, $n=140$

<table>
<thead>
<tr>
<th>Year</th>
<th>$R^2$</th>
<th>Significance of F</th>
<th>Coefficient</th>
<th>T value</th>
<th>SS</th>
<th>MS</th>
<th>df</th>
<th>Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>0.424</td>
<td>0.00</td>
<td>-0.57</td>
<td>-10.087*</td>
<td>31.06</td>
<td>1.76</td>
<td>139</td>
<td>140</td>
</tr>
<tr>
<td>2002</td>
<td>0.50</td>
<td>0.00</td>
<td>-0.554</td>
<td>-11.751*</td>
<td>29.76</td>
<td>2.3</td>
<td>139</td>
<td>140</td>
</tr>
<tr>
<td>2003</td>
<td>0.494</td>
<td>0.00</td>
<td>-0.492</td>
<td>-11.611*</td>
<td>25.49</td>
<td>3.7</td>
<td>139</td>
<td>140</td>
</tr>
<tr>
<td>2004</td>
<td>0.527</td>
<td>0.00</td>
<td>-0.487</td>
<td>-12.412*</td>
<td>31.28</td>
<td>3.33</td>
<td>139</td>
<td>140</td>
</tr>
<tr>
<td>2005</td>
<td>0.584</td>
<td>0.00</td>
<td>-0.497</td>
<td>-13.933*</td>
<td>33.62</td>
<td>3.49</td>
<td>139</td>
<td>140</td>
</tr>
<tr>
<td>2006</td>
<td>0.624</td>
<td>0.00</td>
<td>-0.527</td>
<td>-15.138*</td>
<td>33.62</td>
<td>4.31</td>
<td>139</td>
<td>140</td>
</tr>
<tr>
<td>Average</td>
<td>0.575</td>
<td>0.00</td>
<td>-0.532</td>
<td>-13.682*</td>
<td>29.45</td>
<td>2.9</td>
<td>139</td>
<td>140</td>
</tr>
</tbody>
</table>

* Significant at 1%
Source: Author’s estimation

Annex 4.2 First stage OLS results for capital as a function of HIV/AIDS (linear production function approach)- $K = b_0 + b_1 \times HIV/AIDS$, $n=140$

<table>
<thead>
<tr>
<th>Year</th>
<th>$R^2$</th>
<th>Significance of F</th>
<th>Coefficient</th>
<th>T value</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>0.3</td>
<td>0.00</td>
<td>-1251.45</td>
<td>-7.62*</td>
</tr>
<tr>
<td>2002</td>
<td>0.35</td>
<td>0.00</td>
<td>-1216.77</td>
<td>-8.57*</td>
</tr>
<tr>
<td>2003</td>
<td>0.38</td>
<td>0.00</td>
<td>-1164.45</td>
<td>-9.29*</td>
</tr>
<tr>
<td>2004</td>
<td>0.42</td>
<td>0.00</td>
<td>-1232.76</td>
<td>-9.89*</td>
</tr>
<tr>
<td>2005</td>
<td>0.47</td>
<td>0.00</td>
<td>-1219.02</td>
<td>-11.02*</td>
</tr>
<tr>
<td>2006</td>
<td>0.44</td>
<td>0.00</td>
<td>-1192.9</td>
<td>-10.4*</td>
</tr>
<tr>
<td>Average</td>
<td>0.32</td>
<td>0.00</td>
<td>-815.51</td>
<td>-7.99*</td>
</tr>
</tbody>
</table>

* Significant at 1%
Source: Author’s estimation
Annex 5 First stage OLS yearly estimation results, use of land regressed on HIV/AIDS

Annex 5.1 First stage OLS results for land use as a function of HIV/AIDS-(Cobb-Douglass production function approach)- \( \ln{LU} = c_0 + c_1 \ln{HIV/AIDS} \), n=140

<table>
<thead>
<tr>
<th>year</th>
<th>( R^2 )</th>
<th>Significance of F</th>
<th>Coefficient</th>
<th>T value</th>
<th>SS</th>
<th>MS</th>
<th>df</th>
<th>observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>0.0499</td>
<td>0.01</td>
<td>-0.163</td>
<td>-2.694*</td>
<td>31.66</td>
<td>1.76</td>
<td>139</td>
<td>140</td>
</tr>
<tr>
<td>2002</td>
<td>0.0757</td>
<td>0.00</td>
<td>-0.171</td>
<td>-3.363*</td>
<td>29.75</td>
<td>2.44</td>
<td>139</td>
<td>140</td>
</tr>
<tr>
<td>2003</td>
<td>0.143</td>
<td>0.00</td>
<td>-0.192</td>
<td>-4.805*</td>
<td>25.49</td>
<td>3.80</td>
<td>139</td>
<td>140</td>
</tr>
<tr>
<td>2004</td>
<td>0.100</td>
<td>0.00</td>
<td>-0.164</td>
<td>-3.919*</td>
<td>31.28</td>
<td>3.33</td>
<td>139</td>
<td>140</td>
</tr>
<tr>
<td>2005</td>
<td>0.121</td>
<td>0.00</td>
<td>-0.174</td>
<td>-4.367*</td>
<td>33.62</td>
<td>4.29</td>
<td>139</td>
<td>140</td>
</tr>
<tr>
<td>2006</td>
<td>0.122</td>
<td>0.00</td>
<td>-0.164</td>
<td>-4.38*</td>
<td>33.62</td>
<td>4.31</td>
<td>139</td>
<td>140</td>
</tr>
<tr>
<td>Average</td>
<td>0.093</td>
<td>0.00</td>
<td>-0.161</td>
<td>-3.771*</td>
<td>29.46</td>
<td>2.8</td>
<td>139</td>
<td>140</td>
</tr>
</tbody>
</table>

* Significant at 1%  

Source: Author’s estimation

Annex 5.2 First stage OLS results for land use as a function of HIV/AIDS (linear production function approach)- \( LU = c_0 + c_1 * HIV/AIDS \), n=140

<table>
<thead>
<tr>
<th>year</th>
<th>( R^2 )</th>
<th>Significance of F</th>
<th>Coefficient</th>
<th>T value</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>0.07</td>
<td>0.01</td>
<td>-0.13</td>
<td>-3.13*</td>
</tr>
<tr>
<td>2002</td>
<td>0.09</td>
<td>0.00</td>
<td>-0.12</td>
<td>-3.74*</td>
</tr>
<tr>
<td>2003</td>
<td>0.11</td>
<td>0.00</td>
<td>-0.10</td>
<td>-4.12*</td>
</tr>
<tr>
<td>2004</td>
<td>0.14</td>
<td>0.00</td>
<td>-0.1</td>
<td>-4.78*</td>
</tr>
<tr>
<td>2005</td>
<td>0.16</td>
<td>0.00</td>
<td>-0.09</td>
<td>-5.19*</td>
</tr>
<tr>
<td>2006</td>
<td>0.17</td>
<td>0.00</td>
<td>-0.08</td>
<td>-5.31*</td>
</tr>
<tr>
<td>Average</td>
<td>0.13</td>
<td>0.00</td>
<td>-0.10</td>
<td>-4.52*</td>
</tr>
</tbody>
</table>

* Significant at 1%  

Source: Author’s estimation
Annex 6 The yearly OLS estimation result for income as a function of production factors (L, K, LU)

Annex 6.1: The yearly OLS estimation results (Cobb-Douglas production function approach) \[ \ln Y = \beta_0 + \beta_1 \ln L + \beta_2 \ln K + \beta_3 \ln LU \]

<table>
<thead>
<tr>
<th>year</th>
<th>R²</th>
<th>Significance of F</th>
<th>SS</th>
<th>MS</th>
<th>df</th>
<th>R²</th>
<th>T value</th>
<th>Coefficient</th>
<th>T value</th>
<th>Coefficient</th>
<th>T value</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>0.893</td>
<td>0.00</td>
<td>22.69</td>
<td>6.76</td>
<td>0.00</td>
<td>13</td>
<td>9</td>
<td>0.488</td>
<td>17.823</td>
<td>0.158</td>
<td>6.247</td>
</tr>
<tr>
<td>2002</td>
<td>0.708</td>
<td>0.00</td>
<td>30.09</td>
<td>7.16</td>
<td>0.00</td>
<td>13</td>
<td>9</td>
<td>0.409</td>
<td>7.903</td>
<td>0.227</td>
<td>4.991</td>
</tr>
<tr>
<td>2003</td>
<td>0.736</td>
<td>0.00</td>
<td>33.71</td>
<td>8.34</td>
<td>0.00</td>
<td>13</td>
<td>9</td>
<td>0.394</td>
<td>7.854</td>
<td>0.259</td>
<td>5.766</td>
</tr>
<tr>
<td>2004</td>
<td>0.692</td>
<td>0.00</td>
<td>43.39</td>
<td>10.11</td>
<td>0.00</td>
<td>13</td>
<td>9</td>
<td>0.393</td>
<td>6.786</td>
<td>0.350</td>
<td>6.849</td>
</tr>
<tr>
<td>2005</td>
<td>0.673</td>
<td>0.00</td>
<td>50.84</td>
<td>11.53</td>
<td>0.00</td>
<td>13</td>
<td>9</td>
<td>0.345</td>
<td>5.581</td>
<td>0.416</td>
<td>7.557</td>
</tr>
<tr>
<td>2006</td>
<td>0.714</td>
<td>0.00</td>
<td>62.88</td>
<td>15.1</td>
<td>0.00</td>
<td>13</td>
<td>9</td>
<td>0.224</td>
<td>3.488</td>
<td>0.552</td>
<td>10.309</td>
</tr>
<tr>
<td>Average</td>
<td>0.799</td>
<td>0.00</td>
<td>34.40</td>
<td>9.21</td>
<td>0.00</td>
<td>13</td>
<td>9</td>
<td>0.395</td>
<td>8.874</td>
<td>0.317</td>
<td>8.298</td>
</tr>
</tbody>
</table>

* Significant at 1%  
Source: Author’s estimation

Annex 6.2 The yearly OLS estimation result (Linear production function approach) \[ Y = \beta_0 + \beta_1 L + \beta_2 K + \beta_3 LU \]

<table>
<thead>
<tr>
<th>year</th>
<th>R²</th>
<th>Significance of F</th>
<th>Coefficient</th>
<th>T value</th>
<th>Coefficient</th>
<th>T value</th>
<th>Coefficient</th>
<th>T value</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>0.90</td>
<td>0.00</td>
<td>175.76</td>
<td>17.62</td>
<td>0.26</td>
<td>6.28</td>
<td>732.01</td>
<td>4.16*</td>
</tr>
<tr>
<td>2002</td>
<td>0.73</td>
<td>0.00</td>
<td>156.92</td>
<td>8.04</td>
<td>0.33</td>
<td>4.1*</td>
<td>1352.63</td>
<td>3.35*</td>
</tr>
<tr>
<td>2003</td>
<td>0.80</td>
<td>0.00</td>
<td>150.26</td>
<td>7.88</td>
<td>0.43</td>
<td>6.77</td>
<td>2100.76</td>
<td>4.32*</td>
</tr>
<tr>
<td>2004</td>
<td>0.79</td>
<td>0.00</td>
<td>159.12</td>
<td>7.81</td>
<td>0.350</td>
<td>7.23</td>
<td>2362.97</td>
<td>3.71*</td>
</tr>
<tr>
<td>2005</td>
<td>0.77</td>
<td>0.00</td>
<td>165.97</td>
<td>7.24</td>
<td>0.416</td>
<td>7.3*</td>
<td>2605.54</td>
<td>4.02*</td>
</tr>
<tr>
<td>2006</td>
<td>0.7</td>
<td>0.00</td>
<td>25.89</td>
<td>0.52</td>
<td>0.552</td>
<td>12.85</td>
<td>3078.94</td>
<td>4.72*</td>
</tr>
<tr>
<td>Average</td>
<td>0.81</td>
<td>0.00</td>
<td>159.50</td>
<td>8.06</td>
<td>0.317</td>
<td>8.01</td>
<td>2121.97</td>
<td>4.62</td>
</tr>
</tbody>
</table>

* Significant at 1%  
Source: Author’s estimation
Annex 7 Derived equations to calculate the yearly values of production factors for each year (with and without HIV/AIDS affliction) from the regression result of $\ln Y = \beta_0 + \beta_1 \ln L + \beta_2 \ln K + \beta_3 \ln LU$, $n=70$

<table>
<thead>
<tr>
<th>year</th>
<th>Derived equations to compute income of farmers without HIV/AIDS affliction (WOH/A)</th>
<th>Y(income) without the impact of HIV/AIDS (Natural logarithmic values are converted to actual values of income)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>$\ln Y(WOH/A)=6.13+0.49(\ln L)+0.16(\ln K)+0.12(\ln Lu)$</td>
<td>609130.47</td>
</tr>
<tr>
<td>2002</td>
<td>$\ln Y(WOH/A)=5.8+0.41(\ln L)+0.23(\ln K)+0.19(\ln Lu)$</td>
<td>625095.16</td>
</tr>
<tr>
<td>2003</td>
<td>$\ln Y(WOH/A)=5.5+0.41(\ln L)+0.23(\ln K)+0.19(\ln Lu)$</td>
<td>493635.34</td>
</tr>
<tr>
<td>2004</td>
<td>$\ln Y(WOH/A)=4.74+0.39(\ln L)+0.35(\ln K)+0.25(\ln Lu)$</td>
<td>600284.92</td>
</tr>
<tr>
<td>2005</td>
<td>$\ln Y(WOH/A)=4.3+0.34(\ln L)+0.42(\ln K)+0.28(\ln Lu)$</td>
<td>600338.59</td>
</tr>
<tr>
<td>2006</td>
<td>$\ln Y(WOH/A)=3.6+0.22(\ln L)+0.55(\ln K)+0.34(\ln Lu)$</td>
<td>650300.05</td>
</tr>
<tr>
<td>Average result</td>
<td>$\ln Y(WOH/A)=5.09+0.40(\ln L)+0.32(\ln K)+0.23(\ln Lu)$</td>
<td>664654.24</td>
</tr>
</tbody>
</table>

N.B Values of production factors without the effect of HIV/AIDS are directly taken from the empirical data (Source: Author’s estimation)

Equations used to calculate production factors with the effect of HIV/AIDS

<table>
<thead>
<tr>
<th>Year</th>
<th>Equations to calculate the values of Labor with the effect of HIV/AIDS (the equations are derived from the regression result of L=f(HIV/AIDS))</th>
<th>Equations to calculate the values of Capital with the effect of HIV/AIDS (the equations are derived from the regression result of K=f(HIV/AIDS))</th>
<th>Equations to calculate the values of Land use with the effect of HIV/AIDS (the equations are derived from the regression result of LU=f(HIV/AIDS))</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>$L(\text{with HIV/AIDS})=3.59-0.49(\text{HIV/AIDS value})$</td>
<td>$K(\text{with HIV/AIDS})=8.89-0.57(\text{HIV/AIDS value})$</td>
<td>$Lu(\text{with HIV/AIDS})=0.67-0.16(\text{HIV/AIDS value})$</td>
</tr>
<tr>
<td>2002</td>
<td>$L(\text{with HIV/AIDS})=3.61-0.43(\text{HIV/AIDS value})</td>
<td>$K(\text{with HIV/AIDS})=9-0.55(\text{HIV/AIDS value})</td>
<td>$Lu(\text{with HIV/AIDS})=0.71-0.17(\text{HIV/AIDS value})</td>
</tr>
<tr>
<td>2003</td>
<td>$L(\text{with HIV/AIDS})=3.63-0.39(\text{HIV/AIDS value})</td>
<td>$K(\text{with HIV/AIDS})=9.16-0.49(\text{HIV/AIDS value})</td>
<td>$Lu(\text{with HIV/AIDS})=0.99-0.19(\text{HIV/AIDS value})</td>
</tr>
<tr>
<td>2004</td>
<td>$L(\text{with HIV/AIDS})=3.63-0.36(\text{HIV/AIDS value})</td>
<td>$K(\text{with HIV/AIDS})=9.34-0.49(\text{HIV/AIDS value})</td>
<td>$Lu(\text{with HIV/AIDS})=0.69-0.16(\text{HIV/AIDS value})</td>
</tr>
<tr>
<td>2005</td>
<td>$L(\text{with HIV/AIDS})=3.6-0.37(\text{HIV/AIDS value})</td>
<td>$K(\text{with HIV/AIDS})=9.44-0.5(\text{HIV/AIDS value})</td>
<td>$Lu(\text{with HIV/AIDS})=0.7-0.17(\text{HIV/AIDS value})</td>
</tr>
<tr>
<td>2006</td>
<td>$L(\text{with HIV/AIDS})=3.64-0.34(\text{HIV/AIDS value})</td>
<td>$K(\text{with HIV/AIDS})=9.6-0.5(\text{HIV/AIDS value})</td>
<td>$Lu(\text{with HIV/AIDS})=0.7-0.16(\text{HIV/AIDS value})</td>
</tr>
<tr>
<td>Average</td>
<td>$L(\text{with HIV/AIDS})=3.64-0.37(\text{HIV/AIDS value})</td>
<td>$K(\text{with HIV/AIDS})=9.29-0.53(\text{HIV/AIDS value})</td>
<td>$Lu(\text{with HIV/AIDS})=0.7-0.16(\text{HIV/AIDS value})</td>
</tr>
</tbody>
</table>

Source: Author’s estimation
Values of Income with the effect of HIV/AIDS

<table>
<thead>
<tr>
<th>year</th>
<th>Derived equations to compute income of farmers with HIV/AIDS affliction (with H/A)</th>
<th>Total Y(income) with the impact of HIV/AIDS (Natural logarithmic values are converted to actual values of income)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>$\ln(Y_{\text{with H/A}})=6.13+0.49(\ln L_{\text{with H/A}})+0.16(\ln K_{\text{with H/A}})+0.12(\ln L_u_{\text{with H/A}})$</td>
<td>$551781.41$</td>
</tr>
<tr>
<td>2002</td>
<td>$\ln(Y_{\text{with H/A}})=5.8+0.41(\ln L_{\text{with H/A}})+0.23(\ln K_{\text{with H/A}})+0.19(\ln L_u_{\text{with H/A}})$</td>
<td>$560775.2$</td>
</tr>
<tr>
<td>2003</td>
<td>$\ln(Y_{\text{with H/A}})=5.5+0.41(\ln L_{\text{with H/A}})+0.23(\ln K_{\text{with H/A}})+0.19(\ln L_u_{\text{with H/A}})$</td>
<td>$441303.53$</td>
</tr>
<tr>
<td>2004</td>
<td>$\ln(Y_{\text{with H/A}})=4.74+0.39(\ln L_{\text{with H/A}})+0.35(\ln K_{\text{with H/A}})+0.25(\ln L_u_{\text{with H/A}})$</td>
<td>$529984.61$</td>
</tr>
<tr>
<td>2005</td>
<td>$\ln(Y_{\text{with H/A}})=4.3+0.34(\ln L_{\text{with H/A}})+0.42(\ln K_{\text{with H/A}})+0.28(\ln L_u_{\text{with H/A}})$</td>
<td>$526249.82$</td>
</tr>
<tr>
<td>2006</td>
<td>$\ln(Y_{\text{with H/A}})=3.6+0.22(\ln L_{\text{with H/A}})+0.55(\ln K_{\text{with H/A}})+0.34(\ln L_u_{\text{with H/A}})$</td>
<td>$560718.56$</td>
</tr>
<tr>
<td>Average result</td>
<td>$\ln(Y_{\text{with H/A}})=5.09+0.4(\ln L_{\text{with H/A}})+0.32(\ln K_{\text{with H/A}})+0.23(\ln L_u_{\text{with H/A}})$</td>
<td>$585032.65$</td>
</tr>
</tbody>
</table>

N.B. Estimations with the above equations were done for each HIV/AIDS afflicted ones and the sum of the values of income (in natural logarithmic value) for each respondent was taken for each year. The values in natural logarithm were finally converted to the actual income values. (Source: Author’s estimation)

Annex 8 Calculated yearly values of Income for each year with and without HIV/AIDS affliction, n=70

Annex 8.1 Calculated yearly values of income using the Cobb-Douglass production function approach

<table>
<thead>
<tr>
<th>Income without the impact of HIV/AIDS</th>
<th>Income with the impact of HIV/AIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>609130.47</td>
<td>551781.41</td>
</tr>
<tr>
<td>625095.16</td>
<td>560775.2</td>
</tr>
<tr>
<td>493635.34</td>
<td>441303.53</td>
</tr>
<tr>
<td>600284.92</td>
<td>529984.61</td>
</tr>
<tr>
<td>600338.59</td>
<td>526249.82</td>
</tr>
<tr>
<td>650300.05</td>
<td>560718.56</td>
</tr>
<tr>
<td>664654.24</td>
<td>585032.65</td>
</tr>
</tbody>
</table>

Source: Author’s estimation
Annex 8.2 Calculated yearly values of income using the linear production function approach

<table>
<thead>
<tr>
<th>year</th>
<th>Income without the impact of HIV/AIDS</th>
<th>Income with the impact of HIV/AIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>597675.6</td>
<td>551249.2</td>
</tr>
<tr>
<td>2002</td>
<td>639436.4</td>
<td>586513.1</td>
</tr>
<tr>
<td>2003</td>
<td>658209.4</td>
<td>602059.9</td>
</tr>
<tr>
<td>2004</td>
<td>636343.8</td>
<td>572401.6</td>
</tr>
<tr>
<td>2005</td>
<td>630875.9</td>
<td>565445.9</td>
</tr>
<tr>
<td>2006</td>
<td>623143</td>
<td>528028.5</td>
</tr>
<tr>
<td>Average</td>
<td>617752</td>
<td>561246.6</td>
</tr>
</tbody>
</table>

*Source: Author’s estimation*

Annex 9 Change in income level due to HIV/AIDS affliction for each year

Annex 9.1 Yearly Change in income level due to HIV/AIDS affliction using the Cobb-Douglas production function approach

<table>
<thead>
<tr>
<th>year</th>
<th>Income without the impact of HIV/AIDS</th>
<th>Income with the impact of HIV/AIDS</th>
<th>Income change (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>609130.47</td>
<td>551781.41</td>
<td>9.41%</td>
</tr>
<tr>
<td>2002</td>
<td>625095.16</td>
<td>560775.2</td>
<td>10.29%</td>
</tr>
<tr>
<td>2003</td>
<td>493635.34</td>
<td>441303.53</td>
<td>10.6%</td>
</tr>
<tr>
<td>2004</td>
<td>600284.92</td>
<td>529984.61</td>
<td>11.71%</td>
</tr>
<tr>
<td>2005</td>
<td>600338.59</td>
<td>526249.82</td>
<td>12.34%</td>
</tr>
<tr>
<td>2006</td>
<td>650300.05</td>
<td>560718.56</td>
<td>13.78%</td>
</tr>
<tr>
<td>Average</td>
<td>664654.24</td>
<td>585032.65</td>
<td>11.98%</td>
</tr>
</tbody>
</table>

*Source: Author’s estimation*
Annex 9.2 Yearly Change in income level due to HIV/AIDS affliction using the linear production function approach

<table>
<thead>
<tr>
<th>year</th>
<th>Income without the impact of HIV/AIDS</th>
<th>Income with the impact of HIV/AIDS</th>
<th>Income change (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>597675.6</td>
<td>551249.2</td>
<td>7.8%</td>
</tr>
<tr>
<td>2002</td>
<td>639436.4</td>
<td>586513.1</td>
<td>8.3%</td>
</tr>
<tr>
<td>2003</td>
<td>658209.4</td>
<td>602059.9</td>
<td>8.53%</td>
</tr>
<tr>
<td>2004</td>
<td>636343.8</td>
<td>572401.6</td>
<td>10%</td>
</tr>
<tr>
<td>2005</td>
<td>630875.9</td>
<td>565445.9</td>
<td>10.4%</td>
</tr>
<tr>
<td>2006</td>
<td>623143</td>
<td>528028.5</td>
<td>15.3%</td>
</tr>
<tr>
<td>Average</td>
<td>617752</td>
<td>561246.6</td>
<td>9.1%</td>
</tr>
</tbody>
</table>

Annex 10. Farmers still use draft animals for tillage
Annex 11 Animals are also used for transportation of Human beings and harvests
Annex 12: cattle production is practiced in a backward way
Annex 13: Poor tillage for Teff production among HIV/AIDS afflicted households
Annex 14: well managed tillage for *Teff* production among non-HIV/AIDS afflicted households

Annex 15: Harvesting is performed by hand-mowing demanding a number of labor force
Annex 16: Questionnaires used to collect data from respondents (farmers)

**Ethics statement**

1. The following information is collected for academic purposes and the objectives of the research will be made clear for all responsible persons and stakeholders.
2. The data collection process will be commenced after getting permission from the community, clan leaders and elders as well as local government officials.
3. The participation in the data collection process is voluntary and made at convenient time of the interviewee.
4. All data recording and collection mechanisms will be made clear to all target groups.
5. Respondents have full right to leave/withdraw at any point of time if they feel uncomfortable by any reason.
6. Personal and sensitive issues will be kept in a confidential and accountable manner in the data collection process.
7. Cultural and traditional aspects of the people will be respected in the data collection process (sensitive to cultural values and norms).
8. The research findings will be submitted to the relevant bodies at the end of the research.

**Data collector**

Name
Signature

A. General Information

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Household number-------------</td>
</tr>
<tr>
<td>2.</td>
<td>Respondent name-----------------</td>
</tr>
<tr>
<td>3.</td>
<td>Respondent number-------------</td>
</tr>
<tr>
<td>4.</td>
<td>Age ------------</td>
</tr>
<tr>
<td>5.</td>
<td>sex-------------</td>
</tr>
<tr>
<td>6.</td>
<td>Village(Peasant Association)-------------------</td>
</tr>
<tr>
<td>7.</td>
<td>HIV/AIDS status-------------</td>
</tr>
<tr>
<td>8.</td>
<td>Year afflicted (for AIDS afflicted households)-------------------</td>
</tr>
<tr>
<td>9.</td>
<td>Reason for being infected-------------</td>
</tr>
</tbody>
</table>

B. Household type and composition

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>10.</td>
<td>Household head</td>
</tr>
<tr>
<td>i.</td>
<td>male</td>
</tr>
<tr>
<td>ii.</td>
<td>Female</td>
</tr>
<tr>
<td>11.</td>
<td>Marital status</td>
</tr>
<tr>
<td>i.</td>
<td>Single man(unmarried)</td>
</tr>
<tr>
<td>ii.</td>
<td>Male headed, one wife</td>
</tr>
<tr>
<td>iii.</td>
<td>Male headed ,two wives</td>
</tr>
<tr>
<td>iv.</td>
<td>Male headed, more than two wives</td>
</tr>
<tr>
<td>v.</td>
<td>Female headed, absentee husband</td>
</tr>
</tbody>
</table>
vi. Female headed, no husband
vii. Single woman(unmarried)

12. Current size of the household
   i. Age of the household head-----------------
   ii. Size of household members less than 5 years---------------------
   iii. Size of household members between 5-10 years-----------------
   iv. Size of household members between 10-15 years-----------------
   v. Size of household members greater than 15 years-----------------
   vi. No. of active members of the household-----------------
   vii. No. of dependents-----------------

13. If male headed with one or more wives, how is the arrangement between husband and wife for sharing land?
   i. Each wife has her own plot to control
   ii. All plots controlled by husband
   iii. Each wife has little input
   iv. The older wife has more input
   v. Others specify

14. If Female headed, why no husband?
   i. Not alive due to AIDS related diseases
   ii. Passed away due to non-AIDS diseases
   iii. Divorced
   iv. Left for job
   v. Other

15. If male headed, why no wife?
   i. Not alive due to AIDS related diseases
   ii. Passed away due to non-AIDS diseases
   iii. Divorced
   iv. Left for job
   v. Other

C. EDUCATIONAL BACKGROUND

16. Can you read and write?
   i. No
   ii. Somewhat
   iii. Yes

17. How many years of formal education have you completed?
   i. None
   ii. <Grade 3
   iii. Grade 4-7
   iv. Grade 7-10
   v. College and above

D. OCCUPATION

18. What is your main occupation?
   i. Farming only
ii. Farming+ others<25%
niii. Farming+ others<50%
iv. Farming+ others>50%
v. Other specify

19. What is your major source of income currently?
i. Crop sale
ii. Livestock sale
iii. Both
iv. Others

E. FARMING SYSTEMS

20. What type of farming are you involved in?
i. Crop production only
ii. Crop and livestock production
iii. Livestock production only

21. How did you obtain your cropland?
i. Inherited from the father
ii. Inherited from own family
iii. Allocated by local chief (kebele)
iv. Others specify

22. What are the major crops grown currently?
Enumerate in order of importance

<table>
<thead>
<tr>
<th>Crop</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>5</td>
</tr>
</tbody>
</table>

23. What are the major livestock kept currently?

<table>
<thead>
<tr>
<th>Livestock</th>
<th>No. of livestock</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cattle</td>
<td></td>
</tr>
<tr>
<td>1. Oxen</td>
<td></td>
</tr>
<tr>
<td>2. Cows</td>
<td></td>
</tr>
<tr>
<td>3. Heifers</td>
<td></td>
</tr>
<tr>
<td>Equines</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
</tr>
<tr>
<td>Sheep and goats</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td></td>
</tr>
</tbody>
</table>

24. Do you practice crop rotation?
1. Yes------------------ 2. No---------------------

25. If yes, describe the common crop sequence?
26. Do you practice intercropping?
1. Yes-------------------------------------------- 2. No------------------------------------------
27. If yes, indicate crop combination in order of importance
1= Very common  2= common 3= not common
1. ---------------------------------------------------------------------
2. ---------------------------------------------------------------------
3. ---------------------------------------------------------------------
28. Do you practice-irrigated agriculture
1. Yes ------------------------------- 2. No---------------------------------------
29. If yes, which type of crops you are growing under irrigation?
1. ----------------------------------------------------
2. -----------------------------------------------------
3. -----------------------------------------------------
4. -----------------------------------------------------
5. -----------------------------------------------------
30. What are your major constraints in farming?
1. Lack of agricultural inputs and infrastructure
2. Hardly affordable price of inputs
3. Malaria and HIV/AIDS
4. Lack of infrastructure
5. Others

F. HUMAN CAPITAL

31. Source of labor used on the farm (in proportion)
i. family labor(labor from the members of the household)
ii. Hired labor
iii. Machineries and tools

32. Household size and composition

<table>
<thead>
<tr>
<th>Year</th>
<th>Age and sex</th>
<th>&lt; 15 years old</th>
<th>B/n 15 and 49</th>
<th>&gt;49</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
</tr>
<tr>
<td>2001</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
33. The number of AIDS related deaths in the household

<table>
<thead>
<tr>
<th>Year</th>
<th>&lt; 15 years old</th>
<th>B/n 15 and 49</th>
<th>&gt; 49</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
</tr>
<tr>
<td>2001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>2004</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

34. The number of people with AIDS related illness in the household currently--------

35. Which member of the household is affected by the epidemic currently?
   i. Age < 15 (in number-----------------), responsibility in the farm------------------------
   ii. between 15-49 (in number-----------------), responsibility in the farm-----------------
   iii. >49 (in number------------------), responsibility in the farm------------------

36. No. of non-AIDS afflicted members of the household diverted towards care giving for the sick member of the household.

<table>
<thead>
<tr>
<th>Year</th>
<th>&lt; 15 years old</th>
<th>B/n 15 and 49</th>
<th>&gt; 49</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
</tr>
<tr>
<td>2001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

37. An average amount of time allocated in the farm in hours per day (for those farmers with AIDS related illness) ------------------------------

38. Average time allocated for non-AIDS afflicted members of household
   i. On farm activities---------
   ii. Care giving ---------------
   iii. Funeral rituals------------
   iii. Off-farm income generating activities-------------

39. AIDS related deaths or severe illness of experienced persons in the household

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of deaths or with severe illness</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td></td>
</tr>
</tbody>
</table>
40. Activities in the household per available experienced farmer

<table>
<thead>
<tr>
<th>Year</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>M F</td>
<td>M F</td>
<td>M F</td>
<td>M F</td>
<td>M F</td>
<td>M F</td>
<td></td>
</tr>
</tbody>
</table>

**Crop production**
1. Land preparation and tillage
2. Planting and fertilizing
3. Weeding
4. Harvesting and threshing
5. Marketing

**Animal production**
1. Feeding
2. Health care
3. Marketing

41. Amount of Labor allocated on the farm in the household

**Crop production**
- Teff
- Wheat
- Chickpea
- Vegetables

**Livestock production**
- Cattle
- Sheep and goats

<table>
<thead>
<tr>
<th>Chicken</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
</tr>
<tr>
<td>2002</td>
</tr>
<tr>
<td>2003</td>
</tr>
<tr>
<td>2004</td>
</tr>
<tr>
<td>2005</td>
</tr>
<tr>
<td>2006</td>
</tr>
</tbody>
</table>

**G. FINANCIAL CAPITAL**

42. Average yield for each year

<table>
<thead>
<tr>
<th>Crops (Q/ha)</th>
<th>Livestock</th>
</tr>
</thead>
<tbody>
<tr>
<td>(number/herds)</td>
<td>cattle</td>
</tr>
<tr>
<td>Teff</td>
<td>Chickpea</td>
</tr>
<tr>
<td>Wheat</td>
<td>vegetables</td>
</tr>
<tr>
<td>Chicken</td>
<td></td>
</tr>
</tbody>
</table>

93
43. Total amount of income obtained by the household per each year [in Ethiopian Birr (ETB) per quintal]

<table>
<thead>
<tr>
<th>Year</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A. The main produces of the farm
   i. Teff
   ii. Chickpea
   iii. Wheat

B. Off-farm income
   2001 2002 2003 2004 2005
   i. trading
   ii. Crafts
   iii. Brewing
   iv. Government/private job
   v. Borrowing from relatives or local banks
   vi. Remittance from other individuals

44. Pattern of consumption of Household income/savings

<table>
<thead>
<tr>
<th>Year</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Purchase of agricultural inputs and implements
2. Buy food and cloths
3. Health care costs (Treatment and drug costs)
4. Cost of funeral ceremony
5. Wage payment for external laborers
6. Education/training costs

H. USE OF LAND

45. Farm size of the household with ownership holders of the household (in ha)

<table>
<thead>
<tr>
<th>Year</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

M F M F M F M F M F

i. Total farm size (in Ha)
ii. Arable land
iii. Grazing land
iv. Fallow land

46. Area allocated by the household

<table>
<thead>
<tr>
<th></th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

1. Teff
2. Chickpea
3. Wheat
4. Vegetables
5. For livestock production

47. Area of farm left fallow or uncultivated (in ha)

<table>
<thead>
<tr>
<th>Hectare</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td></td>
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<tr>
<td>2003</td>
<td></td>
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<tr>
<td>2004</td>
<td></td>
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<tr>
<td>2005</td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td></td>
</tr>
</tbody>
</table>

48. Average yield loss (for uncultivated land)

<table>
<thead>
<tr>
<th>Teff</th>
<th>Chickpea</th>
<th>Wheat</th>
<th>Vegetables</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td></td>
<td></td>
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<td>2005</td>
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<td></td>
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<tr>
<td>2006</td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

49. Area of land sold/rented out (in ha)

<table>
<thead>
<tr>
<th>Hectare</th>
<th>reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td></td>
</tr>
</tbody>
</table>
50. Do you have farm conservation practices? 1=Yes/2=No
51. If yes, which farm conservation practices do you use? 2001 2002 2003 2004 2005 2006
   i. Afforestation (number of trees planted)
   ii. Mulching (rate of mulching per cropping season)
   iii. Crop rotation (rate of rotation)
   iv. Application of fertilizers (Kg per hectare)
   v. Other practices

52. Reasons for poor conservation practices and consequences

_____________________
_____________________
_____________________

I. PHYSICAL CAPITAL

53. The number of Available farm assets

2001 2002 2003 2004 2005 2006
   i. Hand tools and ploughs
   ii. Cattle (esp. Oxen)
   iii. Tractors
   iv. Stores
   v. Transporting vehicles/animals

54. Number of Assets sold

2002 2003 2004 2005 2006
   i. Hand tools and ploughs
   ii. Oxen for ploughing
   iii. Tractors
   iv. Stores
   v. Transporting vehicles/animals

55. Reasons for selling of assets

_____________________
_____________________
_____________________

56. Consequences/problems due to selling of the assets (like yield loss, change of occupation, etc)
57. How do you first hear about HIV/AIDS?
   i. newspaper/magazines
   ii. Radio
   iii. TV
   iv. Through training and education
   v. Local institutions
   vi. Others

58. Are you aware about the transmission ways of the epidemic? 1=YES/2=NO
59. Is there an awareness and teaching programs by governmental/non-governmental/indigenous organizations? YES/NO

60. Health facilities available in your area
   Number
   i. Clinics
   ii. Hospital
   iii. Maternal and children health center

61. Do these health centers have departments of HIV/AIDS? 1=YES/2=NO

62. What services did you get from these health centers?
   i. HIV/AIDS pre-advice and testing
   ii. ARV therapy and drug distribution
   iii. Follow up and treatment for AIDS patients

63. Are you satisfied with the services given by the health centers? 1=YES/2=NO

64. What do you think the main causes for the expansion of the epidemic in your area?
   i. Lack of awareness
   ii. Lack of behavioral change
   iii. Being polygamous and having many sexual partners
   iv. Mother to child
   v. Infected blood transfusion
   vi. Needle and sharp materials sharing
   vii. Drugs and alcoholism
   viii. Stigma and discrimination

65. Have you experienced stigma and discrimination due to HIV/AIDS(for AIDS afflicted households) 1=YES  2= Sometimes  3= No
66. What do you suggest in combating the epidemic?


Thank you very much!

Annex 17: Questionnaires used to collect data from key informants

**Ethics statement**

1. The following information is collected for academic purposes and the objectives of the research will be made clear for all responsible persons and stakeholders

2. The data collection process will be commenced after getting permission from the community, clan leaders and elders as well as local government officials

3. The participation in the data collection process is voluntary and made at convenient time of the interviewee

4. All data recording and collection mechanisms will be made clear to all target groups.

5. Respondents have full right to leave/withdraw at any point of time if they feel uncomfortable by any reason.

6. Personal and sensitive issues will be kept in a confidential and accountable manner in the data collection process

7. Cultural and traditional aspects of the people will be respected in the data collection process (sensitive to cultural values and norms)

8. The research findings will be submitted to the relevant bodies at the end of the research

**Data collector**

Name

Signature
For key informants

A. general Information
1. Respondent name------------------------
2. Respondent number---------------------
3. Occupation-----------------------------
4. Responsibility in the community----------
5. Organization(if any)---------------------
6. How long have you been in this district? ---------

B. Agricultural information
7. What are the opportunities and threats of agricultural production of the area?
   Opportunities                           Threats
   __________________________________________
   __________________________________________
   __________________________________________
   __________________________________________
8. Is there market accessibility for the agricultural produces of the area? Yes/No
9. Is there Road accessibility and transportation facilities? Yes/No
10. Is there availability of agricultural inputs? Yes/No
11. Soil type of the area---------------------
12. Annual precipitation of the area---------
13. Annual average temperature--------------
14. Availability of migrant laborers (rate of estimated migrants per year) ---------------
15. Availability of Natural calamities
   _______________________________________
   _______________________________________
16. Incidence of disease, weed and pest infestation in the last six years
   Diseases                                Weed                             Pests
   _______________________________________
   _______________________________________
   _______________________________________
   _______________________________________
17. Crops and livestock which bring higher income for the farmers in order of importance
   Rank

Crops
   ___________  ___________  ___________  ___________  ___________  ___________
   Teff  Chickpea  Wheat  Other cereals  Vegetables
   2001
   2002
   2003
   2004
   2005
2006

**Livestock**

Cattle    Sheep and goats    Chicken    Others

2001
2002
2003
2004
2005
2006

18. What are the available agro-industries who can take up produces of the farm?

________________
________________
________________

19. What type of links exists between the produces of the farm and the industries of the area?  i=strong ii=medium iii= week iv= no link at all

20. Are there community support programs (self helps, existing social network) in the area? If yes, list them
21. Other infrastructures in the area

________________
________________
________________

C. Information about HIV/AIDS

22. The first time HIV/AIDS cases identified in the area ____________________

<table>
<thead>
<tr>
<th>Age and sex</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 15 years old</td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
</tr>
<tr>
<td>B/n 15 and 49</td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
</tr>
<tr>
<td>&gt;49</td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
</tr>
</tbody>
</table>

24. Total number of deaths since the beginning of the epidemic in the district

**Number**
-Men
-Women
-Children

Total

25. Total number of extension professionals died in the district in the last six years

2001
2002
2003
2004
2005
2006

26. The status of stigma and discrimination against HIV/AIDS
i=High rate ii=medium iii= Low iv= not at all

27. Effective available media for awareness of the people about HIV/AIDS?
   i. newspaper/magazines
   ii. Radio
   iii. TV
   iv. Training and education
   v. Local institutions
   v. Others

28. What are the strategies/policies undertaken by the local government to combat the epidemic in the last six years

29. Health centers involved in the treatment of HIV/AIDS and ARV drugs in the last six years

Number

30. Involvement of local and international NGOS in combating the epidemic?
31. Future policies being designed to promote the agriculture sector and combat the epidemic

Thank you very much!