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i

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FOREWORD

The Ethiopian Economics Association (EEA) and its Bahir Dar Chapter are happy to issue the proceeding of the First Annual Conference on the Amhara Regional State Economic Development which was organized on the 15th August, 2009 at Amhara Regional State Bureau of Finance and Economic Development Conference Hall.

In quest of its mission, EEA has been actively engaged in economic research, training, organization of International and National conferences and round table discussions on the Ethiopian economy and the dissemination of the results of these activities through its professional journals and various publications. It has also been engaged in providing professional opinion and reflections on many issues affecting the development of this country. As a result of these and other efforts of the Association, EEA has established itself as a truly independent source of socio-economic policy options and data base in Ethiopia for the Ethiopian Government, the Ethiopian people and the International Community at large.

EEA organized this important conference as one of its objectives of broadening its activities and coverage at regional level so as to contribute to the economic advancement of regional state through dissemination of economic research findings; promotion of dialogue on socio-economic issues; promotion of education in economics in higher learning institutions; enhancing national, continental and global networks of professionals and institutions; and advancement of the professional interests of its members.

The First Annual Conference on the Amhara Regional State Economic Development was attended by about 120 participants drawn from Regional Bureaus, Universities, NGOs, private sector representative and EEA members in the region. The conference presentation and discussions thereof covered divers themes. These included: Health Extension Program, Fertility of the Household, Tenure security and Soil conservation, Trade, Wheat Technologies, the Contribution of SIDA Amhara Rural Development Program to Poverty Reduction, Contract Farming and Productive Safety Net Program.

All papers which were presented at the first Annual Conference were reviewed by external reviewers and Comments and suggestions including editorial comments were communicated to authors for improvement. Finally, those papers which passed all the review and editorial process published in the Proceeding of the First Annual Conference on the Amhara Regional State Economic Development.

I would like to take this opportunity to express my heartfelt gratitude, on my own behalf and on behalf of the Ethiopian Economic Association, to the many people and organizations that made the conference a resounding success. First and foremost, I thank the authors of the papers and the audience whose active participations made the first annual conference meaningful and dynamic. The Amhara Regional State Bureau of Finance and Economic Development deserves huge thanks for granting us the free use of its conference hall. The many professionals who dedicated their time to the conference and served as chairpersons deserve due thanks for their special contributions.

The staffs of the Economics Department of the Bahir Dar University which runs the EEA Bahir Dar Chapter and EEA/EEPRI deserve a special recognition for their enthusiasm and perseverance in managing the conference from inception to completion.

I would like to seize this moment to express our gratitude to the Consortium of Donors who have funded the conference and all other activities of EEA/EEPRI and maintained continued interest in our Association. These are: Friedrich Ebert Stiftung of Germany (FES), Embassies of UK (DFID), Ireland (DCI), Sweden (SIDA), the Netherlands, Norwegian Church Aid, the African Capacity Building Foundation (ACBF) and International Development Research Centre (IDRC) of Canada.

Finally, I would like to extend my sincere gratitude to H.E. Ato Degu Andargachew, V/President of the Amhara Regional State, and H.E. Ato Yinager Dessie, Head of Finance and Economic Development Bureau, for their encouragement for the successful conclusion of the conference and for their continued support for the activities of EEA Bahir Dar Chapter; and Dr. Fantahun Ayele, Vice President of Bahir Dar University, for his an insightful opening speech.

Wolday Amha (Ph.D)
President of the Ethiopian Economics Association

Table of Contents

THE ROAD TO LONG-TERM SOCIAL PROTECTION: THE CASE OF AMHARA REGION PRODUCTIVE SAFETY NET PROGRAMME

Amdissa Teshome[1]

Abstract

The Ethiopian Productive Safety Net Programme (PSNP) is designed to address chronic food insecurity. For the purpose of the programme, the Government of Ethiopia (GoE) defined chronic food insecurity as a state of food aid recipient for three consecutive years over a ten year period (1994-2004). The PSNP was introduced in 2005 with 5.5 million people, which gradually grew to 8.29 million. The programme has two operational modalities – public works and direct support. It has completed two phases and is expected to enter its third phase as of January 2010.

Amhara National Regional State (ANRS) is one of the regions severely affected by drought over the last 3-4 decades. About 2.5 million people are chronically food insecure as per the above definition and therefore are PSNP beneficiaries since 2005. In this paper, the Amhara PSNP is used as a case to demonstrate how challenging the implementation of PSNP has been and explore the possibility of using PSNP as a basis to design a long-term social protection for the nation in general and the region in particular.

The Ethiopian PSNP is regarded as the largest safety net programme in Africa. Partly for this reason it has attracted attention from government and non-government agencies from within and outside Africa. Broadly speaking, the programme has been successful in transforming Ethiopia from a state of annual relief to a multi-year predictable transfer of resources (cash, food or both) to chronically food insecure people. However, in the past five years, the programme has been facing a number of challenges both at national and regional levels and some of these challenges are expected to continue into the new phase. The challenges identified and discussed in this paper are (i) targeting, (ii) programme linkages, (iii) timeliness and predictability of transfers, (iv) purchasing power of cash, (v) graduation, and (vi) programme expansion.

The PSNP is still a short-term intervention in an environment that requires a long-term vision to address deep rooted food insecurity and poverty. Therefore, the paper argues for a long-term social protection and provides options that both the federal and regional governments could consider.

Keywords: safety net, targeting, linkages, transfers, graduation, social protection

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1. Introduction

This paper draws on secondary data from four major sources. First, two reviews in the life the PSNP (2006, 2008) that the author was involved in.[2]. Second, it also draws on what is probably the last review undertaken in 2008/09 for the design of the new phase of the programme. Third, the paper has also benefited from the author's joint work on options for social protection in Ethiopia undertaken for the Department for International Development (DFID). Finally, the questions and comments by the participants of the First Annual Conference on the Amhara Regional State Economic Development held on the 15th August, 2009, Bahir Dar have immensely contributed to refining the final paper.

The paper is divided into seven sections. Section 2 provides a short background to the Amhara region. Section 2 introduces PSNP and presents key success factors. Section 3 identifies and discusses key challenges that the programme has been facing and likely to face in the next phase. The study also highlights progress made to address some the challenges.

Section 4 looks forward to long-term social protection. It provides some background and justification for moving towards social protection and presents a few options with cost implications based on the experience gained from the PSNP. Section 5 is conclusion and recommendations.

# 2. Background to Amhara National Regional State

The Amhara National Regional State (ANRS) is one the nine regional states making up the Federal Democratic Republic of Ethiopia. It covers an area of 170,150 km^2 (14.4% of the national landmass) divided into 11 administrative zones and 150 *woredas*, of which 128 (85%) are rural. According to CSA, the total population of the region is around 17.83 million (25% of the total national population).

Geographically, the region shares one international boundary with the Sudan (North West) and national boundaries with four regions. These are Benishangul Gumuz (South West); Oromiya (South), Afar (North East) and Tigray (North).

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[2] The 2008 review was conducted in the same 8 *woredas* selected for the research in 2006 – Bugna and Kalu (Amhara), Chiro and Fedis (Oromiya), Boricha and Derashe (SNNPR), and Enderta and Wukro (Tigray). It must be emphasized that these *woredas* are not representative of all PSNP *woredas,* and findings cannot be extrapolated to the national level. However, they provided indicative ideas that have improved implementation of the existing programme and informed the design of the next phase of the programme.

In terms of food security and poverty, the region is most hit by drought and famine over the past 3-4 decades which resulted in household and community asset depletion. As a result, 64 *woredas* are categorized as chronically food insecure and the number of people living under the poverty line is estimated to be 30.5% or 5.4 million people in 2004-05.[3] Of these 5.4 million people, 2.5 million are chronically food insecure while the remaining 2.9 million are facing acute food insecurity. From the drought history of the region, the eastern part (yellow shaded in map below) is the most vulnerable to drought but according to Tafesse (2009) in most recent times environmental degradation is also becoming serious in the western part of the region (green shaded on the map below) which is traditionally considered surplus producing.

Figure 1: Map of Amhara

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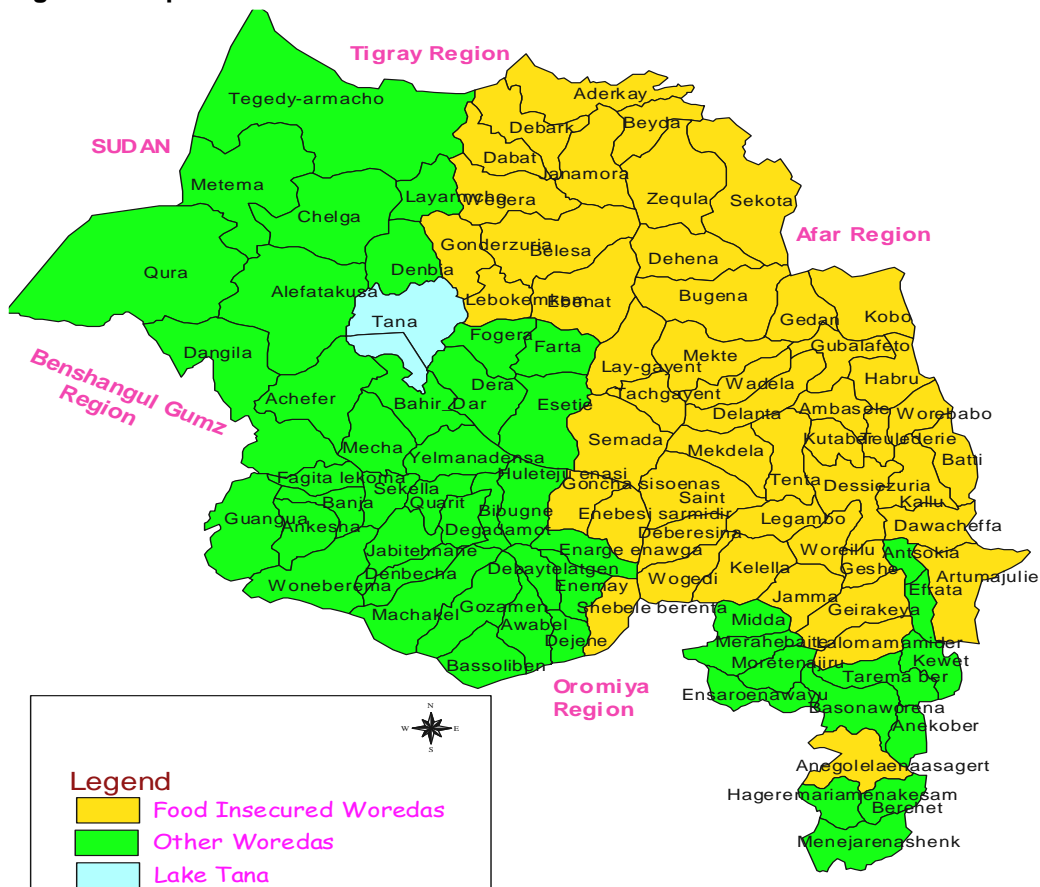
[3] According to the CSA Welfare Monitoring Unit, the number of people living below the poverty line was 54.3% in 1995-96 and 41.8% in 1999-2000 which further declined to 30.5% in 2005.

3.   The Productive Safety Net Programme (PSNP): rationale, coverage and key successes

3.1   The rationale and coverage of the PSNP

Ethiopia in general and the Amhara region in particular has been characterised by (i) long history of drought and famine which have depleted household and community asset; (ii) ineffective annual emergency response system which took too long to assess, appeal and respond; and (iii) food aid dominated emergency response believed to have dampened local production.

The 2003 drought which affected 14 million people is perhaps a turning point for Ethiopia. It generated the desire to move away from an annual emergency response system towards a multi-year programming (reliable and predictable resource transfer) and flexible resource transfer (cash only, food only, cash/food). To this end, the Government of Ethiopia designed a Food Security Programme (FSP) with three major components, namely the Productive Safety Net Programme (PSNP), the Other Food Security Programmes and Resettlement[4].

According to the Programme Implementation Manual (PIM), the PSNP has two components - Public Works (PW) and Direct Support (DS). Public works participants are able-bodied men and women who are required to make labour contribution to community asset building scheme such as construction of roads, terracing and water ponds. These schemes are designed to be labour intensive so as to allow for employment generation. Table 1 shows that a small percentage of public works project uses heavy or light machinery. This demonstrates the high prevalence of labour intensive public works implemented by the PSNP.

Table 1: **Public Works using Heavy or Light Machinery**

Public works activity	Share of new construction activities using heavy or light machinery (%)
	2006
Roads	9.0
Soil conservation sites	4.3
Trees and tree nurseries	13.2
Wells	15.2
Health clinics	10.5
Irrigation works	10.0
Schools	8.5

Source: Annex 1: MoARD, Food Security Review: PSNP Report, 2009 (based on IFPRI baseline study, 2006)

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[4] The next phase of the FSP is envisaged to have four components by splitting the OFSP into Household Asset Building (HAB) and Complementary Community Infrastructure (CCI).

Direct support beneficiaries as outlined in the PIM are (i) **sick or mentally challenged** people unable to undertake even light work; (ii) **pregnant** women after the sixth month; (ii) **lactating** women in the first ten months after child birth; and (iv) **orphaned** teenagers. Sharp et. al (2006) commented that 'old age' was not mentioned in the PIM as a criterion for DS eligibility, but in practice, communities were sensibly prioritising the old and indeed consider them the most obviously eligible group for Direct Support.

These groups of vulnerable people are not required to contribute to community asset building through public works but the PIM lists some light activities that DS beneficiaries could accomplish (childcare at PW sites, record keeping). However, PSNP reviews have shown that none of these schemes has been operational during the two phases of the programme.

The PSNP has two basic objectives: (i) to prevent asset depletion at the household level (ii) to create assets at community level. The first objective is achieved through timely transfer of food or cash or both in order to stop households from selling their asset when they go hungry. The second is through participation in public works. Ultimately, the PSNP beneficiaries are expected to graduate from the programme when they are able to meet their food gap not only from PSNP transfers but mainly from the investment opportunities offered through household asset building components.

The programme meets food gap for an average of 6 months nationwide with some exceptions where additional resources were used to increase duration up to 10 months (e.g. REST in Tigray). It is widely recognised that this average duration of transfer largely adopted for administrative purposes underestimates food gap for some households and overestimates for others. In recognition of this, the GoE together with its development partners has begun piloting "Variable Levels of Support" (commonly known as 3-6-9). The purpose is to determine the exact months of food gap and provide transfers accordingly. The results of the pilot are expected in late 2009.

The programme is considered the largest of its kind in Africa. Data compiled from various African countries (see Figure 2 below) shows that the PSNP has about 8 million beneficiaries (approximately 7 million in PW and 1 million in DS). South Africa has 3.7 million beneficiaries under its child support programme and other are still piloting with smaller figures.

The PSNP is also unique in that it is implemented on a large scale without piloting largely because of the desire to urgently address chronic food insecurity. This put considerable pressure on grassroots implementers that had little or no experience in implementing such a large scale programme, which indeed is believed to be the source of many of the challenges discussed in this paper.

The ANRS has 2.5 million PSNP beneficiaries with about 2.25 million of them in PW and about quarter of a million benefiting from DS (see Figure 3).

Figure 2: PSNP - the largest programme in Africa
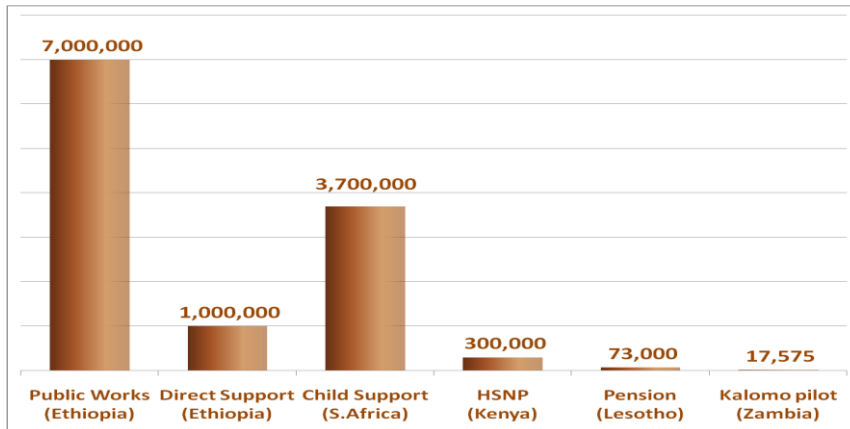
Source: Devereux and Amdissa (2009)

Figure 3: PSNP in Amhara
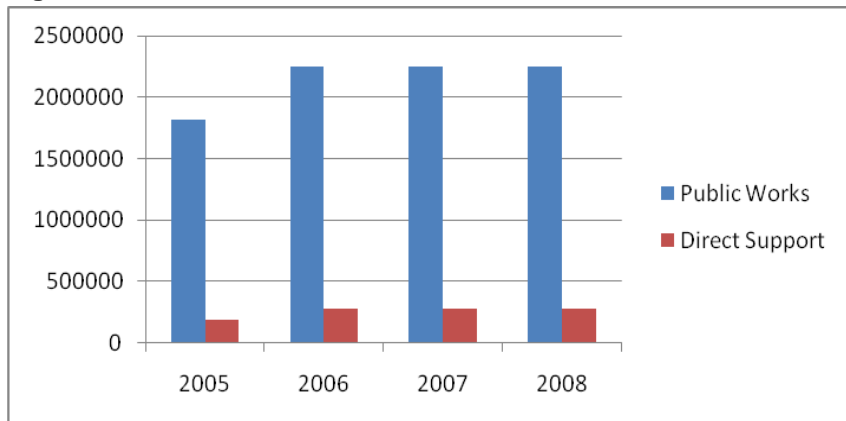
3.2   Key success factors of the PSNP

How is the success of the PSNP measured? It is measured primarily by the extent to which its objectives are met. Has the programme protected household asset? Has it created community assets? But ultimately the programme's success is measured by how effectively it has linked with the household investment opportunities and brought about graduation from the programme at scale.

6

Broadly speaking, the transition from annual emergency appeal to multi-year programme (5 years) is a breakthrough for Ethiopia. At the time of initiating PSNP, the record showed that the country has been appealing for emergency assistance for 27 consecutive years. The long process of assessment and re-assessment of food security situation by government and non-government agencies; the negotiations over beneficiary figures and delayed responses contributed to household and community asset depletion. Therefore, moving to regular transfer of cash or food or both to chronic food insecure households was a welcome change.

PSNP reviews have indicated that the transfers have contributed, among other things, to asset protection, access to education and health, and better feeling about 'food security'. Although household asset creation is not the objective of PSNP, households have indicated acquiring some kind of asset because of PSNP transfers (see Box 1).

Box 1: Impacts attributed to PSNP

Food security impacts: Three-quarters of beneficiary households reported that they consumed more food or better quality food in 2006 than 2005 and 94% of these households attributed this to the PSNP. Three in five beneficiaries retained more of their own food production to eat rather than selling for other needs and 90% of these beneficiaries said that this was directly because of the PSNP.

More than half of the sampled beneficiary households (62%), but less than half of the sampled non-beneficiaries (46%) reported being better off than one year earlier (before PSNP). When asked why beneficiaries felt better off than a year ago, by far the most common reason given was:
   "We received assistance from the Safety Net Programme"(79%), followed by:
   "We received assistance from other government programmes" (24%).

Conversely, the commonest reason given by non-beneficiaries for feeling worse off than this time last year was: *"Our household was not included on the Safety Net Programme"* (54%), followed by: *"The rains are not good this year"* (48%). This confirms that the PSNP was recognised by beneficiaries as having a significant positive impact on their well-being in 2005.

Asset protection: Three in five beneficiaries avoided having to sell assets to buy food in 2005 – a common 'distress response' to household food shortage. A smaller but still sizeable proportion of beneficiaries – just over one-third – avoided using their savings to buy food. In both cases again, 90% of these households explained these positive outcomes in terms of the PSNP. Since one of the stated objectives of the PSNP is to protect household assets, this is an important and very positive finding.

Access to services: Almost half the beneficiaries surveyed stated that they used healthcare facilities more in 2005/06 than in 2004/05 and 76% of these households credited the PSNP with this enhanced access. More than one-third of households enrolled more of their children in school and half of all beneficiaries kept their children in school for longer, rather than withdrawing them when cash or food was short. Over 80% of these beneficial impacts were said to be due to the PSNP.

Asset creation skill acquisition: Approximately one-quarter of PSNP beneficiaries acquired new assets for their households or new skills during 2005/06. The PSNP was held responsible for the acquisition of most of these skills (86%), presumably through training received on public works projects (Source: Devereux et. al. 2006).

7

Table 2: Number of households graduated from the PSNP (Oct. 2008)

Region	Graduated from PSNP	% of total
Amhara	14,368	77.5
Oromiya	365	2.0
SNNPR	3,805	20.5
TOTAL	**18,538**	**100.0**

Source: MoARD, Food Security Review PSNP Report (2009)

The most important success indicator of PSNP is graduation from the programme. However, graduation has been a major challenge both conceptually and practically (see Section 4.5 for further discussion). The progress towards graduation has also been slow both at national and regional levels. As of October 2008, 18,538 households have graduated from the programme and Amhara accounted for 77.5% of the total. (See Table 3 and 4 respectively).

Table 3: Number of PSNP Graduates in 2008 – Amhara

S. No.	Region	HH Heads	HH Members	Total
1	North Shoa	554	2042	2596
2	East Gojjam	738	1312	2050
3	Oromiya	1022	3162	4184
4	South Wollo	4608	14959	19567
5	South Gondar	1249	3802	5051
6	North Gondar	1714	6181	7895
7	North Wollo	2567	7461	10028
8	Wag Hemra	2048	6961	9009
9	Total	14500	**45880**	**60380**

Source: Tafesse, 2009

# 4.   Implementation challenges and future directions for PSNP in Amhara

The PSNP has been facing several implementation challenges since its inception. Some of these challenges were identified and discussed in an earlier work (Amdissa Teshome, 2006). This paper re-visits the old challenges and shows some progress towards resolving them. It also identifies some new ones that may influence the next phase of the PSNP.

4.1   Targeting

Targeting is a process of identifying and selecting an area, a household or an individual for a given emergency of development intervention. Since the mid-1990s, considerable efforts have been made to improve emergency targeting both at national and regional levels. In 1997, a comprehensive food aid targeting study was carried out covering Amhara, Oromiya, SNNPR and Tigray (Sharp, 1997). Based on this study, a National Food Aid Targeting Guidelines was developed in 2000 (DPPC, 2000). Subsequently, a targeting handbook was developed and translated into Amharic. A training project was designed and implemented specifically for Amhara Region covering 30 *woredas*. Targeting guideline and handbook were also developed for the PSNP. Handbooks prepared and translated into three languages (Amharic, Oromiffa and Tigrigna) and training given at all levels (federal, regional, *woreda* and *kebele* levels). Despite these efforts, the challenges of targeting continued.

The guiding rule for PSNP targeting was that if a household (or *woreda*) received food aid for three consecutive years during 1994-2004, it was considered chronically food insecure and eligible for PSNP. The data for Amhara region is shown in Figure 4. Accordingly, at national level the number of *woredas* increased from 192 in 2005 to 282 in 2008. Similarly, for Amhara the number of *woreda* increased from 52 in 2005 to 64 in 2008.

Figure 4: Relief trend as a basis for PSNP targeting - Amhara
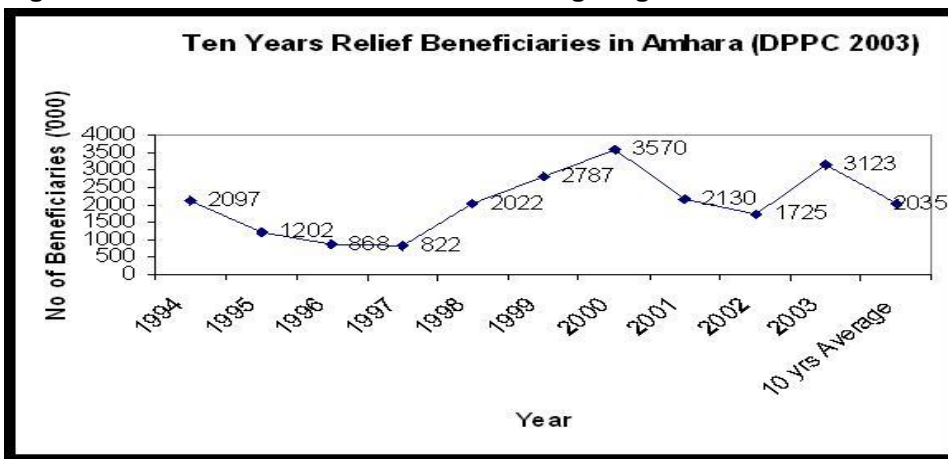
Source: Tafesse, 2009

The most difficult aspect of targeting is household and individual targeting. In this regard, during the first year (2005), the region focused on households that had better

chance of graduating from the programme. This was a strategic move rather than a targeting error in the conventional sense. However, it caused uneasiness among development partners because it clearly left out the neediest households. The government and donors launched a major review of the targeting process in 2006 which confirmed the concern that many mid-level income households were targeted to ensure that graduation targets would be achieved. This review was repeated in 2008 and found that:

> At all levels, the understanding of targeting principles and procedures has improved since 2006 [including Amhara region]. All stakeholders now recognise the importance of targeting the poorest households, though they do not always agree on the best way to achieve this (Devereux, et. al. 2008).

Since targeting is a mechanism for allocating resources, grassroots implementers often used it to spread resources thinly in order to increase coverage. That means when a family is excluded from PSNP, it is either excluded wholly or partially (some households members are included and others excluded). This raised the issue of full family targeting. The 2006 review strongly recommended that the household must be targeted fully not partially primarily because it had implications for graduation. The 2008 review found that the shift to full family targeting has largely been implemented in Oromiya, Tigray, and Amhara.

By and large, considerable targeting lessons have been drawn from the past five years of PSNP implementation. It is not likely that similar mistakes will be repeated but other new challenges are likely to emerge. This is mainly to do with expansion of the programme to areas not regarded as chronically food insecure as per the definition used for PSNP (see Section 4.6).

4.2   Programme linkages

It was well established at the start of the PSNP that it alone could not achieve graduation. It must be linked/integrated with other food security programmes (OFSP), the asset building component in particular. Empirical studies have also established that it is households with access to both the PSNP and packages of support that are more likely to be food secure, to borrow for productive purposes, use improved agricultural technologies, and operate non-farm own business activities; and by implication these are households that are likely to graduate from both PSNP and the food security programme (Hoddinott, et. al. 2008).

Nevertheless, the 2006 review found that the linkage was generally weak. Despite concerted efforts to ensure that PSNP beneficiaries are the prime targets for OFSP, the latest review MoARD, 2008) showed that the linkage remains weak in a number of ways. First, while there have been significant improvements in the concentration of both PSNP and OFSP resources on target households, there remain significant numbers of PSNP beneficiaries yet to be targeted with household assets; second, there appear to have been only minimal attempts to identify ways in which public works could support the household asset building component, increasing the utilisation of the community assets created and enhancing the impact of investments made by households.

Table 4 shows community perception of the extent of linkage between public works and other programmes in 2006 and 2008. For example, with respect to access to improved seeds, in 2006 the weakest linkage was found to be in Amhara (3%) which improved to 13% in 2008. With respect to access to credit, Amhara did better (35%) than most except Tigray (38%). Therefore, programme linkage continues to be a challenge both at national and regional levels.

Table 4: Extent of linkage between public works and components of OFSP (%)

Areas of linkage	Amhara		Oromiya		SNNPR		Tigray	
	2006	2008	2006	2008	2006	2008	2006	2008
Access to improved seeds	3	13	2	3	5	12	17	30
Access to other seeds	0	12	1	3	2	7	4	10
Provision of implements	2	13	1	2	6	8	10	5
Irrigation/water harvesting schemes	7	24	3	18	5	12	25	33
SWC improvements on land	16	31	3	22	5	16	51	47
Improvements in pasture land	3	19	0	10	2	11	15	23
Credit	15	35	3	9	1	12	38	38
Provision of chicks	1	15	0	3	0	8	17	17
Provision of livestock	2	17	2	7	3	12	20	16
Others	0	9	0	1	2	1	3	2
Any OFSP	29	46	12	37	20	33	69	63

Source: MoARD, FSP Review PSNP Report, 2009 (originally from IFPRI) Source: MoARD, FSP Review PSNP Report, 2009 (originally from IFPRI)

4.3 Timeliness and predictability of transfers

Timeliness of transfers is essential to ensure that the basic objectives of PSNP are met - contribute to consumption smoothing and prevent hunger or asset depletion. Predictability of transfers is important because this allows recipients to plan their

spending, to save small amounts every month (if they wish), and to manage risk better (Slater, et. al. 2006 and Devereux et. al 2008) by for example bulk purchases of food during relatively better grain marketing days stuff.

Delayed or unpredictable payments force beneficiaries to adopt unsustainable 'coping strategies' such as selling assets to buy food and this undermines the asset protection objective of PSNP.

Timeliness and predictability take the transfer issue to a higher level – rights and entitlements. For example,

"Transfers can be seen to be **timely** when they a) are provided before or at the time of greatest need and b) take place as per an agreed disbursement schedule" (SC-UK 2008: 10).

"Transfers can be considered to be **predictable** if PSNP participants have timely knowledge of their eligibility for the programme and know what their entitlement is comprised of (how much of what resources and when)" (SC-UK 2008: 7).

Although timeliness of transfers has improved, nearly 60% of beneficiaries state that they do not receive their transfers on time and only 27% feel that PSNP transfers enable them to plan ahead (MoARD, 2009).

As a matter of fact, commitment to timeliness and predictability represent a major departure from the emergency response. Donor commitment to PSNP is more predictable than the emergency response - the Government of Ethiopia 'knows' the budget allocated from donors for the PSNP. In terms of timeliness, it is believed to be better than emergency response. However, logistic difficulties continue to constrain regional/national capacity to achieve timeliness and predictability.

(Fekadu and Mberengwa, 2009) also observed that the timing of payments does not take into consideration the grain marketing periods of the localities. Mostly, it is during September or October that transfers are made when little grain is available on the market. Whatever grain is available then is in most cases too expensive for them as this period coincides with the "hungry season" – a period of chronic food shortage.

4.4   The effect of inflation on PSNP wage purchasing power

### 4.4.1   Household preference vs. actual transfers

'Cash first' is the basic principle governing resource transfers in Ethiopia's PSNP. However, the programme also aims to provide transfers appropriate to people's

needs. This appropriateness is measured through (i) people's preference for food or cash; (ii) the purchasing power of the wage; (iii) the availability of food in local markets; and (iv) the relative cost/capacity of managing food/cash.

Overtime, beneficiary preference for food over cash has increased for the simple reason that the purchasing power of the cash has been weakened due to inflation. Figure 5 shows this situation very clearly. The preference for food increased from 55% in 2006 to 84% in 2008. The government has responded to this preference by introducing a relatively flexible mode of transfer.

In a similar study in one of the PSNP *woredas* in Oromiya (Fekadu and Mberengwa, 2009) found that 89% of the households indicated they prefer the transfer to be in kind/food. During participant group discussions, it was raised that the amount of cash transfer (six birr/day/person) is too little and cannot support the consumption level of the households. A Save the Children UK study also indicated that the vast majority of respondents prefer to receive food, rather than cash, under the PSNP. They distrusted cash because they had seen its value deteriorate so rapidly; food was more tangible and reliable, and did not lose its value (Hobson, 2008).

**Figure 5: Beneficiary preferences for cash or food**
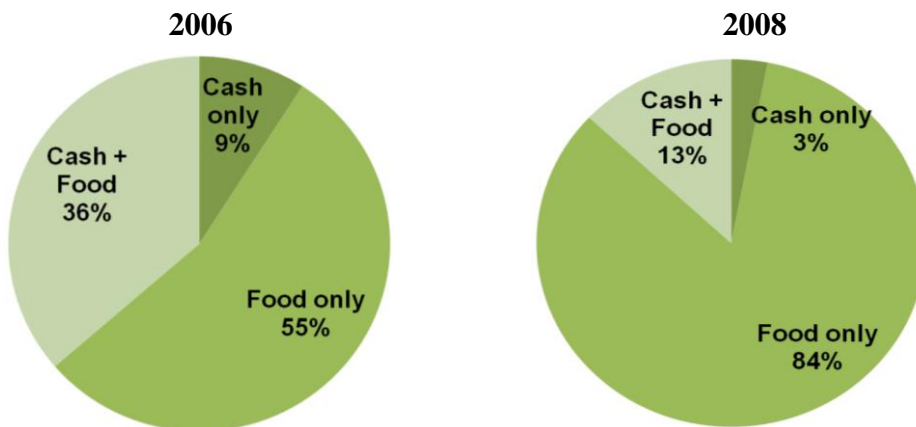
Source: Devereux, et. al. 2008

Actual transfer in Amhara (Figure 6) shows that the food only recipients increased from 14 *woredas* in 2006 to 22 *woredas* in 2009. The cash/food mix distribution also increased from 14 *woredas* in 2006 to 52 in 2009 and slightly dropped to 42 in 2009. The cash only recipients dropped from 19 in 2006 to none in 2009.

Figure 6: Cash/food split - Amhara
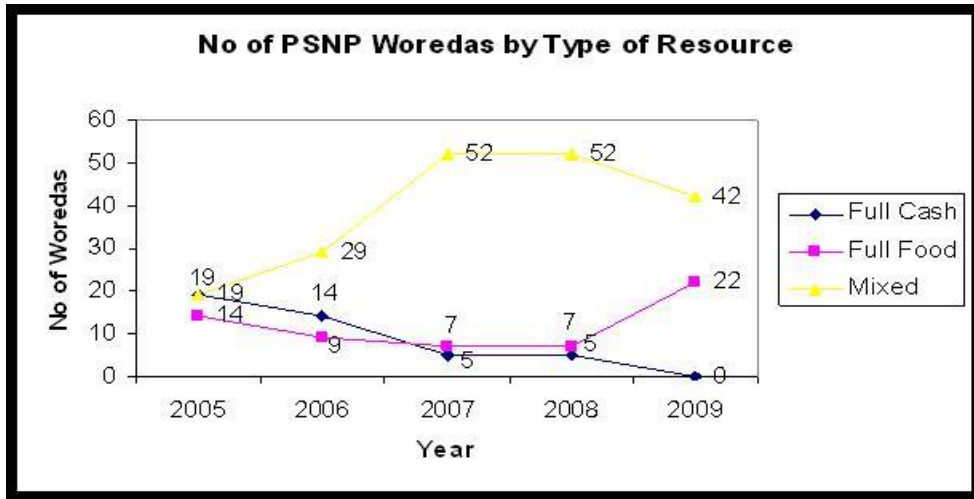
4.4.2 Purchasing power of cash transfers

Hobson (2008) observed that in 2005 the PSNP wage rate (6 Ethiopian birr or $0.42) enabled a household in Amhara Region to buy about 3.6kg of maize. However, due to price escalation, in 2007 households were only able to buy 2.8kg of maize with 6 birr. This constituted a 21% loss in purchasing power in a 'normal' year. Between July 2007 and February 2008 the price of maize rose to 3 birr/kg. In a 'normal' year before 2007, households would expect to see the price of maize decreasing at this time, not increasing.

The Ethiopian government responded to the shock by increasing the PSNP wage rate from 6 to 8 birr ($0.56) per day in early 2008. However, maize prices on local markets continued to rise, to the point where, in February 2008, 8 birr purchased just 2.77kg of cereal. Six months later, at the end of the 2008 PSNP transfers in July, the 8 birr PSNP wage rate only enabled a household to purchase 1.2kg of cereal. As Figure 7 shows, this represents a loss in purchasing power of 56.7% for the poorest and most food-insecure households in Amhara Region, in the space of seven months. Between April and July 2008, the reduction in purchasing power of PSNP wages (and therefore the effective value of the wage rate) continued at nearly 20% a month.

Figure 7: Purchasing power of PSNP wages in *Gubaloafto Woreda*, Amhara Region (2006-2008)
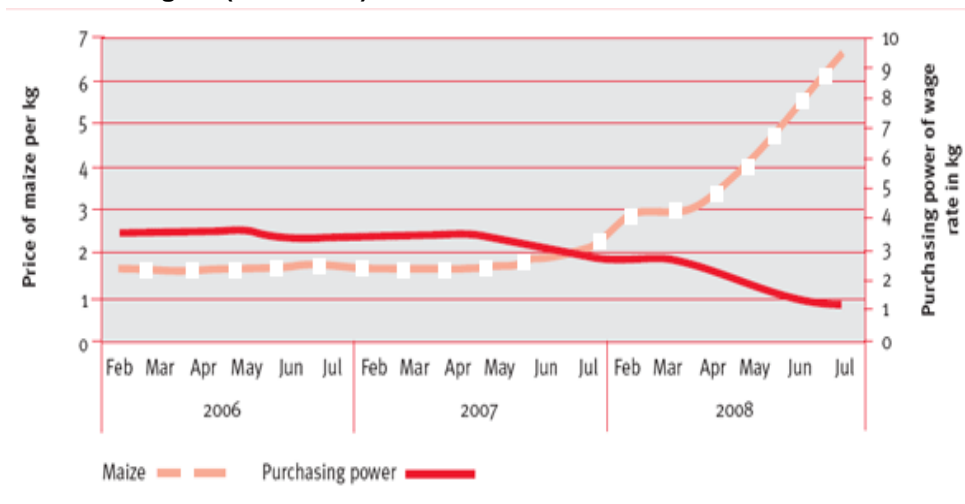
Source: Hobson, 2008

The same study showed that purchasing power among PSNP households varied between Regions (see Figure 8). Taken as an average, purchasing power in Tigray was significantly lower than among comparable households in SNNPR.

Figure 8: Average purchasing power of 6 Birr in four regions in 2007
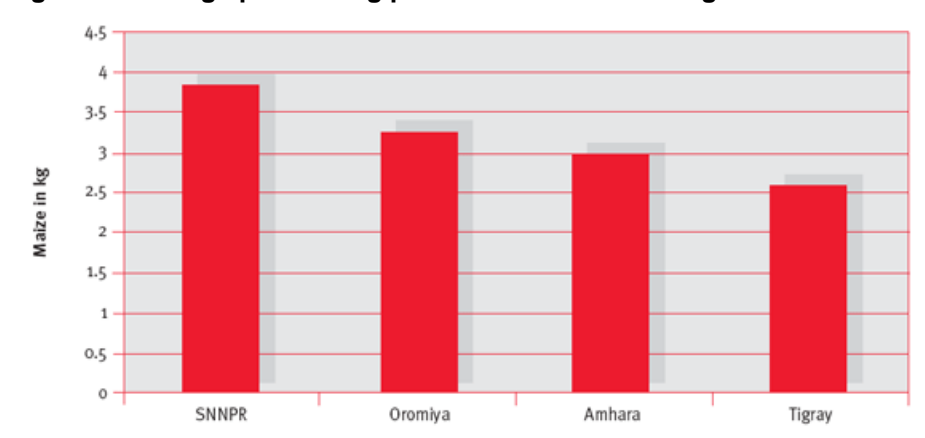
Source: Hobson, 2008

From the end of the scheduled PSNP transfer period in July 2008, food prices in rural markets appear to have stabilised, albeit at (or near) their peak. For example, in Gubaloafto and Sekota markets, Amhara Region, the price of maize peaked at Birr 6.60 and Birr 7.15 respectively in July (usually the seasonal peak price for staple

15

foods). In November 2008, prices were Birr 5.45 and Birr 5.50 respectively. Despite the appearance of cheaper maize on the markets, this still represents just under a 300% increase on prices in the period 2005–2007 (when they were stable at around 2 birr per kilo). Therefore, the prospect is that price fluctuation will continue to challenge PSNP implementers.

4.4.2 The contribution of PSNP cash transfers to inflation

The very fact that PSNP is based on 'cash first' principle raises a fundamental question: to what extent has PSNP contributed to the price rise? It is logical to expect price rise if cash is injected into the local economy. However, one needs to examine how large is the cash and what is the absorbing capacity of the local market?

For example, in recognition of the fall in purchasing power of cash transfers, the government raised the wage rate per person per day to Birr 8. A person is paid for 5 days a month and duration of transfer is six months. At this rate, the amount of transfer is Birr 240 per year per person which amounts to about Birr 600 million per year[5] assuming cash only transfers. However, this sum of money has not actually circulated on the local market to have an impact on food prices. The transfers have largely been a combination of food and cash. As shown in Figure 6 above, the number of *woredas* that received cash only was 19 at its pick in 2006 but dropped to zero in 2009. This gives an indication that the cash transfers were unlikely to have had important bearing on prices. However, more systematic and location specific study is required.

4.5 Graduation

Graduation is perceived as a two stage process to which the PSNP can only contribute. The first stage is graduation from the PSNP and the second is graduation from the wider Food Security Programme. Graduation from the PSNP is defined as follows:

> "A household is said to have graduated from PSNP when, in the absence of receiving PSNP transfers, it can meet its food needs for all 12 months and is able to withstand modest shocks."

There has been considerable debate over the best approach to assess whether or not households have achieved the first stage of graduation. The consensus is that assets are a more accurate method of measuring food security than incomes

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[5] Birr 8 x 5 x 6 months x 2.5 million beneficiaries. These simple calculations are used to generate cost estimates for long term social protection later in this paper.

because asset levels do not vary from year to year as much as income and also indicate income earning or livelihood potential more strongly than income itself.

Although there has been some movement in and out of the Programme, through retargeting since the start of the PSNP, official graduation has only started in 2008. As shown in Tables 2 and 3 above, the official data available shows that 18,500 households have graduated of which 14,500 or 77.5% are from Amhara. Given the initial ambition to graduate 5.5 million people at the end of the five years, this is indeed a very slow progress.

The explanations largely lies in the implementation challenges discussed in this paper, which are important in their own right, but also have significant bearing on graduation. For example, improper targeting, untimely and unpredictable transfers, weak programme linkages and weak purchasing power of cash transfers all have negative impact on graduation. Failure rains also slows down progress towards graduation as the following example form two *woredas* in Amhara demonstrate:

> In **Kalu** and **Lasta** the *woreda* received "how to" instructions on graduation. Kalu planned to graduate 436 beneficiaries in 2008, having developed a format for assessing graduation by measuring assets and establishing *woreda* benchmarks, but the subsequent failure of the *belg* rains and food price inflation forced a reassessment of the benchmark. In Lasta, the *woreda* attempted to assess potential graduates based on the benchmark, but could not find anyone who qualified. Instead, they sought "volunteers" for graduation ("self-graduation") (Devereux, et. al., 2008:33).

In section 3.2 above, limited evidence was presented that incomes and assets of PSNP households have increased and communities have attributed this improvement to the PSNP. In the debate on graduation, two factors have been prominent – conceptual confusion and beneficiary confidence towards graduation. As shown in Table 5 below, there has been considerable progress in addressing the conceptual issues particularly in Amhara where 74% of the respondents have heard of graduation. This is well above average of 49.8% for the four regions.

Table 5*: Awareness levels of graduation*

Have you ever heard of the word 'graduation' from the PSNP? [6]					
	Amhara	**Oromiya**	**SNNPR**	**Tigray**	**Total**
Yes	146 (74%)	107 (56%)	112 (58%)	34 (15%)	399 (49.8%)
No	50 (26%)	84 (44%)	80 (42%)	189 (85%)	403 (50.3%)

Source: Devereux et. al, 2008

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[6] This is a very basic question. It should be noted that communities have heard of graduation does not necessarily mean they have complete understanding of the graduation process.

However, the same study found that confidence of PSNP beneficiaries in their ability to graduate is low.[7] In Amhara, 28.5% of the respondents have some level of confidence (from limited to highly confident). This is second to Tigray which reported 58% level of confidence. Matching confidence level with actual graduation, we find that Amhara has done much better than the three regions.

Table 6: Confidence towards graduation

Confidence level	Amhara	Oromiya	SNNPR	Tigray	Total
No confidence	114 (61.3%)	98 (63.0%)	116 (82.3%)	11 (32.4%)	339 (65.7%)
Limited confidence	37 (19.9%)	19 (12.3%)	9 (6.4%)	8 (23.5%)	73 (14.2%)
Confident	11 (5.9%)	12 (7.7%)	6 (4.3%)	6 (17.7%)	35 (6.8%)
Highly confident	5 (2.7%)	2 (1.3%)	0 (0.0%)	6 (17.7%)	13 (2.5%)
Cannot tell	19 (10.2%)	24 (15.5%)	10 (7.1%)	3 (8.8%)	56 (10.9%)
Total	**186 (100%)**	**155 (100%)**	**141 (100%)**	**34 (100%)**	**516 (100%)**

(Devereux, et. al., 2008)

In addition to the empirical findings, a series of focus group discussions revealed that there are multiple ways of leaving the programme some of which are misconstrued as graduation:
• leaving the PSNP voluntarily ("voluntary graduation", or "self-graduation")
• removed from the list because a household member either migrated or returned from resettlement
• removed from the list for absenteeism from Public Works projects
• removed from the list because their income exceeds the income of a non-beneficiary on the PSNP waiting list
• removed from the list because they have acquired assets through OFSP packages and are therefore considered to be better off
• removed from the list because their income is above the graduation guideline threshold (either regional, *woreda or local community guidelines).*

It is important that data generated on graduation clearly distances itself from these other forms of leaving the programme.

4.5   Programme expansion

The food security programme as a whole has a potential target of reaching 15 million people of which 8.29 are under the PSNP and the remaining treated as transitory food insecure. For Amhara, the potential target is 5.9 million.

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[7] Confidence level is not easy to test. It cannot be fully captured by simply asking "how confident are you?" Therefore, these results should be treated as indicative of household's level of confidence given their asset level.

As noted at the beginning of the paper, the official data suggests that poverty levels, as measured by the number of people living below the poverty line, have fallen from 54.3% in 1995-96 and 41.8% in 1999-2000 to 30.5% in 2005. But there is a general perception that in areas considered "food secure" five years ago, chronic poverty is rising. There are similar reports in Oromiya and SNNPR. This is an emerging challenge facing the regional government but it needs to be supported by concrete evidence that chronic food insecurity has expanded into the food secure or high potential areas.

5.   Towards long-term social protection

5.1   Background and justification

Social protection is by no means new to Ethiopia. Traditionally, Ethiopians are among the most giving people who voluntarily give whatever they can to the less fortunate and disadvantaged citizens. Ethiopia has a long history of formal social security in a form of contributory pension schemes but the system remained limited in coverage and vision. Presently, there is a multitude of "social protection" interventions by NGO and donors. Examples of NGOs engaged in. However, these efforts remain fragmented and lack long-term vision. Even the highly acclaimed PSNP remains a short-term intervention.

There are strong justifications for long-term social protection at national as well as regional levels. First, although the regional poverty levels are falling, at 30.5% it is still high. Second, even if the country achieves high economic growth, there are millions of people who could not take advantage of the enabling environment for various reasons. For example, it is estimated that there are 1.78 million persons with various types of disabilities in Amhara[8] who have no access to education and health services and employment opportunities. For this group of people, social protection is not only livelihoods issues but also a human rights issue. Third, it is widely acknowledged that the present direct support beneficiaries will not be able to "graduate" from the PSNP but there is no plan for them when the PSNP ends.

Therefore, the time is high to advocate for a long-term social protection in Ethiopia and generate options that the federal and regional government could consider. Figure 9 is a representation of the envisaged road to social protection for Ethiopia in general and Amhara region in particular. It depicts over 30 years of emergency response which was the basis for designing the safety net programme. It is envisaged that the

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[8] This is obtained by applying the 10% global estimate of persons with disabilities to the regional population of 17.8 million.

safety net in turn will serve as a base for designing social protection policy and strategy and programme.

Figure 9: Ethiopia's Road to Social Protection

1970s to mid-2000	→	**2005-2015**	→	**2005 and beyond**
Emergency Response		*Safety net*		*Social Protection*

5.2   Potential vulnerable groups in Amhara

Figure 10 shows the potential estimate of vulnerable groups in Amhara calculated based on national averages.[9] Accordingly, it is estimated that children under 18 are about 8 million; persons with disabilities amount to 1.8 million; elders under 1 million and the current direct support about a quarter of a million. This gives the potential vulnerable group of about 11 million. This does not mean all these are eligible for social protection. What are the options? And what are the cost implications?

Figure 10: Estimates of vulnerable groups for Amhara (based on national averages)
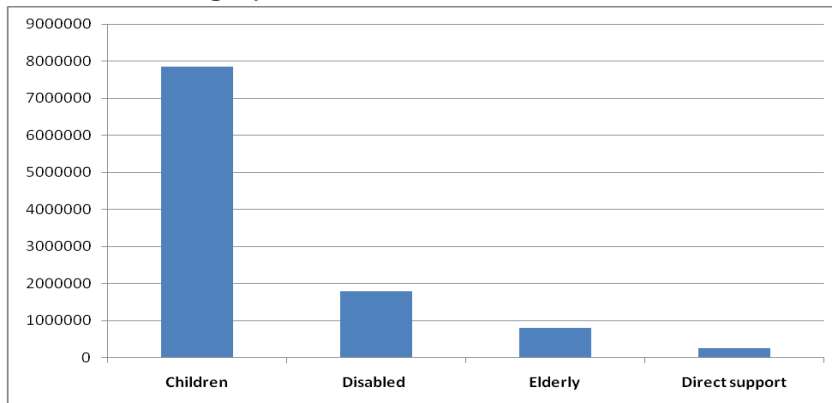
5.3   Options for social protection in Amhara

Table 7 sets out the vulnerable groups and the envisaged levels/duration of social protection. Figure 11-14 provide the options and the estimated cost of these

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[9] It is possible to use the official population figures. However, it does not affect the central argument for social protection. When actual planning is done, the region should use its official figures.

options.[10] Accordingly, <u>Option 1</u> is for the regional government to design a social protection programme for the PSNP direct support beneficiaries and consider extending the support from 6 to 12 months. The regional government can also choose from three levels of transfers per month. For example, at Birr 50/month, this option will cost an estimated Birr 150 million per annum (see Figure 11).

Table 7: Vulnerable groups and envisaged levels/duration of support

Vulnerable groups/options	Levels/duration support	
	1	2
1. Continue with the current direct support but	Support for 6 months of the year (current PSNP)	Extend the support to 12 months
• 30 birr/month	✓	✓
• 40 birr/month	✓	✓
• 50 birr/month	✓	✓
2. Focus on the elderly	(Universal)	(Poor only: those below the poverty line)
• Over 60	✓	✓
• Over 70	✓	✓
3. Focus on children		
• 0-5	✓	✓
• 0-10	✓	✓
• 0-15	✓	✓
4. Focus on persons with disability	✓	✓

Figure 11: Option 1 - Direct support

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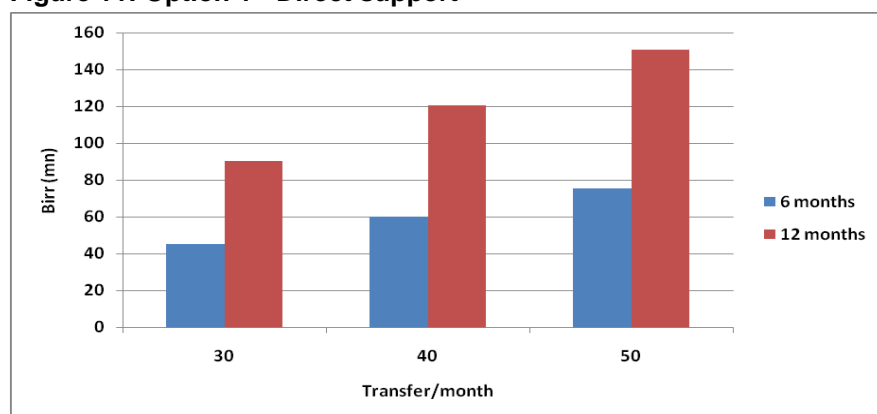
[10] Readers should note that these are at the back of the envelop calculations using PSNP transfer levels (see Annex 1 for the assumptions and tables). They are not based on data collected through surveys or any other means. However, the fundamental argument about social protection remains valid regardless of the source of data.

Option 2 is to focus on the elderly but choose from the over 60s or 0ver 70s. Furthermore, not all elders are vulnerable. Some may have their own retirement schemes or savings or support from relatives. Therefore, the over 60s poor only will cost an estimated Birr 80 million per annum and the over 70 poor only will cost an estimated Birr 50 million (see Figure 12).

Figure 12: Option 2 - focus on the elderly
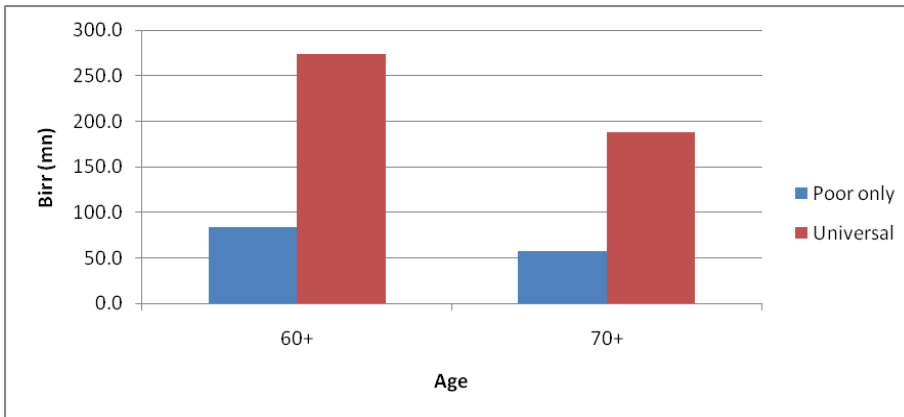
Option 3 is to focus on children and again choose between different age groups. If the regional government chooses to focus on the under 5 poor only, this will cost an estimated Birr 500 million.

Figure 13: Option 3 – focus on children
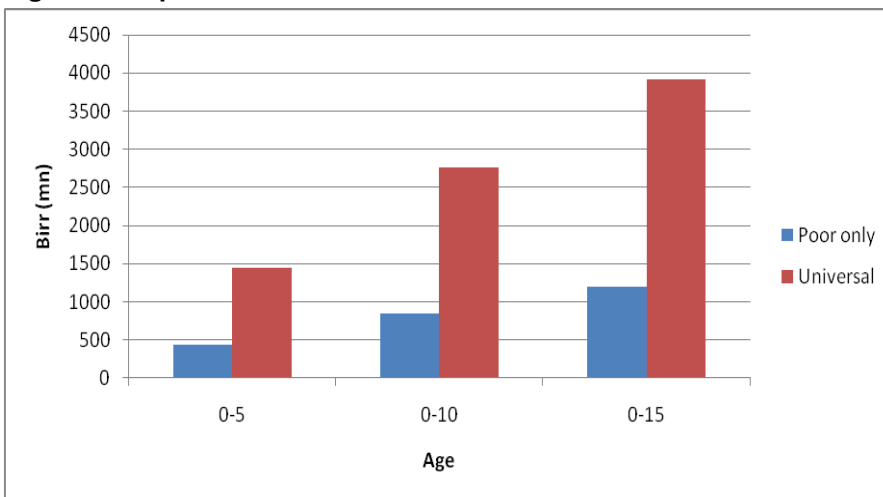
Option 4 is to focus on persons with disability. As indicated above, this group is estimated to be about 1.78 million and it will be the most expensive. Can the social protection accommodate all of them? This is both a financial and political decision. In any case, the government has the option of focusing on either (i) children with disability or (ii) elders with disability or (ii) women with disability. Once this decision is made, any of the transfer levels given above can be applied to this group.

6. Conclusion and recommendations

This paper presented the rationale and coverage of the PSNP both at national and regional levels. The main body of the paper identified and discussed implementation challenges that the programme has been facing over the last five years. Progress made to address and eliminate some of the challenges has also been highlighted.
The paper finally discussed the prospect of using the PSNP experience to move towards a long-term social protection. A number of options are presented with indicative cost implications. The options were (i) continue with the current direct support (ii) focus on children (iii) focus on elderly and (iv) focus on persons with disability.

(1) Targeting - The targeting process has matured. It is unlikely that similar mistakes to the past will be made. However, the following targeting issues will continue to challenge regional implementers: (i) targeting of PSNP beneficiaries for other programmes; (ii) replacement of households leaving the programme for various reasons and (iii) targeting under possible programme expansion.
It is recommended that clear guidelines should be prepared and systematically disseminated on these aspects
(2) Programme linkages – programme linkage is multi-dimensional and this makes it more challenging. Linkage must happen by design (planned) not by chance (ad hoc).
(3) Timeliness and predictability- logistic capacity limitation is the major reason for failing to achieve timeliness and predictability. PSNP is not expected to build logistic capacities. Therefore, alternative mechanisms of resource transfer must be considered. In the case of cash transfers, the use of MFIs and money transfers (Hawala) should be considered.
(4) Purchasing power of cash - It is unrealistic to expect regular and automatic adjustment of wage with inflation for two reasons. First, timely inflation data may not be available. Second, increasing wages will only fuel inflation. However, strengthening the capacity to switch between food and cash depending market/price situations should be considered. Government should also consider adjusting wages on a quarterly basis.

23

(5) <u>Graduation</u> – studies have indicated that confidence is the most critical constraint to graduation. Prospective graduates should receive assurance that better and flexible financial services will be available after graduation. In addition to the two stage graduation, *fast-track (shortest path)* graduation should be considered as the third pathway. This particularly applies to skilled community members who find lucrative *off-farm employments* and *labour migrants.*

(6) <u>Programme expansion</u> - the region has conducted rapid assessment to understand if chronic food insecurity is widening. However, a systematic poverty study (similar to the 2003 *Destitution Study*) should be undertaken to justify programme expansion.

(7) <u>Long-term social protection</u> - It is time the Regional Government engages in a wider long-term social protection debate. To this end, it should consider establishing a *Social Protection Fund* that could be used to design a strategy and put in place the necessary systems and structures to manage a social protection programme. Furthermore, there is a need for establishing a *Regional Social Protection Platform which will link up with the IGAD initiated National Social Protection Platform. This should contribute to advancing the social protection agenda.*

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Annex: Cost tables

Selected vulnerable groups in Amhara based on national average as percent of Amhara population which is 17830000 except direct support which is from PSNP.

Children	7.85
Disabled	1.78
Elderly	0.80
Direct support	0.25

Option 1: Based on current direct support beneficiaries of 250976

Birr/month	6 months (million Birr)	12 months (million Birr)
30	45	90
40	60	120
50	75	151

Option 2: Focus on elders. Poor only defined as below poverty line (30.5%) for Amhara. Birr transfers equivalent to Birr 40/month for 12 months.

Age group	Poor only (million Birr)	Universal (million Birr)
60+	83.5	273.9
70+	57.4	188.2848

Option 3: Focus on children. Transfers equivalent to Birr 40/month for 12 months.

	Poor only	Universal
0-5	441	1446
0-10	841	2756
0-15	1193	3911

WHEAT TECHNOLOGIES FROM WHERE TO WHERE? THE CASE OF EAST GOJJAM ZONE OF AMHARA REGION, ETHIOPIA

Akalu Teshome [1] and Ermias Abate [2]

Abstract

The purpose of this study was to investigate the rate, pattern and intensity of adoption of improved wheat technology as well as the impact of wheat technology on the livelihood of farmers. A formal survey was conducted in two districts of East Gojjam Zone of Amhara region. A two stage sampling procedures was used to select farmers for the study. Logistic curve and Tobit model were used to assess the rate and intensity of adoption wheat technology, respectively. The rate of adoption of improved wheat variety increased from less than 1% in 1994 to 100% in 2006. All the improved wheat package practices considered in this study were found to be practiced by all wheat growers, but there was variation among the grower households in the intensity of adoption). The results of the econometric model revealed that extension contact and hosting demonstration were found to have positive and significant influence on intensity of adoption of improved wheat production package. Contrary to this, number of oxen and participation in off-farm activities had shown negative and significant relationship with intensity of adoption of improved wheat production package. As the result of the adoption of wheat technologies, farmers' livelihoods have change.

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1.   Introduction

Agriculture is the mainstay of Ethiopian Economy. It forms the basis for the livelihood of about 85% of the population, accounts for over 50% of the country's GDP and contributes about 90% foreign exchange. The agricultural sector is the basis of domestic food production and the major sector involved in food security. Small-scale producers operating under rain fed conditions in low-input, low-output mixed farming systems and using traditional technologies dominate the sector. Small-scale farmers account for 95% of the total area under crop cultivation and more than 96% of total agricultural output. Although agriculture is the backbone of the economy, agricultural productivity and production are among the lowest in the world leading to poor economic growth and chronic food insecurity in some parts of the country. Cognizant of this fact and the potential of agriculture to operate as an engine of economic growth, the government of Ethiopia embarked on Agricultural Development Led Industrialization.

Ethiopia's sluggish agricultural production growth coupled with a rapid population growth, which failed to match with and to feed the rapidly increasing population. The low productivity of the agricultural sector coupled with the rapid population growth relative to food production have forced the nation to be an important recipient of food aid and importer of commercial food grain. A closer look at the performance of Ethiopian agriculture reveals that over the last three decades it has been unable to produce sufficient quantities to feed the country's rapidly growing population (Belay and Degnet, 2004). Moreover, with a rapidly growing population, it is vital that agricultural production as well as productivity should be increased at a commensurate rate. But, the opportunity to increase production through area expansion is very limited practically in the Ethiopian highlands (Yohannes et al. 1990). As a result yield could be increased through more intensive application of new technologies. Among the most widely emphasized technological factors that help in raising productivity substantially is the use of improved inputs and methods.

It is obvious that technology development and transfer is crucial to achieve food security, economic stability and poverty reduction. Successful agricultural technology development and transfer contribute to economic development by increasing production and productivity through providing new knowledge and skills. New agricultural technologies play a catalytically role in agricultural development through bringing a positive changes in the entire economy. In view of its potential and catalytically role, agricultural research has been conducted by different organization since the late 1940's in Ethiopia. Since then, a quite number of high yielder

agricultural technologies have been generated and transferred. Research on bread wheat is a typical example.

North-western Ethiopian (Gojjam and Gonder) is one of the major wheat growing regions in the country. Cognizant the fact that Adet research centre in collaboration with different stakeholders has generated and transferred different production package of wheat technologies in its mandate areas since 1994. However, so far, there is no empirical studies conducted in the area and hence there is no information about the level of adoption of the introduced improved varieties of wheat and their management practices. On the other hand, adoption of improved varieties and its management practices alone is not enough to achieve the required level of yield. Adoption and impact studies can also contribute to improving the efficiency of agricultural research, technology transfer, input provision, and agricultural policy formulation. With this background and rationale, wheat technology adoption and impact study was initiated in East Gojjam Zone of Amhara region. The objectives of the study were to investigate the rate and pattern of adoption of improved wheat technologies, assess the adoption and intensity of adoption of improved wheat production package, identify major factors influencing adoption and intensity of adoption of improved wheat production package in the area and evaluate the out come and impact of bread wheat technologies on the livelihood of farmers

1.1 Bread wheat production in Ethiopia, Amhara Region and East Gojjam Zone

Ethiopia has a total land area of about 111.5 million hectares (ha), of which 73.6 million (66%) are estimated to be potentially suitable for agricultural production. Of the total land area suitable for agriculture, 16.5 million hectares (22%) are estimated to be under cultivation, with about 14.6 million under annual crop production and the remainder under perennial crops. Of the total area under major food crops in 2004/2005, 73% was under cereals, 13% was under pulse, and 8% under oilseeds. Total area coverage and production under wheat production is about 1,398,215 hectare and 2,176,603 tons, respectively (CSA, 2005).

Wheat is one of the major cereal crops grown in Ethiopia. Ethiopia is the second largest producer of wheat in sub-Saharan Africa, following South Africa. In Ethiopia, wheat ranks fourth in total area coverage and production. It is also third in productivity (after maize and sorghum) among cereals. The estimated crop area and production of the Amhara region for 2004/2005 main season was 3,374,253 hectares and 3,762,347 tons, respectively (CSA 2005). In the Region, the largest share of arable land is under cereals.

Wheat is grown in the highlands at altitudes ranging from 1500 to 3000 masl, situated between 6-16°N and 35-42°E; however, the most suitable agro-ecological zones for wheat production fall between 1900 and 2700 masl. Major wheat production areas are found in Arsi, Bale, Shewa, Ilubabor, Western Hararghe, Sidamo, Tigray, North Gonder, and Gojjam region. Ethiopia was one of wheat exporter countries, however, since 1957, Ethiopia become a net grain importer (Hailu Gebremariam, 1991).

Wheat is also one of the most important cereal crops in Amhara National Regional State (ANRS). The region holds 28.2% (392,722 ha.) and 26.1% (569,397.2 ton) total area coverage and production of the nation, respectively. From the total area covered by crops and production of the region in 2004/2005, wheat covers about 392,722 hectare (11.64%) and 569,397.2 tons (15.13%), respectively. Particularly, West Amhara (Gonder and Gojjam) holds the largest lion's shares (Table 1).

Table 1: Area, production and productivity of bread wheat at National, Regional and Zonal level

	Area (ha)	Production (ton)	Productivity (ton/ha)
National	1,389,215.00	2,176,603.0	1.56
Amhara Region	392,722.00	569,397.2	1.45
E. Gojjam	80,011.00	131,545.9	1.64

Source: CSA (2004/2005)

2. Methodology

2.1 The study areas, sampling procedure and data collection

The study was conducted in two major districts (Debre-Elias and Baso-Liben) of East Gojjam Zone, Amhara region. The Zone and the districts were selected on the basis of their suitability for bread wheat production as well as the districts were the scaling up pilot areas for bread wheat technologies link with market. A two stage sampling procedures was used to select farmers for the study. Four *kebeles* from each *woredas* were selected using a random sampling procedure. Following the selection of *kebeles*, 72 farmers were randomly selected from each *kebeles*. Totally, 144 farmers were interviewed.

Data were collected from primary and secondary sources. Secondary sources include published and unpublished information about bread wheat production, agricultural production, farming system and other socio-economics information. This information was collected from the Zonal and district level Office of Agriculture and Rural Development. Primary data were collected from sample farmers using a structural

questionnaire. Moreover, group discussions were undertaken with opinion leaders of the respective districts.

2.2   Analytical techniques

Adoption is a decision to make full use of an innovation at best appropriate course of action available (Rogers, 1983). Adoption index measures the extent of adoption of a technology at the time of the survey. Accordingly, adoption index which shows to what extent the respondent farmer has adopted the whole set of package is calculated using the following formula.

In order to know the intensity of adoption of improved wheat production package, adoption index of individual farmer was calculated as follows.

$$AI_i = \sum_{i=1}^{n} \frac{\left[\dfrac{AHi}{ATi} + \dfrac{SRAi}{SRR} + \dfrac{FAi}{FR} + \dfrac{CAi}{CR} \right]}{TWP}$$

Where: i=1, 2, 3… n, and n= total number of respondent farmers

AI_i= Adoption index of the ith farmer

TWP = Total weight of practices

AH_i= area under improved variety of wheat of the ith farmer

AT_i= Total wheat production area (improved variety + local, if any) of the ith farmer

SRA_i= Seeding rate applied per unit of area in the production of improved wheat of ith farmer,

SRR= Seeding rate recommended for application per unit of area,

FA_i= Amount of fertilizer applied per unit of area in the cultivation of improved variety of wheat by i^{th} farmer,

FR= Amount of fertilizer recommended for application per unit of area in the cultivation of improved variety of wheat,

CA_i= Amount of chemical applied/ number of weeding per unit of area in the cultivation of improved variety of wheat,

CR= Amount of chemical/number of weeding recommended for application per unit of area,

On the basis of adoption index respondent farmers were classified in to six categories, viz., non-adopter, very low, low, medium, high and very high adopter. Adoption index is thus a continuous dependent variable which is affected by different factors to be investigated.

2.3 The Tobit model

Tobit model is an extension of Probit model and it is one of the approaches dealing with the problem of censored data (Johnston and Dandiro, 1997). Some authors call such model limited dependent variable model, because of the restrictions put on the values taken by the regressand (Gujarati, 1995). Tobit model is superior over the other dichotomous regression models in that the later only attempts to explain the probability of adoption of agricultural technologies by the farm households rather than the intensity or extent of adoption. However, adoption of improved technology alone is not sufficient enough since improvement in production and productivity of farm households depends not only on adoption but also on the intensity of use of the technology. Strictly dichotomous variable often is not sufficient for examining intensity of adoption (Feder *et al*, 1985). In such cases, Tobit model, which has both discrete and continuous part, is appropriate because it handles both the probability and intensity of adoption at the same time.

2.4 Model specification

The econometric model applied for analyzing factors influencing adoption and intensity of adoption of improved wheat production package was the Tobit model shown in equation (1). This model was chosen because, it has an advantage over other adoption models (LPM, Logistic, and Probit) in that, it reveals both the probability of adoption and intensity of use of improved wheat production package. Following Maddala (1992), Amemiya (1985) and Johnston and Dandiro (1997), the Tobit model for the continuous variable adoption index, can be defined as:

$$AI_i^* = B_0 + B_iX_i + U_i$$
$$AI_i = AI_i^* \text{ if } B_0 + B_iX_i + U_i > 0 \tag{1}$$
$$= 0 \text{ if } B_0 + B_iX_i + U_i \leq 0$$

Where:

AI_i= is adoption index for i^{th} farmer

AI_i^*= is the latent variable and the solution to utility maximization problem of intensity of adoption subjected to a set of constraints per household and conditional on being above certain limit,

X_i= Vector of factors affecting adoption and intensity of adoption,

B_i= Vector of unknown parameters, and

U_i= is the error term which is normally distributed with mean 0 and variance σ^2.

The model parameters are estimated by maximizing the Tobit likelihood function of the following form (Maddala, 1992).

$$L = \prod_{AI_i^* > 0} \frac{1}{\sigma} f\left(\frac{AI_i - \beta_i X_i}{\sigma}\right) \prod_{AI_i^* \leq 0} F\left(\frac{-\beta_i X_i}{\sigma}\right) \qquad (2)$$

Where f and F are respectively, the density function and cumulative distribution function of $\prod_{AI_i \leq 0}$ AI_i^* means the product over those i for which $AI_i^* \leq 0$, and $\prod_{AI_i > 0}$ means the product over those i for which $AI_i^* > 0$.

An econometric software known as "STAT" was employed to run the Tobit model. It may not be sensible to interpret the coefficients of a Tobit in the same way as one interprets coefficients in an uncensored linear model (Johnston and Dinardo, 1997). Hence, one has to compute the derivatives of the estimated Tobit model to predict the effects of changes in the explanatory variables.

Before running the Tobit model all the hypothesized explanatory variables were checked for the existence of multi-collinearity problem.

2.5   Definition of variables and working hypotheses

After the analytical procedure and its requirement are known, it is important to identify the potential explanatory variables and define its measurements as well as the symbol to represent them. Accordingly, the major variables expected to have influence on the adoption status of household are explained below:

Dependent variable:-The dependent variable in this study is adoption index (AI) which indicates respondent farmers' adoption and intensity of adoption of improved wheat package. Adoption index is one of the techniques that are used in the case of adoption study of multiple practices (package) and measures adoption and intensity of adoption of improved wheat production package at the time of the survey. Adoption index in this case is a continuous dependent variable.

The independent variables that are hypothesized to affect the farmers' adoption and intensity of adoption of Wheat technologies are combined effects of various factors such as: household characteristics, socioeconomic characteristics and institutional characteristics in which farmers operate. Based on the review of adoption literature,

past research findings and the researcher's knowledge of the farming system of the study area, among the large number of factors which were expected to relate to farmers' adoption behavior, 11 potential explanatory variables were considered in this study and examined for their effect in farmers' adoption and intensity of adoption. These are presented as follows.

Age (Age):- It is hypothesized that older farmers are expected to be less active and hence rely more on local varieties. This variable, which is defined as the age of the household head, is expected to have a negative coefficient

Level of education (EDUCLEVL):- Level of education is assumed to increase a farmer's ability to obtain, process, and use information relevant to the adoption of improved wheat technologies. Education was therefore expected to increase the probability of adoption and adoption intensity of improved wheat technologies.

Farming experience (FARMEXP):- The previous experience of farmers can be expected to either enhance or diminish their level of confidence. It is anticipated that with more experience, farmers could become risk-averse regarding the adoption of specific wheat technologies. Thus, this variable could have either a positive or a negative effect on adoption and level of adoption of specific wheat technologies.

Access to Credit (CREDSTS):- Access to credit can relax farmers' financial constraints and, in some cases, is tied to a particular technology package. In this study, access to credit was expected to increase the probability of adopting and adoption intensity improved wheat technologies.

Extension Contact (EXTCONT):- Agricultural extension services provided by the bureau of Agriculture at all levels of ARNS represents the major source of information for farmers. Contact with extension agents (development agents) was hypothesized to increase a farmer's adoption and adoption intensity of improved wheat technologies.

Number of Oxen (TOTALOXEN):- The number of oxen owned by a farmer was hypothesized to be positively related to the adoption and intensity of adoption of improved wheat technologies. This is because number of oxen the proxy variable to wealth.

Attend field day (ATTFDAY):- Farmers who have attended field days on wheat technologies are expected to have a positive attitude to the improved wheat technologies. It was hypothesized that participation in the abovementioned activities could be expected to be an exposure variable and would be positively related to the adoption and intensity of adoption improved wheat technologies.

Demonstration (Demon):- Farmers who host demonstration of improved wheat technologies are expected to have a positive attitude to improved wheat technologies. It was hypothesized that hosting demonstration activities would be positively related to the adoption and adoption intensity of improved wheat technologies.

Farm size (FARMSZ):- Land shortage caused by population pressure is acute in the study areas. Increasing the production and productivity of wheat depends on increased cropping intensity by using seed of improved wheat technologies. Therefore, farm size was hypothesized to be inversely related to the adoption and adoption intensity of improved wheat technologies.

Distance to the main road (DISTROAD):- Distance to main road was hypothesized to be negatively related to the of adoption and adoption intensity of improved wheat technologies, since households near the main road tend to have access to information and technologies.

Off-farm activities (Offfarm):- Involvement in off-farm was hypothesized to be negatively related to the adoption and adoption intensity of improved wheat technologies, since households who involve in off-farm activates may not give attention to agricultural practices.

3. Results and discussion

Wheat production package practices considered in this study includes the variety, seeding rates, fertilizer rate, and herbicides/weeding frequency. These package practices are the most common ones recommended by the research system and being promoted by extension in improved wheat production. After all, better production and productivity of wheat farming depends on adoption and level of adoption of these practices, but usually less emphasized in adoption studies.

In order to describe the nature and intensity of adoption of improved wheat production package, adoption index of package practices was calculated (for details look at methodology part). Due to absence of variation in use of some of the practices among sample households only four practices of the package namely, use of variety, seeding rate, fertilizer rate and herbicide amount/ weeding frequency were used for calculating package adoption index.

3.1.   Adoption and intensity of adoption of improved wheat production package

Agricultural innovations are usually recommended in a set or package form for use to farmers. However, for several reasons farmers usually adopt only certain components of the package. Moreover, in most cases there is variation in intensity or level of use of a given technology or practice. Diversity among farmers in their level of package adoption could be related to many factors: economic, social, personal or institutional. Understanding why farmers adopt one component of the package while rejecting the other as well as the underlying reasons for their variation is of a paramount importance

Improved wheat production involves use of different package practices. These include use of improved variety, seeding rate, fertilizer rate and herbicides/hand weeding. After all significant improvement in production and productivity depends on the extent to which a household has applied the recommended package practices. Level of adoption of improved wheat production package by farmers may vary depending on socio-economic situation of the household as well as institutional environment in which the household operates.

Adoption index score was calculated by adding the adoption quotient of each practice to know the level of adoption of each sample farm households. The adoption quotient of each practice was also calculated by taking the ratio of actual rate applied to the recommended rate, which indicates the extent to which an individual farmer has adopted the package practices.

Because of the uniformity in adoption of some practices among the households, only those showing variation were included into the adoption index. These include adoption of a variety, seeding rate, fertilizer rate and herbicides application rate. The final adoption index scores of sample wheat grower households were categorized into five adopter groups namely very low adopter, low adopter, medium, high adopter and very high adopter. The non-adopter group was given a score of 0. This makes up 6 distinct categories across which adoption and intensity of improved wheat production package adoption is assessed. The actual adoption index score ranges from 0 to 1. Adoption index score of 0 point implies non-adoption of the overall improved wheat production package. There is significant difference (F=236.994.045, P=.000) among the adoption index score of the six adoption categories at 5% significance level which indicates variation in level of adoption among sample farmers (Table 2).

Table 2: Distribution of respondents by level of adoption of improved wheat production package

Adoption category	N	Percent	Adoption Index score	Mean	SD	F	P-value
Non Adopter	0	0	0	0	0		
Very low Adopter	0	0	0.1-0.24	0	0		
Low Adopter	0	0	0.25-0.49	0	0		
Medium Adopter	57	43.5	0.5-0.74	0.68	0.04		
High Adopter	48	36.6	0.75-0.84	0.79	0.03		
Very high Adopter	26	19.8	0.85-1.0	0.88	0.05	236.99	0.001

Source: Own survey data, 2006; *. The mean difference is significant at the .05 level.

3.1.1 Adoption rate of improved wheat varieties

Improvement in production and productivity of a given crop depends among other things on presence and use of better and improved varieties. In line with this objective, a lot of efforts have been made by the research system to generate improved varieties of wheat and as a result many varieties have been released. Among the released wheat varieties Dereselegn, K 6290 bulk, K 6295, ET-13 A2, Pavon 76, Dashen, Mitike(HAR 1709), Kubsa(HAR-1685),Galema(HAR-604), Abola(HAR-1522), Tusa(HAR-1407), Tura(HAR-1775), Katar(HAR-1899), Shina(1668), Simba(HAR-2536), Guna(HAR-2029) and Densa(HAR-2562) have been introduced in the farming community through different agents, particularly Bureau of Agriculture and rural Development (BOARD), research, and NGOs.

Regardless of such different type of improved varieties introduced, however, only Kubsa (HAR-1685) is adopted by farmers. All the respondent farmers have grown Kubsa (HAR-1685) improved wheat varieties. The reason is that HAR-1685 is high yielder; fetch good market price and good flour yield. This implies that understanding farmers' technology preference criteria is an important issue in technology generation and dissemination process.

The common procedure for assessing the rate of adoption is the use of a logistic curve, which captures the historical trend of adoption over a given time and can be used to assess the effectiveness of agricultural institutions that have served the farming system over time. The logistic curve was constructed using data on the proportion of farmers adopting improved wheat varieties over a given period. The basic assumption in constructing each logistic curve is that adoption increases slowly at first and then increases rapidly to approach a maximum level.

Mathematically, the logistic curve can be expressed by the following formula:

$$Y_t = K/(1 + e^{-a-bt})$$

Where:

Y_t = the cumulative percentage of adopters by time t;

K = the upper bound of adoption (percentage);

b = a constant related to the rate of adoption; and

a = a constant term related to the time when adoption begins.

The rate of adoption of improved wheat variety increased from less than 1 % in 1994 to 100% in 2006 (Figure 1). The adoption rate had increased dramatically since rigors extension had been undertaken by Bureau of agriculture and rural development and it was followed by scaling up of wheat technology link with market.

Figure 1: The Rate of adoption of wheat variety (HAR-1685)
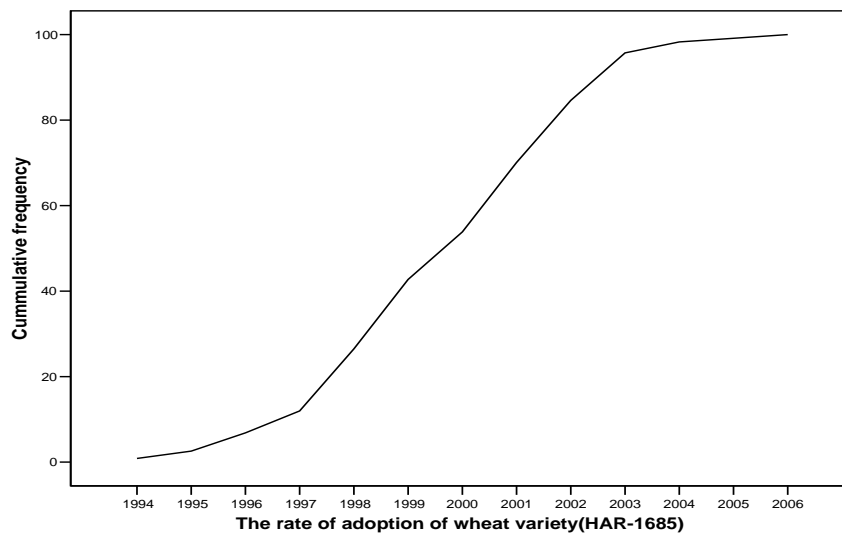
3.1.2 Adoption of fertilizer rate

The recommended rate of fertilizer by research system is 100 DAP and 150 UREA. But the extension system is used blanket recommendation of 100 DAP & 100 UREA. Most farmers have used above the recommended rate of fertilizer especially DAP. They have used high amount of DAP to increase production and productivity without considering the optimum level. The average amount of DAP used by sample

household is 192.68 kg/ha. It is more than 92 kg above the recommendation rate. On the other hand, the average amount of UREA used by interviewed farmers are 108.55 kg/ha. It is less than research recommendation rate but it is a little bit more than extension system recommendation. There is significant difference (F=7.575 P=.001) among the three adoption categories in the amount of DAP utilization at 5% significance level which indicates variation in level of DAP utilization among the different categories of adopter (Table 3). But there is no significant difference in the amount of UREA utilization among different group of adopters (Table 4).

Table 3: Level of DAP utilization among different categories of Adopters

Adopter category	N	Mean	SD	F	P-value
Medium Adopter	57	233.33	142.62		
High Adopter	48	187.58	116.35		
Very high Adopter	26	122.12	69.75	7.575	0.001

Table 4: Level of UREA utilization among different categories of Adopters

Adopter category	N	Mean	SD	F	P-value
Medium Adopter	57	106.58	82.447		
High Adopter	48	110.94	51.288		
Very high Adopter	26	106.73	35.74	0.068	0.935

3.1.3 Adoption of seed rate

The recommended seed rate for improved wheat varieties is from 150-175kg/ha. But in the study area farmers are used more than the recommend seed rate. The average amount of seed rate used by sample household is 264.56 kg/ha. It is more than 100 kg above the recommendation rate. There is significant difference (F=6.593 P=.02) among the three adoption categories in the amount of seed rate at 5% significance level which indicates variation in the amount of seed rate among the different categories of adopter (Table 5).

Table 5: Level of seed rate among different categories of Adopters

Adopter category	N	Mean	SD	F	P-value
Medium Adopter	57	287.65	92.84		
High Adopter	48	249.40	87.54		
Very high Adopter	26	217.31	60.76	6.59	0.02

3.1.4 Adoption of herbicides/weeding

The recommended herbicide of improved wheat technology is 1lit of 2.4 D/ha   or two hand weeding. Around 76.9% of the respondents are used the recommended rate of herbicides or two times of hand weeding and 23.1 % of the respondents are used one times hand weeding.

3.2   Summary of result of descriptive analysis

Before passing to the econometric part of the analysis it is probably important to summarize the results of the descriptive statistics. In general about 11 explanatory variables were considered out of which 4 of them had shown significant association with the intensity of adoption of improved wheat production. Number of oxen is the only continuous variables which significantly differ among adopter categories. Similarly, off-farm activities, extension contact and hosting demonstration have systematic association with different adopter categories. But other variables have no significant difference/ association with different categories of adopters. Summary of the overall findings is presented in the tables below (Table 6 and 7).

Table 6: Summary of results of continuous explanatory variables

Variable	Mean of adopter category			F- value
	Medium	**High**	**Very High**	
Age of HH	39.91	41.06	40.92	0.225 NS
Family Size	6.79	6.68	6.92	0.141 NS
Active labor force	4	3.5	3.3	1.961 NS
Total land holding	2.3	2.1	1.9	1.58 NS
Number of oxen	3	2.88	2.04	6.4***
Distance to main road	7.3	5.7	3.9	2.29NS

a.   *, ** significant at 1 and 5% level of significance respectively. NS= Not significant

Table 7: Summary of results of dummy explanatory variables

Variables	Percentage proportion across adopter categories			χ^2- value
	Medium	**High**	**Very high**	
Education status - Illiterate	30	29	15	0.872NS
- Literate	27	18	11	
Off-farm activities – Yes	5	4	8	10.93***
- No	51	43	15	
Access to credit – Yes	9	9	6	0.256
- No	34	26	19	
Extension contact – Low	13	35	21	37.61***
- High	44	12	5	
Host Demonstration –Yes	14	12	13	6.061**
- No	43	34	13	
Attending Field day - Yes	22	12	13	0.19NS
- No	34	35	13	

***, **,* significant at 1, 5 and 10 % respectively

3.3 Determinants the intensity of adoption of improved wheat production package

Estimates of the parameters of the variables expected to determine the intensity of adoption of improved wheat production package are displayed in Table 8. All the farmers are the adopter of wheat technology. But the intensity of adoption of wheat technology is differing from households to households. A total of 11 explanatory variables were considered to be included into the econometric model out of which four variables were found to significantly influence intensity of adoption of improved wheat production package. These include, number of oxen, off-farm activities, extension contact and hosting demonstration.

Contrary to the hypothesis**,** the result of the study has shown that number of oxen was negatively influenced intensity of adoption of improved wheat production at 1% significance level. The number of oxen is the proxy variable to wealth. This implies that wealthy households are less likely influence the intensity of adoption of wheat technology. It may be explained by the fact that wealthy farmers may be use high amount of inputs which is above the recommended rate. This is because they have no financial constraints to buy inputs.

As expected, contact with extension has positively and significantly influenced the intensity of the adoption of improved wheat production package at 1% significance level. This implies that extension contact is more likely influence the intensity of wheat

technology adoption. This is because farmers who have high contact with extension agents will get information about agricultural technologies and thereby extension contact has influenced in the intensity of adoption of improved technologies.

As hypothesized, hosting demonstration activities is positively and significantly influences the intensity of the adoption of wheat technology at 5% level of significant. This implies that farmers who hosting wheat demonstration are more likely influence the intensity of the adoption of wheat technology. This is because farmers have learnt the benefit of the technology when he/she is hosting demonstration.

As hypothesized, participating in off-farm activities is negatively and significantly influences the intensity of the adoption of improved wheat production package at 10% level of significant. This implies that the households who involve in off-farm activities are less likely influence the adoption intensity of wheat technology. This is because the households who involve in off-farm activates may not give attention to agricultural practices.

Table 8: Maximum likelihood estimates of Tobit model

Tobit estimates		Number of obs = 131
		LR chi2(11) = 74.45
		Prob > chi2 = 0.0000
Log likelihood = 140.48513		Pseudo R2 = -0.3605
Adopindex	**Coefficient**	**Standard Error**
Age	-.0000986	.0007386
Edulevle	-.0000712	.0100613
Familysize	.0031862	.0041899
Distroad	-.0010105	.0009696
Farmsize	-.0011306	.0071961
Oxen	-.0178028***	.0064472
Offarm	-0.053318 *	.0203364
Demon	.0253411**	.0148084
Fieldday	.0183595	.0142781
Extconta	.1187667***	.0168785
Credtacc	.0062303	.0165311
_cons	.5568870	.0472184
_se	.0624636	.0043046 (Ancillary parameter)
Obs. summary	128 uncensored observations	
	3 left-censored observations at adopindex<=.591	
	1 right-censored observation at adopindex>=.98	

***, **,* significant at 1, 5 and 10 % respectively

3.4   Impact of bread wheat on livelihood of farmers

3.4.1   Bread wheat production become a profitable enterprise

The cost benefit analysis is mainly done using the average prices of inputs and outputs. The analysis was done only according to the yield and input data using both prices in the period after harvesting. The costs and benefit analyses of bread wheat are presented in Table 9. The benefit from bread wheat was calculated by multiplying yield and price. In addition, the benefits from crop residues were not considered in this analysis because straw has no market value in the local market.

The type of cost components were material, labor and animal power. Farmers were using mainly their own seed by recycling improved seed and/or rarely buying improved seed. So the price of the seed was the average purchasing price between farmers. Fertilizer and herbicide were used by the interviewed farmers hence are included in the cost-benefit analysis. Labor costs were considered mainly for the preparation of land, planting, weeding, harvesting and threshing activities. The cost of oxen for land preparation and threshing was also considered.

The average total production of bread wheat per hectare and average price included in the cost benefit analysis were 3.6 ton and 18.82$/100kg, respectively as estimated by farmers who participated in the study. The result of the analysis indicated that the total gross return from bread wheat production is 677.6 $ per hectare. On the other hand the average total labor, animal power and other costs per hectare is 302.35 $ as shown in Table 9. Hence, farmers gain the net private profit of 375.4 $ from the production of one hectare of bread wheat during harvesting time. The net return of bread wheat when compared with the net return of *teff* is greater than 385%. This clearly indicates the benefit of growing wheat as compared to *te*ff, which is the second major crop in the study area.

Table 9: Cost benefit analysis of major crops in the study areas

Variable	Bread wheat($/ha)	*Teff*($/ha)
Gross Revenue	677.6	294
Cost- Labor cost	78.8	85.2
-Animal cost	65.8	65.8
- Input cost	157.6	56.4
Total cost	302.35	207.4
Net profit	375.4	97.2

3.4.2 Changing in cropping pattern

As indicated in Table 9, bread wheat production is the most profitable enterprise in the farming system of Baso-Liben and Debre-Elias districts. Therefore, bread wheat has spread like bush fire on windy and dry condition.

Before five years in Baso-Liben and Debre-Elias *Woredas, teff* was a dominate crop in the farming systems (Baso-Liben and Debre-Elias *wereda* Agriculture and Rural Development Office, 2000). But nowadays, bread wheat has become a major crop in the farming systems. It holds the lion's share of total production and area coverage. In 2005/2006 (1997/8 Eth. Cal), bread wheat is the leading crop in area coverage followed by *teff* (Table 10).

Table 10: Land allocation for different crops in the study areas in 2005/2006 cropping season

Crop	Area in Hectare			
	Minimum	Maximum	Mean	SD
Wheat (n=140)	0.13	3.00	1.07	0.61
Teff (n=138)	0.13	1.75	0.70	0.33
Maize (n=110)	0.13	1.00	0.37	0.15
Faba Bean (n=85)	0.06	0.75	0.24	0.11
Linseed (n=78)	0.01	1.00	0.37	0.18
Barely (n=65)	0.06	1.00	0.26	0.16
Noug (n=49)	0.13	0.75	0.35	0.19
Field pea (n=31)	0.13	0.75	0.32	0.14
Potato (n=19)	0.06	0.25	0.18	0.08
Check pea (n=4)	0.13	0.75	0.29	0.15

The trend of area allocated for bread wheat in the study areas have sharply increased in the last four years on the expense of other crops. Area allocated for bread wheat in 2005/2006 cropping season was grater than 2002/2003 cropping season by 143% (Table 11). Surprisingly, some farmers have started to specialize in bread wheat production.

Table 11: Trend of bread wheat expansion in the last four years in study areas

Year	Minimum	Maximum	Mean	SD
2002/2003	0.13	2.00	0.75	0.36
2003/2004	0.13	3.00	0.82	0.46
2004/2005	0.13	3.25	0.93	0.55
2005/2006	0.13	3.00	1.07	0.59

3.4.3   Increasing production and productivity

According to farmers and extension personnel, bread wheat technologies were not known in the study areas before 1986. During the previous government, especially after the establishment of producer cooperatives improved bread wheat varieties were introduced in the study areas. During the participatory demonstration and training extension program, improved bread wheat varieties were also introduced. But the total production was very scanty. After the scaling up of bread wheat in Baso-Liben and Debre-Elias districts, the total production and area coverage of bread wheat has sharply increased (Table 12 and 13).

Table 12: Bread wheat area coverage and total production in Baso-Liben district

Year	Area (Ha.)	Production (ton)	Productivity (ton/Ha)
2003/2004	6,229	16,264.0	2.61
2004/2005	6,339	17,308.6	2.70
2005/2006	8,384	33,186.0	3.95

Source: Zonal Agricultural and Rural development Department

Table 13: Bread wheat area coverage and total production Debre-Elias district

Year	Area (Ha.)	Production (ton)	Productivity (ton/Ha)
2003/2004	7,003	15,414.0	2.20
2004/2005	8,106	25,176.7	3.10
2005/2006	9,400	37,181.1	3.95

Source: Zonal Agricultural and Rural development Department

The productivity of bread wheat in the study areas was 1.48 ton/ha before four years. But after the introduction of bread wheat through scaling up activities, the average yield become 3.6 ton/ha. This indicates that the productivity of bread wheat is increased more than twofold (Table 14).

Table 14: Bread wheat productivity before and after intervention (n=144)

	Before Intervention (Yield in ton)	After Intervention (Yield in ton)
Minimum	0.8	2.40
Maximum	2.0	5.20
Mean	1.48	3.60
St.Dev	0.413	0.88

3.4.3   Increasing income

After the introduction of bread wheat in Baso-Liben and Debre-Elias areas, the gross annual incomes of farmers have increased more than twofold. The average annual income of farmers before producing bread wheat was 447.17 $. But after the

intervention of improved bread wheat production, the annual income becomes 1,988.82 $ (Table 15). This annual income is the aggregated income from different enterprise. But the bread wheat holds the lion's share and it is the main cash source of farmers in study areas.

Table 15: Goss income of farmers before and after producing of bread wheat

	Income before intervention ($)	Income after intervention ($)
Minimum	160.51	469.40
Maximum	964.31	1988.82
Mean	447.17	1235.64
St. Dev	248.10	490.35

During the group discussions and interview with farmers they revelled that due to increase of their income, as the result of bread wheat technologies, the following socio-economic and livelihood changes are observed in the study areas.

❖ Farmers have started to buy input directly in cash rather than credit. Previously, almost all farmers got input (fertilizer and improved seed) on credit basis from cooperatives. But currently the scenarios have changed.
❖ Farmers have paid their debt on time. It was very difficult to them to pay their debit before four years ago. Some of them even sold their oxen to pay their debt. This is because what they produced was not possible to cover the input cost.
❖ Almost all farmers have corrugated iron roof. Surprisingly, some have started to construct to their livestock as well.
❖ Farmers have started to construct house in town to rent it out.
❖ Increasing the number of students who enrolled in school (Farmers have sent their children to school).
❖ Farmers have bought mule for transportation purpose.
❖ Farmers have started to save money in Bank/Amhara credit and saving Institute.
❖ About 82% of the sample farmers from Debre-Elias *woreda* have radio. Similarly, around 53% from Baso-Liben Woreda have, too.
❖ Increased availability of marketable output. Previously, farmers had no enough output for market. Currently, the scenarios have changed and trucks are collected wheat grain from farmers' village.
❖ Farmers have started to buy some household items such as bed, mattress, etc.
❖ Farmers have bought additional oxen. Currently the average number of oxen farmers has in Debre-Elias Woreda is 3.13 and in Baso-Liben Woreda is 2.39.
❖ Numbers of farmers who have used herbicides have increased (due to labor shortage at critical weeding period). About 78% of the interviewed farmers used herbicides for bread wheat. Before four years hand weeding was a common practice. This is as the result of increasing income of the household. Moreover,

farmers have bought sprayer for bread wheat and they rent it out for others farmers as well.

❖ Farmers have bought car (Isuzu) and grinding mill by polling their resources.

❖ Food consumption pattern of farmers has showed some changes in the last three years. They were selling almost all egg, milk and milk products and live animals for cash source but now they have started to use some for home consumption.

❖ Farmers have started to give attention for health care. Previously, due to lack of money, they did not go to health center even if they were seriously sick.

❖ Bread wheat technologies in Baso-Liben and Debre-Elias woredas have created job opportunity for landless and poor farmers. They used to migrate to other places to search for job i.e. Wollega, Metema and etc. But nowadays they are hired by wheat produces from ploughing to threshing time within the Wereda. During peak time they have got 10-15 birr/day/person.

❖ Before introduction of bread wheat technology, food shortage was a common phenomenon in the study areas. Food shortage usually occurs from June to October depending on the season and the locality. Critical food shortage usually occurs from July to August. Currently, food has been available throughout the years. As the result of bread wheat technologies, food security has attained in the study areas.

4.   Major factors for the success of adoption of bread wheat technologies

a.   Link production with market

It is obvious that market enhances the livelihood of farmers. The main factor for the widely dissemination of bread wheat technologies in Baso-Liben and Debre-Elias districts is the establishment of link between production and market. Due to the presence of contractual agreement among farmers, cooperatives and agro-industries, farmers have produced to benefit from assured market. The presence of attractive and reliable price for output has also contributed for widely dissemination of bread wheat technologies.

b.   Linkage among different stakeholders

The presence of strong linkage among different stakeholders in technology development and scaling up process contributed for wide dissemination of bread technologies in Baso-Liben and Debre-Elias Districts. Participation of end users especially farmers in technology development process led to the generation of fine tune technologies which fit with agro-ecologies as well as with farmers' socio-economic conditions.

c.   Policy support

The existence of favorable policy environment for agricultural sector has contributed for success of bread wheat technologies in Baso-Liben and Debre-Elias Districts. Particularly, the presence of credit service for agricultural inputs (fertilizer and improved seed) has played a significant role for bread wheat production and dissemination in the study areas. Access to credit could relax farmers' financial constraints. To foster the adoption process of bread wheat technologies, the regional government had made available $1.17 million on credit basis during the fist year of the scaling up program.

d.   The presence of leading institute

Amhara Region Agricultural Research Institute (ARARI) attributed a lot for the successful adoption of bread wheat technologies in Baso-Liben and Debre-Elias Districts. The institute took the initiation and led to link producers with agro-industries. Moreover, ARARI has built effective and efficient coordination and collaboration among the stakeholders so as to ensure smooth flow of information and knowledge about bread wheat technologies among the stakeholders. This implies that to foster adoption and dissemination of new technologies in the farming system, there should be commitment and integration among concerned stakeholders in the agricultural knowledge and information system.

e.   Resource endowment

Availability of resources (human, financial and physical) were contributed a lot for the successful dissemination and adoption of bread wheat technologies. A lot of resources were utilized from different stakeholders to scaling up bread wheat technologies. In order to make linkages effective and efficient, there must be resources in adequate quantity.

5.   Major problems of wheat production in the study areas

During the group discussions and interview with farmers, they identified the major bottlenecks of wheat production. Some of them are listed below:
- Mono-cropping: due to market demand, farmers have grown wheat more than three years without any rotation. This may have a negative implication for the sustainable production of bread wheat in the areas.
- High-input utilization: most farmers have used above the recommended rate of fertilizer and seed. They use high amount of DAP and seed to increase production and productivity without considering the optimum level.

- Recycling of seed: due to unavailability of improved seed, farmers use their improved seeds more than five years by recycling it. It may reduce the potential as well as increase mixture of seeds which further deteriorated the quality.
- Pests: there are many economically important insects and diseases which affect the production of bread wheat in study areas. These are: rust (steam and yellow), Seporia and Wollobush cricket (*Decticoides brevipennis*).
- Unavailability of farm implements: there are no improved farm implements in the study areas. Farmers used traditional methods such as manual harvesting and oxen threshing.

6. Conclusion and recommendation

The adoption rate of wheat technologies in the study areas is very high. All the farmers are adopted wheat technologies with different level of intensity. Adoption of wheat technologies has brought socio-economics impacts on the livelihood of farmers.

One way ANOVA and chi-square test shows that number of oxen, extension contact, hosting demonstration and off- farm activities variables were significantly related to the intensity of adoption of improved wheat production package. There is a significant difference among adopter categories in fertilizer use amount, seed rate and number of weeding/herbicides use. On the other hand, results of the econometric model indicated the relative influence the different variables on intensity of adoption of improved wheat production package. A total of ten (10) explanatory variables were included into the model of which four (4) of them had shown significant relationship with the intensity of adoption of improved wheat production package. Accordingly, extension contact and hosting demonstration were found to have positive and significant influence on intensity of adoption of improved wheat production package. Contrary to this, number of oxen and participation in off-farm activities had shown negative and significant relationship with intensity of adoption of improved wheat production package.

In order to make bread wheat production sustainable in the farming system, the research system should generate high yielding bread wheat varieties, develop an Integrated Pest Management (IPM) as well as study an optimum level of fertilizer and seed rate for wheat technologies. Moreover it is of paramount importance to introduce other economic crops in the areas.

To sum up, the adoption intensity of improved wheat technology is highly influenced by institutional factors rather than socio-economics factors. The implication of this finding is that in order to facilitate the adoption and diffusion of improved wheat technologies in wheat based farming system it is necessary to link production with market.

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TENURE SECURITY AND SOIL CONSERVATION INVESTMENT DECISIONS: EMPIRICAL EVIDENCE FROM EAST GOJAM, ETHIOPIA

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Abstract

The purpose of this study is to investigate the mutual relation between tenure security and soil conservation investment and to examine the influence of other socio-economic and institutional factors on soil conservation investment and tenure insecurity. A formal survey is conducted in two districts of East Gojjam Zone of Amhara region. The Zone and the districts are selected because of their long time experience with soil conservation development activities and land re-distribution. A two-stage random sampling procedure is used to obtain sample households. Because the structural model represents a simultaneous binary choice system, the investment and insecurity equations are estimated using a two-stage probit method. The results show that tenure insecurity is an important variable that affects the probability of investing in soil conservation technologies. However, the reverse relation is insignificant. Farmers' soil conservation investment decisions are positively and significantly related to slope, age, education level and public investment, whereas, tenure insecurity and distance from the main road have a negative significant influences on soil conservation investments. The analysis of tenure insecurity reveals that expectation of redistribution and farm size has a negative influence on tenure security, whereas education level has a reverse effect.

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1.   Introduction

Land degradation is one of the major environmental problems in developing countries. Soil erosion by water is the principal cause of land degradation, and a major constraint to agricultural development in developing countries (de Graaff, 1996). Globally, the problem of soil erosion is widely recognized and millions of dollars are spent every year on soil conservation projects. But in spite of money being spent and great effort being made, the problem is gradually getting worse. An important factor in land degradation and farmers' investment in soil conservation in developing countries is the change in the socio-economic environment of farm households resulting from policy reform measures taken at higher levels (Heerink et al, 2001).

As population increases and land becomes scarce, land demand by the growing number of land claimants may be met by non-market mechanisms such as state land redistribution, informal land contracts and customary inheritance. The persistence of such mechanisms and absence of an established legal rights land system has resulted in increasing tenure insecurity and continued land fragmentation (Amare, 1998). The absence of tenure security is highly linked to poor land use which in turn leads to environmental degradation (Otsuka and Place, 2001).

Ethiopia is one of countries that is heavily dependent on peasant agriculture and is affected by extensive degradation of agricultural land. Coupled with the poor performance of the agricultural sector, high population growth, land scarcity, technological stagnation, misguided policies and deficient institutional structure hinder sustainable utilization of agricultural land (Shiferaw, 1998).

Reducing resource degradation, increasing agricultural productivity, combating poverty, and achieving food security are major challenges of the nation. The poor agricultural practice and the country's intrinsic fragile biophysical conditions have resulted in large areas becoming severely degraded. Land degradation is most severe in highlands (over 1500 m altitude), which account for more than 43% of the country, 95% of the cultivated area, 75% of the livestock and host about 88% of the population. Hurni (1988) estimates that the annual rate of soil loss on crop land is on average 42 t/ha per year. If soil erosion continues with this rate, by the year 2010 some 60000 km^2 of agricultural land will have disappeared.

The Amhara National Regional State (ANRS) is one of the nine regional states of Ethiopia. Agriculture is the mainstay of the region, employing about 90% of the rural population and contributing about 31% of annual of the country grain production; and

constituting about 35% of the nation's livestock population (FAP, 1999). The Region is endowed with huge potential of land and water for agriculture, but these are now under the threat of land degradation due to soil erosion. A recent study by Gete (2003) revealed that Western Amhara (Gojjam) which was once known as bread basket of Ethiopia is now at severe risk due to soil degradation.

The cause of soil erosion in ANRS is a combination of natural factors such as topography, erratic and erosive rainfall patterns and human actions including destruction of vegetation cover through deforestation, overgrazing, and inappropriate agricultural practices that are not in harmony with the environmental conditions. In this regard, dense population, primitive farming practices combined with intensive rains and rugged topography intensified land degradation (Betru, 2003).

To alleviate this problem, a massive conventional soil conservation program has been launched since 1975 (Shiferaw and Holden, 1998). In spite of the effort in introduction, the adoption rate has been minimal (Shiferaw and Holden, 1998 and 1999).

According to de Graaff (1993) investment in soil and water conservation practices are influenced and constrained by socio-economical and institutional factors. Soil conservation investment may be undertaken when sufficient returns are expected for a considerable period of time in comparison with the situation when such investments are not made. This is possible with a secure land tenure system.

Since the beginning of the twentieth century, Ethiopia has implemented different types of interventions in the area of land tenure. Currently, land is the state property and redistribution is the sole mechanism through which land transfer to accommodate new demands. The majority of the smallholders in Ethiopia (76%) are not sure whether their current land will belong to them in five years time (Ethiopia Economic Association, 2002 cited in Dessalegn, 2004). Benin and Pender (2001) in their study of the incidence of land redistribution in the Amhara region of Ethiopia revealed that every community has experienced at least one redistribution since 1974, and nearly half had a land redistribution since 1991, mainly in the recent redistribution since 1997. And also about four-fifths of the communities expect redistribution in the future. The stronghold of the state over rural land and subsequent action of land allocation through redistribution has given rise to tenure insecurity by rural farmers (Dessalegn, 2004).

Lack of secure rights on land decreases farmers' incentives to invest in land improvement (Besley, 1995; Otsuka and Place, 2001). Moreover soil conservation investment is constrained and influenced by credit facilities, extension service,

53

infrastructure availability, household endowment and household and farm characteristics. This implies that there are a lot of institutional and socio-economical factors that might hinder farmers to invest their own conservation measures.

In view of this, it is important to investigate the factors influencing subsistence farmers' soil conservation decisions in the context of north-western Ethiopia. The main objectives of the study are to investigate the mutual relation between tenure security and individual soil conservation investment and to examine the influence of other socio-economic and institutional factors on individual soil conservation investment and tenure insecurity

2.   Theoretical framework

2.1   Property rights, uncertainty and investment behavior

Land property rights rank among the most important society's institutions. Rights to land are a bundle of rights which comprise property rights, use rights, transfer rights and disposal rights. These rights are fundamental to economic analysis (Cole and Grossman, 2002). Property rights to land are a crucial factor in shaping productivity, efficiency and distribution in agrarian societies (Heltberg, 2002). They are also the main incentives to increase agricultural production and farm investments (Ruben et al., 2001; Meinzen et al., 2002).

Rights to land and their enforcement may shape the security of tenure and hence the incentives to undertake investment in land. Secure, individual and transferable land titles (rights) are usually regarded as highly important for rural development because they induce immobile land related investment (Deininger and Feder, 1998). Uncertainty in property rights often leads to insecurity and reduced investment in land. This is because farmers make investments by comparing risk alternatives. The degree of risk for a certain event depends on the manner in which the farm household interprets and view the events itself with regard to future expectations. Ellis (1988) argues that, in most decision-making situations, what is relevant is not the knowledge concerning the likelihood of an uncertain event, but rather the decision maker's personal expectation about the occurrence of events. We can therefore conclude that it is the personal view of the individual farm household about the likelihood of an event that influences their decisions rather than the knowledge about the probability of its occurrence. Therefore, the action or decision an individual takes as to an event depends on their perception of risk and uncertainty.

The degree of risk aversion of the farm household determines the willingness to invest in technologies, and the extent to which a technology is adopted. The

perception of risk is based on farm household's personal strengths of belief about the occurrence of uncertain events and their personal evaluation of potential consequences. This is reflected in the theory of expected utility maximization. During the subjective assessment of uncertain events, individual farm households maximize expected utility, given their beliefs about events and outcomes and technical, economical and institutional constraints.

Expected utility maximization theory plays a key role in explaining household's behaviour. In the process of making a decision farm households are influenced by their production constraints, which determine their willing to invest in various production activities including the desired production technologies. The hypothesis is that a rational farm household will always choose the production and consumption alternatives that maximize expected utility.

A property rights regime can affect the production function of a farm household indirectly by influencing the use of input or technology choice. Property rights provide incentives to use land efficiently and to invest in it. Tenure insecurity, in particular, can be a cause for sub optimal allocation of resources (Dejene, 1999). On the other hand, however, the household can increase investment if the investment in turn increases security of tenure (Brassele et al., 2002).

The empirical findings on tenure security and investment based on the theory of property rights, uncertainty and investment behaviour are described below.

Most developing countries have weak land rights (Ferreira, 2004). Clearly defined rights are those that are exclusive to a specific holder, identifiable and legally verifiable. The existence of such rights and the legal provision to protect and enforce them constitutes a complete security over the holding of lands. On the other hand, tenure insecurity, in general term, can be defined as the holder perceived probability or likelihood of losing their use rights of land with out their permission (Hays et al., 1997 and Alemu, 1999).

It is widely claimed that tenure security enhances better use of land resources. The theoretical framework laid out by many economists explains the benefits of increasing tenure security in terms of increasing incentives for investment and reducing uncertainty in land transfer. On the other hand, lack of secure property rights on land decrease farmer incentives to invest in yield-increasing technologies and to make land its most productive use (Besley, 1995; Hayes et al., 1997; Heltberg, 2002). Moreover, unenforceable, ill-defined and insecure use right are linked with poor land

use which in turn leads to environmental degradation (Lapar and Pandey, 1999 and Otsuka and Place, 2001).

A secured holding raises the likelihood of realizing the reward of long-term investment, which inspires holders to demand more investments. Moreover, a secured holding lowers the cost of lending because land serves as collateral and reduces the supply price of credit. More capital and land improvements on land increase the productivity of variable inputs used and, consequently, output per unit of land is expected to be higher (Feder et al., 1988 and Dessalegn, 2004). Moreover, the greater security over a holding reduces uncertainties associated in land transfer which reduces transaction costs and leads to efficient allocation of land resource by equalizing factor proportion across farmers through trade. Secured holdings allocate land resources to those who can put it in to its best use, resulting in an output gain to the society.

A study in Thailand showed that titled land is characterized by higher investment demand and input intensity and as the result yield was higher on titled lands than on lands with out title (Feder and et al. 1988). Pender and Kerry (1997) found in their study on India that conservation investment is significantly lower on leased land in two of the studied villages and lower on plots that are subjected to sales restriction in one village. In Gambia, Hays et al. (1997) also found that with in a customary tenure system more individual rights are associated with higher propensity to make investment, which in turn had a positive effect on yield. The study by Gavian and Fafchamps (1996) in Nigeria also supports this positive relationship between tenure security and farm investment. They reported tenure insecurity stimulates farmers to divert scarce resources from less secure land to more secure land. More recently, Winters et al. (2004) in their study in adoption of conservation technologies in Ecuadorian Andes found that land ownership and the type of lands operated have a significant impact on participation in soil conservation activity. Likewise, Ostuka and et al. (2003) in their study on customary land tenure areas of Ghana found that there is a significant tendency for trees to be planted on parcels with more secure land rights. They concluded that the strength of ex- ante land rights would have a positive effect on tree planting.

Other studies, on the other hand, have challenged this view with their finding that tenure security has little or no effect on productivity and investment. Place and Hazale (1993) revealed that land rights were not significant related to yields in Ghana, Kenya and Rwanda. They also found no relation between total inputs use and land rights in Ghana, although there was a positive correlation between the incidence of some types of land improvement and land rights in Rwanda. They concluded that

lack of access to credit, insufficient human capital, and labour shortage adversely affected investment decision more than insecurity of tenure. Surprisingly, Brasselle et al. (2001) on their study in Burkina Faso found that land tenure security is influenced by investment.

Gebremedhin and Swinton (2001) investigated the factors that determine the adoption of natural resource conservation at household and community level in the Tigray region in northern Ethiopia. They found that land tenure security was a major factor that significantly influences the conservation technology adoption. Additionally, Alemu (1999) found that small farm holders invested more in land conservation than large farm holders did in a sample of household from central and northern Ethiopia. He concluded that lower investment on large farm holders was due to their higher level of tenure insecurity as they were more likely to lose land in future re-distribution.

Benin and Pender (2001) found that land redistribution in Amhara region of Ethiopia had a positive impact on productivity by increasing access to land for farmers; however, re-distribution and expectation of future land redistribution have a statically insignificant and usually small association with long-term land investment.

Additionally, Holden and Yohannes (2002) in their the study on the relationship between tenure insecurity and intensity of production in Southern Ethiopia found that tenure insecurity had no direct effect on whether household purchased farm input or planted perennials. They concluded that resource poverty in land, livestock and basic education, rather than tenure insecurity, may have undermined investment in perennials and purchase of farm inputs in the study areas. By contrast, in Arsi Zone of Ethiopia, Gavian and Ehui (1999) found that farmers on less secure lands applied more inputs than those holding more secure lands, although the less secure lands appeared to be farmed 10-16 % less efficiently than the more secure lands. Another study using the same data (Pender and Fafchamps (2001)) found no significant difference in input intensity on owned versus sharecropped fields after controlling for difference in village, household and plot characteristics.

The above empirical investigations regarding the relation between tenure security and investment have come up with mixed results and suggest different policy options to solve the problem. This is due to varying context of land rights, land availability, land re-distribution experience, investment type and characteristics, and technology interventions in these studies. Such differences in context make it difficult to conclude the pattern of relation between land right and investments in these studies. Moreover, the complex nature of the relationship between tenure security and investment poses methodological difficulties in identifying and handling the various two-way causality

and simultaneous relationship in the models used to analyze the interactions, leading to various result for the same issue observed.

In most of the above reviewed Ethiopia studies (Gebremedhin and Swinton 2003; Alemu 1999; Benin and Pender 2001; Holden and Yohannes 2002) the effect of tenure security on use of land improvements inputs or technology is limited to single equation Probit/logit or Tobit. They only considered tenure security or insecurity as an endogenous variable. The effect of investment on tenure security is usually not considered. In this study, we consider simultaneous relation between investment and insecurity.

2.2   Analytical model

Following the above description of the relationship between property rights, uncertainty and utility maximization, we use a one-period household model to assess the impact of tenure security on land related investments as the conceptual basis for our empirical investigation. There are two alternatives hypotheses related to tenure security and investment. The first one is that more secure land rights will have a positive impact on investment. In this case tenure security is exogenous. The other hypothesis is that investment is undertaken to enhance tenure security, in this case tenure security is endogenous.

In our situation, the farmer willingness to invest may be affected by the perception of risk. A farmer decides whether to invest in soil conservation technologies by considering risk of losing land, due to redistribution some time in the future. When the farmer feels secure about the tenure system he may decide to invest in soil conservation technologies and his production may increase as the result of the investments. Meanwhile he may lose his investment some time in future due to redistribution. If a farmer feels insecure about tenure he may decide not to invest in soil conservation technologies and his production may decrease due to soil erosion. But he will not lose any investment when redistribution is undertaken. The farmer decides whether to invest or not by considering the above scenarios.

Assuming that farmers maximize expected utility, the decision whether to invest ($I_i =1$) or not ($I_i = 0$) is based on a comparison of expected utilities of investing or not investing soil conservation technology. Using the difference in expected utilities gives the following decision rule:

$$I_i = \begin{cases} 1, if, E[U_I^I - U_I^O | z_i, \gamma_i] > 0 \\ 0, if, E[U_I^I - U_I^O | z_i, \gamma_i] < 0 \end{cases} \tag{1}$$

Where E denotes expectation of a farmer which is conditional on household and farm characteristics (z_i) and perception of risk (γ_i). U_I^I denotes utility of investing soil conservation and U_I^O is utility of not investing soil conservation. The utility level of investing or not investing depends up on the expectation of income with the presence or absence of soil conservation technologies.

Consider an individual farmer with utility function $U(\omega)$, where ω is income which depends on individual and farm characteristics (z_i) and variables affecting perception of risk (γ_i). Farmer's expected utility is assumed to be increasing in income $[\omega]$, as indicated in Equation (3)

$$\max E[U(\omega) | z_i, \gamma_i] \setminus \tag{2}$$

Subject to

$$\omega = \sum_{t=1} (Y_i A_i p_i - w_I I_i - C) \tag{3}$$

$$Y_i = Y(I_i, F_i, A_i, Z_{1i}) \tag{4}$$

$$I_i = I(T_i, Z_{2i}) \tag{5}$$

$$T_i = T(I_i, Z_{3i}) \tag{6}$$

This equation defines income $[\omega]$ as annual crop revenues minus the unit cost (w_i) of conservation investments (I_i) and other variable costs (C). Crop revenue is the product of crop price (p_i), yield (Y_i) per ha. and land area (A_i).

Yield, in turn, is concavely increasing with the presence of soil conservation investments $(Y'(I_i) > 0)$ and also depends on fertilize use (F_i), land area (A_i) and other factors (Z_{1i}) such as soil fertility, pest and weather condition.

Soil conservation investment (I_i) depends on tenure security $(I'(T_i) > 0)$. This implies that better land security leads to more land investment. Soil conservation

investment (I_i) also depends on other factors (Z_{2i}) such as slope of the plot, farm size, distance of the homestead from the main road, age of the household, extension contact, public investment, number of oxen, and education level.

On the other hand, tenure security is endogenous; security of tenure can be enhanced through investment $(T'(I_i) > 0)$. Tenure security also depends on other factors (Z_{3i}) such as farm size, expectation of re-distribution, age and education level of the household.

2.3 Hypotheses

Investment hypotheses

From the theoretical framework, several hypotheses can be derived that serve in empirical examination. Investments are measured in this study with the presence of soil conservation technologies on farmers' fields (fanya juu terrace[4], fanya juu with plantation and perennial) or not. The farmers are asked whether they invest or not individual soil conservation measures on their own plots. Investments undertaken by mass mobilization are not considered. Therefore, our dependent variable represents the presence of investment or not on farmer fields and it is a function of social, institutional, physical, and economical and attitudinal factor.

Development of the model is influenced by a number of working hypotheses. Based on the literature reviewed it is hypothesized that farmers decision to invest in conservation measures is influenced by combined effects of social, economical and institutional factors. A number of variables are expected to influence investment in soil conservation measure, as explained below.

Slope of the plot (Slope):- Slope is an indicator of the probability of erosion on the land (Lapar and Pandey, 1999). The steeper the slope, the more likely the land will erode. Hence, it is hypothesized that investment tends to be likely on steeper slope.

Tenure insecurity (T_i):- Tenure insecurity measures the perceived risk of loss of land at some time in the future. Investment is undertaken when the household is assured that he will reap the benefit for a considerable time. The household that feels insecure

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[4] A fanya juu terrace is made by digging a trench and throwing the soil uphill to form an embankment. In our case farmers plant a grass strip on the fanya juu.

will not invest in soil conservation measures. So it is hypothesized to negatively influence investment.

Farm size (Farms):- To invest soil conservation measure, the farm size is the crucial matter. Farmers having a large farm invest more than the others (Shiferaw and Holden, 1998). So it is hypothesized to positively associate with investment decision.

Distance to the main road (Disth):– Distance to the main road is hypothesized to be negatively related to the probability of investment of soil conservation measures, since households near to main road tend to have access to information and are more likely to be visited by extension agents (Lapar and Pandey, 1999).

Family size (Shh):- Larger families will be able to provide the labor that is required for soil conservation investment. So it is hypothesized to be positively related to soil conservation investment.

Level of Education (Edu):- Level of education is assumed to increase a farmer's ability to obtain, process, and use information relevant to the investment of soil conservation decision (Lapar and Pandey, 1999). Education is therefore expected to increase the probability of investment of soil conservation.

Number of oxen (Ox):- Number of oxen is hypothesized to be positively related to the probability of investment. This is because oxen are indicator of wealth and it is used in digging while soil bund is constructed.

Age of the household (Age):- The age of household is hypothesized to be negatively related to the probability of investment. This is because old farmers are more suspicious about new technologies than young (Shiferaw and Holden, 1998 and Bekele, 2003).

Extension contact (Extc):- Farmers who have frequent contact with extension agent are positively influenced to invest (Makokha et, al.1999). So it is hypothesized to be positively related to soil conservation investment.

Public investment (Pubcon):- Farmers who have public investment are expected to have positive attitude towards soil conservation. This is because they perceive the benefit of the measures. Here public investment is a soil conservation investment practice which is constructed on farmers' plots by mass mobilization of the community.

61

From equation 5 the model of investment is specified as follows:

Investment = ƒ(Slope, Tenure Insecurity, Farms, Disth, Shh, Edu, Ox, Age, Extc, Pubcon)   **(5a)**

Tenure Insecurity hypotheses

Tenure insecurity is measured as the perceived risk of loss of land some time in future. The farmers are asked about their expectation of handling their lands at different time interval (1year, 5years, 10 years and throughout their life time). The response will fall in one category: insecure land holding or secure land holding. Therefore, our dependent variable represents the feeling of tenure insecurity and it depends on a lot of factors. A number of variables are expected to influence tenure security, as explained below.

Farm size of the household (Farms):- During re-distribution, farm size was   one of the yardstick to lose land. In line of this, the household who has a large farm size fear the risk of losing his/her land. So it is hypothesized to be positively related to   tenure insecurity.

Investment (I_i):- Land tenure security is influenced by investment. Tenure security can be enhanced through investment. Land related investment is undertaken to enhance security of land holding (Brasselle et al., 2001).This implies that investment will be undertaken by insecure households in order to increase their security. So it is hypothesized to be positively related to tenure insecurity.

Expectation of re-distribution (Expredis):- The household may expect re-distribution due to the government land re-distribution policy. So it is hypothesized to be positively related to tenure insecurity.

Education level of the household (Edu):- Level of education is assumed to increase farmers' ability to obtain information about the tenure system. So it is hypothesized to positively relate to tenure insecurity.

Number of oxen (Ox):- Number of oxen is the proxy variable for wealth and power. Wealthy households may fear losing their land due to the past redistribution criteria. So number of oxen is hypothesized to be positively related to tenure insecurity.

From equation 6 the model of tenure insecurity is specified as follows:

Tenure insecurity = (Age, Edu, Farms , Ox, Expredis, Investment)   **(6a)**

3.   Methodology

3.1   Study areas, sampling procedure and data collection

The study is undertaken in two major districts (Gozamen and Awabel) of East Gojjam zone, Amhara region. The Zone and the Woredas are selected purposely because of their long-time experience of soil conservation development activities and their land re-distribution experiences. A two stage sampling procedures is used to select farmers for the study. Kebeles (Dijil Watershed and Gudalema Watershed) are selected using a random sampling procedure. Following the selection of Kebeles, 60 farmers are randomly selected from each Kebeles (Watersheds). Data are collected from primary and secondary sources. Secondary sources include published and unpublished information about soil conservation activities, agricultural production, farming system and other socio-economics information. This information is collected from the zonal and woreda level office of Agriculture. Primary data are collected from sample farmers using a structural questionnaire. Moreover, group discussions are undertaken with opinion leaders of respective districts.

3.2   Empirical model and estimation

Investment and tenure insecurity equation and their estimation

In this study, we empirically investigate the relations laid out in the theoretical model by a system of binary choice equations. As discussed earlier, the influence of tenure insecurity on soil conservation investment is direct. Alternatively, some factors may simultaneously affect both tenure insecurity and investment. With a simultaneous equations model two or more endogenous variables are determined jointly within the model. Both are also depend on set of exogenous variables. Simultaneity induces correlation between error terms of each equation in the system. Ordinary least squares (OLS) can not be used to estimate this model, because the relationship specified by equations violates the OLS assumption of zero covariance between the disturbance term and the independent variables. Estimation of such model through OLS will lead to biased and inconsistent estimates of the coefficients (Verbeek, 2002). As a result, the main estimating technique is two stage least squares (2SLS) for continuous variable and two stage probit estimation in the case of binary choice (Maddala, 1983).

I_i^* and T_i^* are endogenous (latent) variables and β and γ are the set of parameters and the simultaneous equations model is written the following form:

$$I_i^* = \beta_{11}T_i^* + \gamma_1 Z_{1i} + u_1 \tag{7}$$

$$T_i^* = \beta_{21}I_i^* + \gamma_2 Z_{2i} + u_2 \tag{8}$$

Where

$I_i = 1$ if $I_i^* > 0$

$I_i = 0$ otherwise

$T_i = 1$ if $T_i^* > 0$

$T_i = 0$ otherwise

For this study, our simultaneous probit equations model is:

$$I_i = f(Z_1, X, T_i) \tag{9}$$

$$T_i = f(Z_2, X, I_i) \tag{10}$$

Where investment (I_i) and tenure insecurity (T_i) are binary [0,1] indicator variables for a given household. The Z and X are vectors of observed exogenous variables representing household and farm specific characteristics and institutional setting. And f represents the non-liner transformation of I_i^* and T_i^*

To investigate the relationship between investment and tenure insecurity, we use a simultaneous probit equation model which consists of two simultaneous binary choice equations. The estimation procedure comprises the following steps: first, the reduced form of tenure insecurity (exogenous variable) is estimated and then its predicted value obtained. Second, the predicted value of insecurity $(\hat{T}_i^*)$ is used as a regressor in the investment equation. The process is repeated for insecurity equation using predicted value of investment $(\hat{I}_i^*)$.

4. Result and discussion

4.1 Descriptive analysis of soil conservation investment

About 44 percent of the households in the study invest in their own conservation technology (Table 1). Family size, age and farm size variables are assumed to influence the decision to invest in the soil conservation technology. The average family size, farm size and age of the households' head in the study area are 5.6, 1.47

and 38.6, respectively. But in this study no significant differences in these variables between investing and non-investing households are found based on univariate t-test.

Table 1: Characteristics of investing and non-investing households in the study area

Characteristics		Investing HH N= 52		Non-Investing HH N= 66		t- statistic
		Mean	S.D	Mean	S.D	
Age (years)		40.59	12.01	37.06	11.95	0.11
Family size		5.94	1.77	5.48	2.00	0.19
Farm size (ha.)		1.54	0.79	1.40	0.71	0.37
Distance from main road (km)		0.95	1.09	1.32	1.0	0.05**
Number oxen		2.11	0.83	1.69	1.15	0.02**
		% of Investing HH		% of non-Investing HH		χ^2 statistic
Slope	Yes	86.4		50.0		0.000**
	No	15.4		50.0		
Tenure insecurity	Yes	30.8		56.1		0.006**
	No	69.2		43.9		
Level of Education	Literate	61.5		39.7		0.001**
	Illiterate	38.5		62.1		
Extension Contact	High	82.7		53.0		0.001**
	Low	17.3		47.0		
Public investment	Yes	59.6		34.8		0.007**
	No	40.4		65.2		

Note:* indicates significance at the 10% level; **indicates significance at the 5% level

The number of oxen is hypothesized to influence the decision of soil conservation investment. This is because the number of oxen indicates the wealth status of the household. The average number of oxen per household is 1.88. A t-test indicates that investing households on average have significantly more oxen (2.11) than non-investing households (1.69). Education level is also assumed to influence decision of soil conservation investment. The majority of the households who invest in soil conservation technologies (69.2%) are literate. The chi- square test shows a systematic association between the level of education and soil conservation investments.

Frequency of extension contact is also assumed to influence the decision of soil conservation investment. About 82.7 percent of investing households and 53 percent of non-investing households has high level of extension contacts. The chi-square

analysis shows a systematic association between soil conservation investment and extension contact. Furthermore, the presence of public soil conservation investments on the plot of household is hypothesized to influence in decision of investments. This is because the households who have public investments may perceive the benefit of the technologies. About 59.6 percent of investing households and 34.5 percent of non-investing households have public soil conservation investments. The chi-square analysis reveals a systematic association between the presence of public investments and individual soil conservation decision. In addition insecurity of tenure is hypothesized to influence soil conservation investment. This is because investment may be undertaken when the household is assured that he will reap the benefit for a considerable time. The household who feels insecurity may not invested soil conservation measures. About 56.1 percent of non-investing households and 30.8 percent of investing households feel tenure insecurity. The chi-square analysis also reveals a systematic association between tenure insecurity and soil conservation investment.

4.2   Descriptive analysis of tenure security

Around 55 percent of the sample households feel secure about their landholdings (Table 2). Farm size is hypothesized to influence the feeling of tenure insecurity. The households who have a larger farm size may feel insecurity of tenure because they fear some plots of their land may be taken away through redistribution. Insecure households on the average have a larger farm size (1.7ha) than secure households (1.29 ha). The t- test shows that this difference is significant. Moreover, the number of oxen is also assumed to influence the feeling of tenure security. This is because the number of oxen indicates the wealth status of the household. Insecure households on average have significantly more oxen (1.7) than secure households (1.29).

Expectation of redistribution is assumed to influence the feeling of tenure insecurity. This is due to the prevailing land tenure policy. About 92.2 percent of insecure households and 75 percent of secure households expect re-distribution in the future. Chi-square analysis reveals a systematic association between tenure insecurity and expectation of re-distribution in the future. Level of education is also hypothesized to influence the feeling of tenure insecurity. However, Chi-square analysis shows no systematic association between education level and tenure insecurity.

Table 2: Descriptive statistics results of tenure security and insecure households in the study area

Characteristics		Insecure household N= 53		Secure household N= 65		t- statistic
		Mean	S.D	Mean	S.D	
Age (years)		39.4	12.5	37.9	11.71	0.5
Farm size(ha.)		1.7	0 .8	1.29	0.62	0.003**
Number oxen		2.0	1.1	1.7	0 .95	0.065*
		% Land insecure HH		% Land secure HH		χ^2 statistic
Investment	Yes	24.5		55.4		0.006**
	No	75.5		44.6		
Expectation of redistribution	Yes	92.2		75.4		0.018**
	No	7.8		24.6		
Level of Education	literate	58.5		46.2		0.182
	illiterate	41.5		53.8		

Note:* indicates significance at the 10% level ;   ** indicates significance at the 5 %level

4.3   Soil conservation investment model

Using the variables described in the preceding section, equation (2.1) is estimated using two- stage probit method. Two-stage probit estimation results (Table 3) reveal that the investment decision of soil conservation technologies is influenced by different factors at different levels of significance.

Most of the regressors used in this model have signs in line with our prior expectations. The results show that farmers' soil conservation investment decisions are positively and significantly related to slope, age, education level and public investment. Similarly, tenure insecurity and distance from the main road have negative significant influence on soil conservation investment. Some variables like farm size, extension contact and number of oxen have positive signs but are not significant.

Consistent to our expectation, the level of the slope of plot is positively related to the decision of the soil conservation investment and statistically significant. This implies that farmers who operate on fields with steeper slope are more likely to invest in soil conservation technologies than the others. This may be explained by the positive relationships between slope and severity of soil erosion. This result is consistent with the findings of Shiferaw and Holden (1998), Gebremedhin and Swinton (2003) and Bekele (2003) in Ethiopia, and Lapar and Pandey (1999) in the Philippines. Therefore, the level of the slope of the plot is an important factor for the decision of soil conservation investment.

Table 3: Two- stage probit estimation results of investment of soil conservation

Variable	Coefficient	Standard error
Age	0.033**	0.013
level of education	0.678**	0.299
family size	-0.037	0.096
distance	-0.318**	0.131
farm size	0.267	0.262
extension contact	0.321	0.327
number of oxen	0.188	0.160
public conservation	0.815**	0.303
slope	1.048**	0.333
insecurity(predicted value)	-0.856*	0.518
constant	-3.171	0.776

Regression diagnostic			
Chi-square	45.79	Count R^2	0.756
Probability >Chi-square	0.000	Base line for count R^2	0.56
Pseudo R-square	0.290	Number of observations[5]	115

Note:* indicates significance at the 10% level ; ** indicated significance at the 5% level

As expected, tenure insecurity has a significant negative influence on soil conservation investments. This suggests that tenure insecure households are less likely to invest in soil conservation technologies. It is argued that in Ethiopia, land is state property and farmers have only use and lease rights and redistribution of land is a common phenomenon. For instance, in the Amhara region Benin and Pender (2002) revealed that nearly half of the communities have experienced land redistribution since 1991 and about four-fifths of the communities expect redistribution in the future. This expectation of redistribution may erode tenure security and hence farmers may not undertake land improving investment because they may not be able benefit fully from the returns on their investments. This result is consistent with findings by Besley (1995) in Ghana, Hays and et al., (1997) in Gambia, Gavian and Fafchamps (1996) in Nigeria, Ostuka and et al., (2003) in Ghana, Winters et al.,(2004) in Ecuador and Fraser (2004) in Southwest British Columbia. Moreover, a study conducted by Gebremedhin and Swinton (2003) in the Tigray region of North Ethiopia is in line with our result. Thus, tenure insecurity has a negative influence on soil conservation decision. Conversely, Benin and Pender (2001) in their study in Amhara found that land redistribution and expectation of land redistribution have a statistically insignificant effect on the influence of land investment. Similarly, Holden and Yohannes (2002) in Southern Ethiopia revealed that tenure insecurity has no

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[5] Here the number of observation is not equal to 118. This is because a few number of missing data in the explanatory variables. For example number of oxen variable has three missing value. Due to this missing, when we estimate the equation of investment the number of observations decrease.

negative effect on long-term investment like planting of perennials. These differences could be explained by the differences of socio-economic and land re-distribution experiences between Amhara and Southern regions, but the different results for the same region may be due to methodological difference.

As hypothesized, the presence of public soil conservation investments on a plot is positively related with individual soil conservation investments and statistically significant. This means that households who have public investments on their plots are more likely to invest in individual soil conservation technologies than others. This is because they perceive the benefits of soil conservation technologies. This result is consistent with the finding of Gebremedhin and Swinton (2003) in Ethiopia. They found that farmers, who have nearby public investment, are encouraged to invest in private soil conservation measures. Therefore, public soil conservation is stimulating individual soil conservation investment. Consistent with our expectation, the coefficient of distance from the main road is negative and significant. It implies that farmers whose homesteads are far from the main road have a lower probability of investing in soil conservation technologies. This can be due to the fact that households near the main road tend to have access to information and are more likely to be visited by extension agents. Moreover, the transaction cost of searching for technical knowledge and information is lower for farmers living close to the road. This result is in line with the findings of Gebremedhin and Swinton (2003) in Ethiopia and Lapar and Pandey (1999) in the Cebu districts of Philippines. It can be concluded that distance from the main road is a crucial factor for the individual soil conservation decision.

Investment is found to be positively and significantly influenced by education status of the households. This suggests that literate farmers are more likely to invest in soil conservation measures than illiterate farmers. It is argued that literate farmers have the ability to obtain, process and use information related to soil conservation technologies and they are also taking more rational decisions. This result is consistent with the findings of Pender and Kerr (1999) in Aurepalle district of India and Lapar and Pandey (1999) in the Cebu district of Philippines. Thus, level of education has a positive influence on the decision of soil conservation investment.

Contrary to the hypothesis, the household age is found to have a significant and positive effect on the decision of soil conservation investment. This result implies that older farmers are more likely to invest soil conservation technologies. An explanation could be that farmers cognizant the problem of soil erosion through their life experience and hence they may take decisions of soil conservation investments.

69

The overall model goodness of fit represents by model count R-square is satisfactory. Using the model we predict that 44 households would invest and that 71 would not. In reality 50 households did invest and 65 did not. When we evaluate the predictions it is found that 33 of these 44 predictions of investing are correct and 11 not. Of the 71 predictions of non-investing 54 are correct and 17 not. So in total there are 33+54=87 correct predictions and 11+17= 28 wrong predictions. Overall the predictive power of the model is 87/115= 0.756. Moreover, the prediction of a model with only an intercept and no explanatory variables is 65 of the 115 observations. This gives us a baseline for predictions. So, the explanatory variables in the model give us an additional 22 correct predictions.

4.4   Tenure insecurity model

The results of two stage probit estimation for tenure insecurity are presented in Table 4. Most of the explanatory variables used in this model have signs similar with our prior hypothesis. The results indicate that tenure insecurity is positively and significantly related to farm size and expectation of redistribution. Age and number of oxen variables have negative and positive signs, respectively, but are not significant.

As expected, farm size is positively and significantly related to tenure insecurity. This result suggests that large farm size holders are more likely to feel tenure insecure. It is argued that owners of more than the average landholding may fear loss of some plots of land through redistribution. Moreover, the large farm size holders may feel tenure insecurity due to the past land redistribution policy as well as a great land holding inequality in the community. This result is also in line with the finding of Holden and Yohannes (2002) in some study sites of Southern Ethiopia.

Table 4: Two stage probit result of determinants of tenure insecurity.

Variable	Coefficient	Standard error
age	-0.003	0.011
level of education	-0.511*	0.287
farm size	0.491**	0.191
number of oxen	0.063	0.135
expectation of redistribution	0.609*	0.135
investment(predicted Value)	0.262	0.367
constant	-1.222	0.566

Regression diagnostic			
Chi-square	19.01	Count R^2	0.678
Probability>Chi-square	0.0042	Base line for count R^2	0.55
Pseudo R-square	0.1203	Number of observation	115

Note:* indicates significance at the 10% level ; ** indicates significance at the 5% level

Contrary to the hypothesis, the variable education is significant with a negative sign. This implies that literate farmers are less likely to feel tenure insecure. This may be explained by the fact that educated farmers may have alternative employment and the result they may give less attention to farm activities. Hence they may not feel tenure insecurity. However, Holden and Yohannes (2002) in their study in southern Ethiopia found that educated households (above grade 6) feel more tenure insecure. They argued that educated farmers may have better information about recent redistribution history of Amhara region.

As hypothesized, expectation of redistribution is positively and significantly related to the feeling of tenure insecurity. This result suggests that farmers who expect re-distribution are more likely to feel tenure insecurity. It is argued that farmers may expect redistribution due to the government land policy as well as the past redistribution experience in the region and these perceptions may be a real source of tenure insecurity[6]. Therefore, expectation of redistribution due to land policy is the main source of tenure insecurity.

Age, whether investing soil conservation or not, and number of oxen do not have a significant effect on the feeling of tenure insecurity. Particularly, the finding of investment is not in line with the new finding of Brasselle et al., (2002) in Burkina Faso. They suggest that investment may be undertaken to enhance tenure security rather than as a consequence of more secure rights. The reason that our results are not in line with their findings may be that during the previous redistribution, investments did not guarantee tenure security and most farmers has lost what they invested and denied of their rights to compensation and payments for their investment. Investments may influence tenure security in flexible indigenous and customary land tenure system.

The model goodness of fit represents by model count R-square is acceptable. Using the model we predict that 40 households would feel insecurity and that 75 would secure. In reality 51 households felt insecurity and 64 secure. When we evaluate the predictions it is found that 27 of these 40 predictions of insecure are correct and 13 not. Of the 75 predictions of secure 51 are correct and 24 not. So in total there are 27+51=78 correct predictions and 13+24= 37 wrong predictions. Overall the predictive power of the model is 78/115= 0.678. Moreover, the prediction of a model

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[6] Some authors use tenure insecurity and expectation of redistribution interchangeably. Here the two terms are different. Some farmers may expect re-distribution but they do not feel tenure insecurity due to their farm and personal characteristics. For instance small farm holders may expect re-distribution in the future but may not feel insecurity due to the size of their holding. This is because they are sure that they are not evicted from their small size

with only an intercept and no explanatory variables is 64 of the 115 observations. This gives us a baseline for predictions. So, the explanatory variables in the model give us an additional 14 correct predictions.

5.   Conclusion and recommendation

The result of the analysis indicates that tenure insecurity is an important factor that affects the probability of investing in soil conservation technologies. However, the reverse relation is insignificant. This shows that tenure insecurity has a negative impact up on the propensity to invest in soil conservation. This is because uncertainty in use rights leads to insecurity and reduced investment in land. Without clear and enforceable use rights, everyone is afraid others will reap the benefits of one's own investment. Under conditions of tenure insecurity, resource use and investment decisions regarding land can not be made with the long-term. Planning horizons will be short-term, and oriented to maximizing immediate profits. In Amhara Region, tenure insecurity is the result of the past redistribution and government land policy and hence farmers do not undertake long-term soil conservation investment. Therefore, the land policy should provide long-term and lasting tenure security to the peasant. Secure and stable rights to the land may possibly help in creating positive incentive to undertake long-term investments by land users, stimulating the rural economy. Moreover, secure rights may increase the planning horizon of farmers. The new initiatives undertaken by the regional government to address the problem of tenure insecurity through a user right document is a promising start. But registration of land use rights without prior legal clarification of land rights may not increase tenure security[7].

The analysis of soil conservation investment equation reveals that age, education, distance from the main road, public conservation investment, slope and tenure insecurity are the main socio- economic and institutional factors that influence on individual soil conservation decision. The study shows that the presence of public investments has a substantial positive impact on private soil conservation decision. This is because farmers perceive the benefit of soil conservation technologies. Thus, continuing and expanding public soil conservation measures that serve as demonstration sites with collaboration of research, extension and farmers is of paramount importance. In this study we find a negative relation between distance from the main road and decision to invest soil conservation. This results suggest that policy makers to give emphasis on expanding road facilities. Expansion of road

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[7] User rights documentation is being undertaken within the context of existing legislations. And these legislations are the ones that are responsible for promoting tenure insecurity

network has facilitated access to market and as the result the improvement in communication has enabled farmers to keep better informed about outlets. This has provided farmers with strong incentives to seek ways of increasing production by better conservation technologies. The analysis also shows that literate farmers have higher probability of investing soil conservation technology compared to illiterate farmers.

The analysis of insecurity model reveals that expectation of redistribution and farm size have a positive influence on tenure insecurity, whereas education level has a reverse effect. Almost all farmers expect future redistribution and this may erode tenure insecurity. To reverse this situation, the regional government should consider a policy that may end up periodic land redistribution and there should be an awareness campaign to inform all the stakeholders about it to immune them from this problem. Additionally, improving access to land rather than redistribution through other means such as development of land rental markets and encouraging longer lease may be an alternative strategy in situation where formal land transactions are not possible. However, investment has no a significant influence on tenure insecurity.

To sum up, the implication of these findings is that tenure security should be the top priority agenda for the regional government in order to increase farmers' propensity to invest in soil conservation technologies and thereby to reduce soil erosion in particular, and to combat resource degradation in general. Finally, the study underlines the need to carry out future research to investigate the impact of tenure insecurity on agricultural productivity.

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THE CONTRIBUTION OF Sida AMHARA RURAL DEVELOPMENT PROGRAM TO POVERTY REDUCTION IN AMHARA REGION

Approaches, Achievements and Challenges

Ayichew Kebede[1]

ABBREVIATIONS AND DEFINITIONS

ACSI	Amhara Credit and Savings Institution
ADLI	Agricultural Development Led Industrialization
AI	Artificial Insemination
AMSTIEPA	Amhara Micro and Small Industry Enterprises Promotion Agency
ANRS	Amhara National Regional State
B.D	Bahir Dar
BDS	Business Development Service
BDU	Bahir Dar University
BoFED	Bureau of Finance & Economic Development
CDF	Community Development Fund
CEP	Community Empowerment Program
CESC	Community Empowerment Steering Committee
CSA	Central Statistical Authority
DAs	Development Agents
EDC	Economic Diversification Component
EDF	Enterprise Development Fund
EPLAUA	Environmental Protection, Land Administration & Use Authority
FDRE	Federal Democratic Republic of Ethiopia
FREGs	Farmers Extension Groups
FSCDP	Food Security Coordination & Disaster Prevention
FTC	Farmers Training Center
GDP	Gross Domestic Product
GER	Gross Enrolment Ratio
GoE	Government of Ethiopia

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SARDP-PCU

HDI	Human Development Index
HH	Household
HICES	Household Income Consumption & Expenditure Survey
HIPCs	Highly Indebted Poor Countries
HIV/AIDS	Human Immune Deficiency Virus/Acquired Immune Deficiency Syndrome
HQ	Head Quarter
HTP/VAW	Harmful Traditional Practices/ Violence Against Women
IFAD	International Fund for Agricultural Development
IGAs	Income Generating Activities
IPIS	Integrated Planning & Information System
IPRSP	Interim Poverty Reduction Strategy Paper
IRDP	Integrated Rural Development Program
IT	Information Technology
IWSM	Integrated Watershed Management
LFIs	Local Financial Intermediaries
M&E	Monitoring & Evaluation
MDGs	Millennium Development Goals
MEDAC	Ministry of Economic Development and Cooperation
MFIs	Micro Financial Intermediaries
MIS	Management Information System
MoFED	Ministry of Finance & Economic Development
NRM	National Resource Management
OFR	On-farm Research
OSC	Orgut Scanagri Consortium
PASDEP	Plan for Accelerated and Sustainable Development to End Poverty
PCC	Programme Coordinating Committee
PCU	Program Coordination Unit
PLWHAs	People Leaving with HIV/AIDs
PRSPs	Poverty Reduction Strategy Papers
RGDP	Regional Gross Domestic Product
RRA	Rural Road Authority
SACCO	Saving & Credit Cooperative
SARDP	Sida Amhara Rural Development Programme
SDPRP	Sustainable Development & Poverty Reduction Program
SEK	Swedish Kroner
SME	Small & Micro Enterprise
UNDP	United Nations Development Program
VCT	Voluntary Counselling & Testing
WDF	Woreda Development Fund
WMU	Welfare Monitoring Unit

1.   Introduction

1.1   Background

Poverty reduction is top on the development agenda of national governments and the international community. More than one billion people still live on less than one dollar a day (Sida, 2002:5). Currently more than eight million people around the world die each year because they are too poor to stay alive (Sachs, 2005:1). In a related literature it is indicated that about 800 million people do not have enough food to meet their nutritional need (Todaro & Smith, 2009:432). The authors further argue that the core problems of widespread poverty, inequality and rapid population growth all originate in the stagnation and often retrogression of economic life in rural areas, particularly in Africa. Cognizant of this reality, the international community has committed itself to reduce poverty by half in 2015 and eradicate it in 2025.

The situation in Ethiopia is not exceptional, though a lot of efforts have been made so far to reduce poverty and extreme hunger. At present it is estimated that about 38% of the population live below the poverty line (MoFED, 2006). The Amhara region constitutes 15% and 25% of the countries land and population size, respectively. Sadly, it constitutes a quarter of the poverty level of the country (BoFED, 2006). On average, about 2.5 million people are chronically food insecure in 56 *woredas* of the region; mainly in the Eastern part (i.e. Wollo) which are mainly vulnerable to recurring droughts (FSCDPO, 2007). But the drought occurrence has expanded towards the western part of the region to include part of East Gojjam, which used to be the grain granary of the country. Parts of Enebse, Goncha and Shebel Berenta woredas towards the Abay gorge are included under the food security program. In South Wollo and East Gojjam, before the launching of SARDP III, the proportion of poor people was reported to be 60% and 59%, respectively (SARDP-PCU 2005). So tackling poverty is the prime agenda of the government and donors alike.

The government of Ethiopia has adopted its poverty reduction strategies. The recent one is the Plan for Accelerated and Sustained Development to End Poverty (PASDEP) (2005/6 – 2009/10) which is the overarching program to guide all development actors. This plan is designed and imbedded in the long-term development strategy of the country i.e. agriculture development led industrialization (ADLI) with a vision to put Ethiopia under the middle income category. There are also policies and strategy documents, including the rural development strategy, elaborated to support and guide the effort. Similarly the Amhara region has adopted its five year plan in tune with the national PASDEP. The central focus is the rural and agricultural sector, though unlike its predecessors emphasis is given to urban-rural linkage,

employment creation, tapping the potentials of women, promoting the private sector and addressing the population issue (MoFED, 2006). Specific programs such as the national food security program, the productive safety net program and various sector wide programs have also been designed and are being implemented across the nation. These programs are supported by other development partners and donors (e.g. Sida).

Currently there are about 20 donor financed programs/ projects (8 bilateral and 12 multi-lateral) operating and supporting the overall development and poverty reduction effort of the Amhara region (BoFED, 2007). Sida is one of the major development partners in the Amhara region aiming at contributing to the poverty reduction effort of the region through ensuring food security and building the institutional capacity of local governments and communities. Sida Amhara Rural Development Program (SARDP) is the largest of such programs in the region financed by Sida since 1997 with the aim to contribute to the poverty reduction effort of the region through ensuring food security in 30 targeted woredas of East Gojjam and South Wollo zones. The intervention zones have contrasting features. The former is relatively moisture surplus while the latter is drought prone and highly degraded leading to recurring food shortage. SARDP has been implemented almost for a decade in the region in three consecutive phases. Currently SARDP is in a period of phasing out to end by June 2010 with a possible future support of Sida. A new program is under the process of preparation which will focus on economic diversification together with agriculture and land administration (Tengnans, et al, 2009). The purpose of this paper is, therefore, to share the experience of SARDP and document its contribution to poverty reduction in the Amhara region.

Following this introduction, a brief review of literature on the theory and practice of rural development and poverty reduction will be highlighted. The third section is devoted to highlight on the national context. Here, the poverty profile and poverty reduction strategies of the country are briefly discussed. The regional context is elaborated in the fourth section. The poverty situation and the region's third five year plan will be highlighted. The fifth section is devoted to discuss Sida support to the Amhara region. The inception of SARDP and its evolution through time, overall objectives, the design, guiding principles and strategies, and organizational set up and budget of the program are discussed. In the subsequent sections, major achievements of the program in terms of outputs and outcomes, best practices, challenges and lessons learnt are presented in the respective order. In the final section summary and conclusions are made.

1.2   Objective of the study

The overall objective of the study is to examine and share experience and document the contribution of Sida Amhara Rural Development Program (SARDP) to poverty reduction in Amhara Region. The study has the following specific objectives.

- To review the available literature on poverty reduction and integrated rural development as a theoretical framework.
- To examine the overall national and regional poverty situation and poverty reduction strategies.
- To assess the relevance of SARDP to poverty reduction, approaches and major achievements of the program.
- To single out major challenges, best practices and lessons learnt for future development undertaking.
-

1.3   Method and source of information

Descriptive approach is mainly followed in the analysis and presentation of the paper. Both qualitative and quantitative data and information are employed to prepare the paper. The paper is entirely dependent on secondary sources of information and desk review of the available documents at the program coordination unit (PCU). Relevant literatures are, however, reviewed to backup the paper with some theoretical and conceptual framework. Relevant facts and figures are mainly gathered from various sources, inter alia, annual reports, impact assessment studies, external evaluation reports, and periodic monitoring field visit reports. The major internal and external source documents to substantiate the achievements and challenges of SARDP include; (i) Internal impact assessment of SARDP (Gosage et. al, 2008), (ii) Results report of SARDP updated (SARDP-PCU, 2009), and (iii) External Evaluation of SARDP; 1997-2008 (Tengnans et al, 2009).

1.4   Theoretical framework

Poverty is a multi dimensional phenomenon. It "can be seen as broad, multidimensional, partly subjective, variable over time, comprising capabilities as well as welfare, and in part relative to local norms, comparisons and expectations" (IFAD: 2001:18). Traditionally, poverty is defined as 'shortfalls in income/consumption' (Jones, 2001:1258). Conventionally, it has been measured in terms of income/consumption or by a poverty line, which reflects only the economic dimension. The concept, however, embraces broad dimensions such as the ability to lead a long, creative and healthy life, to acquire knowledge, to have freedom, dignity,

self respect and respect for others, and to have access to resources necessary for a decent of standard of living (ibid: 1258). The Nobel Prize winner for economics, Sen concurs that"…poverty must be seen as the deprivation of basic capabilities rather than merely as lowness of incomes, which is the standard identification of poverty (Sen, 1999, p.88). Poverty is an outcome of the interaction between economic, social and political processes. In political terms, it is an outcome of lack of responsiveness and accountability of state institutions (World Bank, 2001: 99). Therefore, poverty reduction requires a long-term solution to structural causes like social and power relations and vulnerability (Rajasekhar, 2002). The level and pattern of poverty is also quite varied. It is with this conceptual underpinning of poverty that this study will base itself to examine SARDP's approach to tackle poverty.

The number of people living on a dollar a day was estimated to be 1.2 billion, of which the majority are found in South Asia and sub-Saharan Africa, although significant improvements have been made, mainly in Asia (World Bank, 2001: 3). But in sub-Saharan Africa the situation is quite alarming. Over 3.3 billion people lived in rural areas in 2007, a quarter of them in extreme poverty. In sub Saharan Africa, the ratios are much higher, with rural dwellers constituting 65% of the total population. Well over two-thirds of the world's poorest people are also located in rural areas and engaged primarily in subsistence agriculture. Their basic concern is survival (Todaro & Smith, 2009, p.431).An international target has been set to reduce the number of people living in absolute poverty by one-half by the year 2015 (Thomas, 2001:10). Many development scholars and agencies suggested that poverty could be reduced through promoting economic growth along with redistribution and accelerated social development (Jones, 2001: 1260). The World Bank (2001) also stressed opportunity, empowerment, and security as pillars and broad-spectrum strategies in poverty reduction. In order to qualify for concession lending and debt relief, Highly Indebted Poor Countries (HIPCs) are obliged to prepare and submit Poverty Reduction Strategy Papers (PRSPs) (World Bank, 2002). The strategy papers are thus the guiding documents to all efforts towards reducing poverty. Among the various development strategies rural development program (IRDP) is dominant in many developing countries. SARDPs approach to poverty reduction and its strategies will be examined in this perspective. The theoretical underpinning of rural development is discussed here under.

The term (Integrated) Rural Development Program (IRDP) is used by various institutions dealing with problems of rural areas, though it denotes varied and sometimes conflicting approaches (Weitz, 2006). The approach was dominant during the 1970s and 80s often advocated by many donors. Despite its popularity it was subject to some critics that the integration was often only in name; shopping list of

essentially independent sub projects (Clayton, Dent, & Dubois, 2003). However, through time it has gone through changes. Since the mid 1990s, it was increasingly acknowledged that isolated projects wouldn't result in sustainable results, unless they were embedded in a sound macro-economic situation and a supportive policy environment (Zoomers, 2007, p. 493). The World Bank on its part defines rural development as a strategy designed to improve the economic and social life of a specific group of people-the rural poor. Rural development involves extending the benefits of development to the poorest among those who seek livelihood in the rural areas (Jain, 1997). The group includes small scale farmers, tenants, and the landless (Ibid. p.23). IRDP puts a major emphasis on the eradication of poverty, by meeting the basic needs of the entire population of the rural areas through an increase in production, and where necessary a redistribution of productive assets such as land (Weitz, 2006, p.8). It is further noted that a rural development program includes a mix of activities, including projects to raise agricultural outputs, create new employment, improve health and education, expand communication and improve housing (Jain, 1997 pp22-23; Weitz, 2006). This implies that rural development should not be equated solely with agriculture, though the sector plays a dominant role. Chambers (1983) argues that rural development is a strategy to enable a specific group of people, poor rural women and men, to gain for themselves, and their children more of what they want and need. It involves helping the poorest among those who seek a livelihood in the rural areas to demand and control of the benefits of development. In short IRDP involves all things that can most improve the living conditions of the rural masses (Gebregziabher, 1975 cited in Zoomers & Geurten 1991; 155). The GoE in its rural development strategy document has also emphasized an integrated development path. It is stated that:

> "*Integration is required not only among the activities and products in agriculture. Agricultural development is closely linked to social development sectors such as education, health, and infrastructural projects like road construction. One cannot register rapid and accelerated growth without the other. In addition, agricultural development is closely interconnected with sectors such as trade, finance and industry (GoE, 2002, p.12).*"

IRDP is thus conceived as a program for the simultaneous execution of multi-purpose planning activities, activities on the macro and micro levels in the three economic sectors, agriculture, industry and services related to the economic, social, physical and organizational aspect of the development process (Weitz, 2006, p.23). In effect this means the broad spectrum of rural development activities, including small farmers' agricultural progress, the provision of physical and social infrastructure, the development of rural non-farm industries, and the capacity of the rural sector to

sustain and accelerate the pace of these improvements over time (Todaro & Smith, 2009, p.827). In a nut shell, rural development is a multi dimensional and multi sectoral approach which entails the coordination and integration of agriculture, industry and service sectors. In order to realize integrated rural development and address the needs of the poor, a decentralized government is of paramount importance (Weitz, 2006). In this paper SARDP will be examined in view of the above arguments and strategies while addressing poverty reduction in its multidimensional perspective. The following section dwells on the national poverty situation and strategies adopted to reduce it.

2.   National and regional context of poverty

2.1   National context

2.1.1 Level of poverty

Ethiopia is one of the poorest countries in the world by all development indicators. It is the second populous country in Sub-Saharan Africa with a total population of 75 million (CSA, 2007 on line). Out of the total 85% live in the rural areas and derive their livelihoods mainly from subsistence agriculture. The per capita income is estimated to be US$ 141 per person (World Bank, 2005 on line). Out of the total population 81% live on less than $2 a day (UNDP, 2005). Of every 1000 children born alive, 123 die before the age of five years and 77 die before celebrating their first birthday (CSA, 2005, BoFED, 2006). This shows that the state of poverty in the country is pervasive. According to UNDP human development index (HDI), Ethiopia ranks 170, just 7th from the bottom (UNDP, 2005). The HIV/AIDS prevalence rate was 4.4%, which has indeed exacerbated the poverty situation of the country (MoFED, 2006 p. 16-17)

Poverty in Ethiopia is pervasive and multi-faceted (Geda et al, 2002). Although poverty is predominantly rural phenomenon, it is also dominant in urban areas, mainly caused by unemployment and under employment (MoFED, 2000:3). It is also characterized by significant regional variations. For example, given their population share and level of poverty, the bulk of the poor reside in Tigray and Amhara regions (Geda et al, 2002:37).

On the basis of standard and conventional measures, Ethiopia is designated as one of the poorest countries in the World. Food poverty incidence was 41% of the rural poor who lived below the poverty line in 1999/2000. It is now estimated that this has been reduced to 36.2% as was reported by MoFED, while those experiencing food poverty in urban areas were about 47% (MoFED, 2006). The poor are typically less

educated, less healthy, and have larger families than those who are better off income wise.

According to the household income consumption expenditure survey (HICES) conducted in 2004/05, the average family size in Ethiopia is 4.8 and its adult equivalent is 3.9 which is higher in rural areas than urban (Ibid, 2006). According to the survey result, the real total per capita HH consumption is found to be US $ 146. The share of food in total expenditure is 56% which indicates that the majority spend their income to buy food items. The proportion of poor people in the country is estimated to be 38.7%, which is relatively higher in rural areas (39.3%) while in urban areas (35.1%). Over the last few years, there is, in general, a declining trend in the rural areas mainly due to pro-poor interventions such as food security program, the extension program and productive safety-net program. The absolute number of poor people, however, declined only by 2% while in urban areas there is a growing trend in inequality (Opcit, 2006 pp. 24-26).

Similarly the non-income dimension of poverty is alarming. For instance, the literacy rate is only 38% (31% for rural & 27% for female) (MoFED, 2006). The primary GER shows some progress which is 74% in 2004. On the other hand, 35% of the rural population is more than 5 km away from the nearest school. There is also significant variation spatially. The emerging regions like Benishangul and Somalia have 11% & 19% of the population located more than 10 km away from the nearest primary schools, respectively. Furthermore 70% of rural families are forced to travel more than 20 km to find a hospital and 49% of HH are not using the nearest health facilities due to distance, expensive service charges, etc. With respect to nutrition, 47% of children suffer from chronic malnutrition, which is higher for rural areas. Only 11% of women have been attended by health professionals during delivery time. The situation is worse in rural areas which is only 7% (Ibid, 2006).

The poverty situation in Ethiopia also exhibits inequality (MEDAC, 2000). For example, women-headed households are more prone to poverty than their male counterparts (Geda et al, 2002). Despite their role in the economic and social sphere, women in Ethiopia have low level of access to economic resources. The gender dimension of poverty is manifested in the low level of women's access to education and health services, employment opportunities, and participation in the social and political life of the country. Their status in terms of welfare and empowerment by all indicators is below Sub-Saharan Africa and is further undermined by social and cultural barriers (World Bank 2000:59). Hence, as indicated by different indicators the poverty situation in the country is pervasive. In order to reduce poverty various

strategies have been designed. The following section highlights the national poverty reduction strategies.

2.1.2 National strategies

Ethiopia has made a complete shift from a socialist command economy to a free-market-oriented economy since the early 1990s. The major development objective of the government is to reduce poverty and bring sustainable development. In line with this, various policy measures have been taken. The economic reform program, which was implemented between 1992 and 1997, focused on macro-economic stability & poverty related interventions such as health, education, food security and the productive safety net program and these are being implemented by the federal and Regional governments.

Related to land, the constitution has underlined that land belongs to the government and people of Ethiopia. Farmers have only user right and no sale and/or mortgage of land in any form (FDRE 1995, art. 41). The government has adopted initially an interim strategy paper in 2000 which has been serving only as transition until the comprehensive PRSP is adopted. Furthermore, in 2002 the government has adopted a full-fledged first generation PRSP called Sustainable Development and Poverty Reduction Program (SDPRP). This framework document aims at enabling the economy to develop rapidly, to end dependence on food aid and to allow poor people to benefit from economic growth. The building blocks of the program include agriculture development led industrialization (ADLI), reform of the justice system and the civil service, decentralization and empowerment and capacity building of the public and private sectors. In all pillars there were fairly a number of pro-poor interventions and considerable investments have been made over the years.

In the recent past, the Government also adopted a more comprehensive version of poverty reduction program called Plan for Accelerated and Sustained Development to End Poverty (PASDEP). This is a five year program (2005/6-2009/10) mainly aimed at maintaining and building on the achievements of SDPRP, albeit more emphasis has been paid to enhancing growth and redressing the widening income inequality in urban areas. It is the second phase of the poverty reduction strategy program (PRSP) process, which has begun under the SDPRP (2002/3-2004/5). In the plan document it is stressed that the PASDEP carries forward important strategic directions pursued under the SDPRP-related to infrastructure, human development, rural development, food security, and capacity building, but also embodies some bold new directions such as improving the situation of women and the youth, emphasis on area specialization (growth corridor), more private sector development, improving urban

development and management (MoFED, 2006). The outcome of each of these strategies is, however, subject to future research and evaluation.

2.2 Regional context

2.2.1 Background and level of poverty

The Amhara region is located in the North-western part of the country. It has a total area of 161,828 km2 which accounts for 15% of the total size of the country. Administratively the region is divided into 10 zones, 150 districts and 3224 *kebeles*. The total population size of the Amhara region was projected to be 19.6 million, (88.3% rural and 11.7% urban) with an annual growth rate of 2.6 (BoFED, 2006). However, according to the recent official census result, it has come down to 17.6 million (CSA, 2007).

The Region is one of the most degraded areas in the country. It is estimated that about 1.1 billion tons of soil (48% of the country) is washed away annually as a result of intensive cultivation in the highlands and rapid population growth rate (BoFED, 2006). The land use pattern of the region shows that more land is intensively cultivated and the forest cover has dwindled in unprecedented manner. According to the available data source the land use patter shows that, 36.3 % is cultivated, 27.6% bushes and shrubs, 17.1% afro alpine vegetation, 7.5% wetland (swamps), 6.6% woodland, and 1.8% forest land (both natural and plantations) (Ibid, 2006). The agricultural density of the region is estimated to be 4.95 people per hectare where, in the Eastern part of the Region, there is high agricultural density while in the Western part it is relatively low. In South Wollo, North Wollo and Oromiya zones the agricultural density is 6.09, 6.44 and 8.42, respectively while in the remaining zones it is found to be below the regional average. Similarly, the average landholding size per household is about 1.13 ha in the region but with slight difference from zone to zone. In the Eastern part of the Region (South Wollo, North Wollo and Oromiya), per capita household land holding size is below the regional average which is below one ha. In the remaining zones it is well above the regional average.

Agriculture is the mainstay of the economy of the region. It contributes 60.9% of the RGDP while industry and service sectors contribute 22.9% and 16.2% of RGDP, respectively (BoFED, 2006, p. 3). The real average growth of RGDP oscillates between 1.9% in 1997/98 to 8.4 in 1996/97. The total real RGDP growth rate is thus 5.15 per annum and the average growth rate for the agricultural sector is estimated at 3.5% (Ibid, 2006, PP.5-10).

Figure 1: Trends in sectoral GDP growth rates
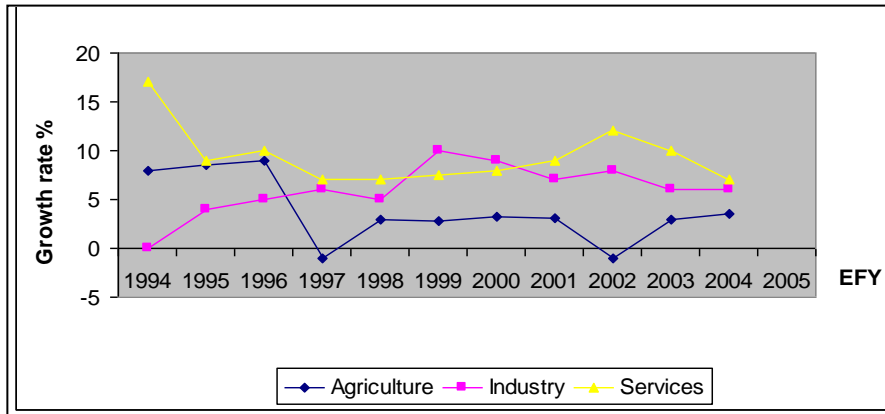
The region is endowed with diverse agro-ecologies suitable for growing different types of crops i.e. cereals, pulses, and oil seeds. Crop production accounts for 62.1% of the regional GDP. The livestock potential of the region is considerable accounting for 25.85% of the region's GDP (BoFED, 2006, p. 12). However, production and productivity of the agricultural sector remains low owing to several factors, inter alia, low level of technology, inadequate institutional support, land tenure insecurity, poor infrastructure and social service development are worth mentioning.

Notwithstanding the above facts, the region is entangled with a myriad of development challenges inter alia, low implementation capacity, deep rooted poverty and food insecurity, environmental degradation, poor infrastructure and low social service coverage, high unemployment rate, especially in urban areas, and the spread of HIV/AIDS (BoFED, 2006).

Like that of the country, poverty is high and pervasive in the Amhara region. It was estimated that about 41.8% of the population in the region fall below the nationally defined poverty line (42.9% for rural and 31.1% for the urban) (MoFED, 2002). It should, however, be noted that there are observable changes in the level of poverty due to efforts made so far. In the region, about 56 rural woredas were chronically food insecure, while 25 woredas were categorized under transitory food insecurity, respectively. Based on relief assessment, a total of approximately 6.3 million people were affected by food insecurity; of these nearly 3 and 3.3 million were facing chronic and transitory food insecurity and is estimated to account for 16.5 and 18.2% of the regional rural population, respectively, (FSCDPO, 2007:3). The depth and severity of poverty is, however, high both in the rural and urban areas. According to a welfare monitoring survey done by MoFED in 1999, the per capita income of the region was about birr 1088 and only 4.8 % was family saving (BoFED, 2006).The majority spent

their income, almost more than 50% of their disposable income, to purchase food which is a characteristic feature of most developing countries. The food poverty situation in the region is critical making nearly 3 million people chronically food insecure and dependent on food aid annually irrespective of the onset of rainfall. It was estimated that 30.5% of the population fall below the nationally defined food poverty line. About 32% of the population covered their food requirement only for six months (BoFED, 2006). Besides, if unexpected disasters happen, 46.6% of the population in the region do not get a weekly income of Birr 100 or more to recover. This shows that the resilience capacity of the rural population is weak. The calorie level is also low for the region compared to the national average (i.e. 2155kcal and 2211kcal, respectively). In general, the poverty level in the region is high which accounts for a quarter of the national poverty level (BoFED, 2006). The Region had the highest stunted growth i.e. 54.7% (BoFED, 2005).

With respect to the non-income dimension of poverty the available data source shows that life expectancy at birth is only 53.4 years for male and 56 years for female. Moreover, the region has experienced high infant, child and maternal mortality rates which are in the sequence of 94/1000 live birth (80 for the national), 154/1000 live birth (132 for national) and 673/100000, respectively. The rural people should travel on average 7.4 km distance to reach the nearest health post and more distance to reach other services. The literacy rate in the region in 1995 was 17.5%. With concerted efforts made afterwards it was possible to improve the situation to 23.1 %. This implies that a lot should be done to improve the literacy rate and other social service delivery. The Region is vulnerable to shocks such as drought, famine, loss of job, death, crop damage, death of animals, etc. According to the welfare monitoring unit estimate about 43% (44% in rural & 24% in urban areas) of total households have been suffering from drought spells and famine shocks, (BoFED, 2006). Cognizant of this reality, Sida has intervened to assist the poverty reduction effort of the region through launching a rural development program called SARDP.

Table 1: Measures of absolute poverty, in Amhara

Residence	% of total population	P0	P1	P2	% contribution to national poverty
Rural	89.0	0.429	0.110	0.040	23.33
Urban	11.0	0.311	0.085	0.032	1.73
Regional	100.0	0.418	0.108	0.108	25.05

Source: Extracted from development and poverty profile of Ethiopia, BoFED (2006)

The Situation in South Wollo and East Gojjam zones, (SARDP intervention zones), is not exceptional. According to the program document for SARDP III the proportion of poor HHs in South Wollo and East Gojjam was 60% and 59%, respectively (SARDP-

PCU, 2005). Table 2 depicts, the participatory wealth classification based on assets and the corresponding proportions for poor, middle & better off households.

Table 2: Poverty categories in program zones

Poverty status	Wealth status			
	South Wollo	**%**	**East Gojjam**	**%**
Poor	▪ HH cover their food need for less than 4 months/yr. ▪ Do not have oxen or other farm animals	60	▪ <0.5 ha land ▪ No. more than one cow and seldom an ox. ▪ Livelihoods depend on daily labor, fuel wood collection, etc. ▪ One meal a day.	59
Middle	▪ HH covers their food need up to 8 months from own production. ▪ Own single ox and a few sheep and ▪ 1 ha plot	30	▪ 0.75 – 2 ha land. ▪ 1-4 oxen, 1.5 cows, 1.2 heifers, 1 donkey, 2.10 goats, 2 beehives.	30
Better off	▪ HH cover their food need all year round in good years. ▪ Own a pair of oxen, some milk cows, calves and sheep. ▪ Have farm plots well above average size.	10	▪ 1.3 ha of land ▪ 2-8 oxen. ▪ Are inputs and produce up to 30 Qt per annum	11

Source: SARDP Program document, SARDP III, Revised August, 2005

2.2.2 Regional poverty strategies

The regional government has adopted a five year development plan (2005/6–2009/10) for the third time with the objective to accelerate growth and reduce poverty. The plan elaborates the major development challenges, opportunities, strategies and targets to be achieved at the end of the plan period. The major development challenges prioritized include, among others, food insecurity, low implementation capacity, unemployment, low infrastructure and social services coverage, environmental degradation, and bad governance.

Based on the level of vulnerability to disasters, 56 woredas were identified as chronically food insecure. Ensuring food security at household level is, therefore, a priority development agenda. The region's capacity to withstand disaster like vulnerability to drought is weak. This leads to fluctuations in agricultural production and asset depletion of the rural communities. So diversification of the rural economy at household level and promotion of modern irrigation will be enhanced. The

implementation capacity of the region especially at *woreda* and *kebele* levels is weak. To build the institutional capacity at all levels, especially at lower levels, attention has been given to implement the various public reform programs. Unemployment is pervasive in the region especially in the urban areas which is estimated at about 10% (BoFED, 2006). Although the problem is more pronounced in the urban areas, it is also prevailing in the rural areas. There is a growing number of landlessness among the youth in the rural areas. The creation of employment opportunities through promoting labor intensive public works and SMEs will be strengthened.

Although effort has been made so far there is still limited infrastructure development in the region. Basic social services are inadequate. The problem is critical especially in remote and inaccessible areas. In order to foster rural urban linkages, especially to link high production areas with markets, the expansion of rural and community roads will be reinforced. Natural resource degradation is high in the region which has exacerbated the poverty situation of the rural inhabitants. The adoption of an integrated watershed management approach is vital to sustain the development effort. There should be a balanced and harmonious growth of population and the economy.

To foster the democratization process and ensure good governance, effort will be made to properly implement public reform programs. Women are the most disadvantaged segment of the population. Their subordinate position emanates from the socio-cultural and institutional bias. Although women in the region constitute nearly half of the population, their contribution to the economy is not properly registered in the Regional income account (BoFED, 2006). In a recent report prepared by Bureau of Women Affairs (BoWA), out of the total active labor force seeking new jobs (i.e. 606,149), 53% are women (BoWA, 2006). Also, participation of women in decision making is found to be low. Between 2001-2005 only 1,444, 2,121 & 49,333 women participated at Federal, Regional, *woreda* and *kebele* level councils, respectively (Ibid, 2006). Hence, effort will be made to tap the potentials of women during the plan period. HIV/AIDS in the region is also a critical problem that the five year plan attempts to address. It is in tune with these development strategies and policy directions that the Sida Amhara Rural Development Program was designed and implemented in the Region, especially in 30 woredas of South Wollo & East Gojjam zones. Sida support to ANRS is further discussed as follows.

3.   Sida support to Amhara Region

3.1   Background

The Amhara region has received significant share of the development assistance by Sida to support the poverty reduction effort in the region through implementing SARDP. Focus on the programme's principles, which are the central elements for poverty reduction recognized by Sida; (human rights, democracy and good governance, gender equality, sustainable nature resources, economic growth, social development and security, conflict management and human security and global public goods) are key to Sida support. These are captured in essence in poverty focus, land security, empowerment, good governance, gender equality and sustainability, which are the programme guiding principles (SARDP-PCU, 2007).

The drought crisis in Wollo in the mid 1980s was the root cause for the first Sida support to particularly Amhara region. The major interventions were agriculture, drought preparedness, primary health care and environmental education. The community empowerment program (CEP) which was launched in 1993 was another area of support by Sida. The major components included road rehabilitation, soil conservation and farm forestry mainly aimed at creating employment opportunities. However, due to the absence of compatible decentralized system of governance, especially at local level, the CEP initiative was hardly materialized as anticipated. Hence, this necessitated to design a full-fledged rural development program or better known as Sida Amhara Rural Development Program (SARDP) which is integrated, area-based program and in line with the government system. SARDP was initially planned in 1995; background technical studies were conducted in 1996 and implementation of the first phase commenced in June, 1997 and was officially ended in December, 2001. Phase I of the program dwelt upon starting up the program at *woreda* level through providing Woreda Development Fund (WDF) and capacity building at both regional and *woreda* levels. Phase II of SARDP, which was under preparation between 1998 and 2001 with interruption during the Ethio-Eritrea conflict, started operation in January 2002. Phase III started in July 2004 and ended in 2008. However, the program is extended for two years and will phase out by June 2010. The first phase was designed to building capacity at regional and *woreda* levels through training and institutional development aside from the main focus on Woreda development (BoFED, 1996).

The objective of Phase II was to improve the living conditions of the rural population targeting the poor and marginalized groups through sustainable increase in agricultural productivity and natural resources, economic diversification, promotion of

good governance and ensuring equitable development. It emphasized *woreda* capacity building, reproductive health, HIV/AIDS and support to the judiciary in addition to most of the area development programs of Phase I (BoFED, 2001). It operated in two zones, East Gojjam and South Wollo, covering a total of 16 woredas. The overall objective was considered consistent with the national and regional government policy of focus on small holder agricultural development that underpins equity. However, there has been an argument that contextually and in terms of allocation of program resources between *woreda-* and region-level interventions it was not in tune with the policy. The fact that the program addressed community empowerment and capacity enhancement at the grassroots level was considered as the strength of the program. It also created the environment for implementing capacity building programs at the community and *woreda* levels.

The third phase was reoriented being highly innovative with focus on direct and indirect Woreda support making the program more reflective of recent policy developments, enhance community and Woreda capacity, strengthening and ensuring the ownership of the program by the community and making the program more responsive to the needs of the poor and local community. Support to build the capacity of land administration and MFIs has also been given due attention during this phase (SARDP-PCU, 2005).

3.2   Programme design and implementation principles

After having developed the program and prior to the initiation of program implementation, basic principles of program approach and implementation were agreed upon by both the donor and the region. The principles were mainly that the program is poverty focused; that it empowers the community; that it promotes gender equality; that environmental care has to be a major issue when considering *woreda* development; that the principle of decentralization is a driving motive; that participation is a core concept in SARDP; that vertical and horizontal linkages of program activities are pertinent; that program interventions need to differ geographically and that sustainability is a key issue for the program (SARDP-PCU, 2005).

3.3   Program goal, objectives and strategies

3.3.1 The program goal

The longer-term/overall goal of the program is to contribute to the poverty reduction of the Amhara region by improving the food security conditions of the rural population of 30 woredas in East Gojjam and South Wollo Zones through sustainable increase in

agricultural productivity and natural resource use, economic diversification as well as improved access to health and education services, water supply and to institute a decentralized and participatory planning and implementation of development interventions (SARDP-PCU, 2005).

3.3.2 Objectives

The immediate objectives of the program include capacity building for communities and their institutions, capacity building of the public sector: for *woreda* government and sector offices to engage in their local constituencies and deliver effective poverty reduction strategies and services, improved HH level food production and cash income from agriculture and livestock sector, improved access to education and health services, diversify the economy to create option to the landless and poor; and improve gender equality in women economic situation and social status within the community (SARDP-PCU, 2005, BoFED, 2001).

3.3.3 Strategies

The overall strategies of the program (mainly SARDP III) include:

Research and demonstration: The program will demonstrate alternatives for improving the food security status and strive to reduce poverty first, using experiences already available from SARDP previous phases and skills and experiences available at local, regional as well as national level. Building on such successful work the program will seek to facilitate the dissemination as well as integration of successful participatory planning approaches and methodologies into the government working system, while also testing/ piloting for additional best practices and approaches in the area of NRM, agriculture, off-farm and non-farm income generating opportunities and to secure sustainable livelihoods.

Capacity building: Improve the capacity and capability of individuals, communities, community based and governmental institutions through transfer of skills and provision of technical, material, logistic and financial support so that they will be able to plan and implement food security interventions that will respond to farmer's priority needs.

Formulation and adoption of appropriate implementation and management systems and structures which will gradually take over the responsibility for coordination of development works in the respective woredas without reliance on external support.

Phased withdrawal: During the first three years SARDP will have to be fully involved in implementing the activities in the target woredas and enhancing the management and technical capacity of community and the government institutions through training, financial, materials/logistics support. In the final year, the program will withdraw from direct involvement in implementation and concentrate on overseeing technical back-stopping and final training to government partners and community institutions to take over to scale-up the proposed activities in the selected woredas. The phase II programme document clearly states the principles underlying the Programme's strategy for sustainability and phasing out. "*The basic principle for the ANRS-Sida cooperation in rural development is that the Sida support should be catalytic and initialising. Thus while the financial and technical support shall be gradually phased out, activities should continue, either self-propelled in a sustainable manner, or with the continued support of the ANRS Regional Government*" (BoFED, 2001).

Scaling up, disseminating and sharing project experiences: Identification and promotion of successful approaches and interventions for potential application in similar woredas in the region. Disseminating through publishing and distributing lessons and networking by establishing links with agencies involved in similar work and exposure visits.

The program focus is thus reducing poverty by all measures. The **objectives of the program** although varying from phase to phase all had common strategic drivers which is either improving the livelihood of the community or contributing to poverty reduction. The primary **target groups** are small holder farmers, rural women, vulnerable groups, private sector/entrepreneurs, and *woreda* and *kebele* administrations (see program documents I, II & III). Various sectors at all levels engaged in rural development and poverty reduction are secondary targets of SARDP.

The major **interventions** of the program to secure achievements of purposes and goals are mainly categorized into four major pillars, especially emphasized in SARDP III. Initially, the program had around 19 components (during the first Phase) and four pillars and a number of components during the second phase. In the third phase, the four major pillars include;
- Agriculture and natural resource management
- Economic Diversification
- Infrastructure and social service development
- Decentralization
- The cross-cutting issues, i.e. gender equality, HIV/AIDS, and population are mainstreamed in the four major components.

95

More than 27 outputs & 108 output and outcome indicators have been included in the LFA, though revised at a later stage.

Figure 2: Major components and sub-components of SARDP III
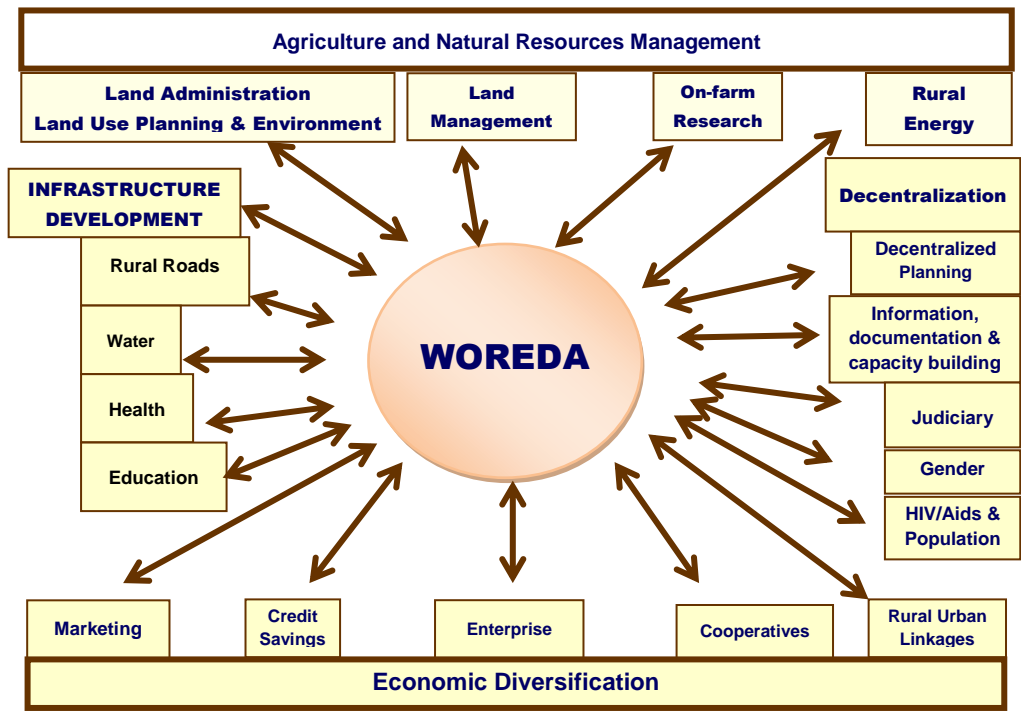
Source: SARDP III – Program Document, 2005

Table 3: Key features of SARDP Phases

Phase	Timeframe	Total budget SEK million Birr million	Geographical coverage	Goal or overall / development objective	Target groups	Components	Main focus for capacity building & implementation
Phase I	April 1997 to Dec 2001	**SEK** 283 m. **Birr** 247 m.	E/Gojjam Zone: 4 Woredas S/Wollo Zone: 5 Woredas,	"**Living conditions** for the rural population of the ANRS improved by a sustainable increase in **agricultural productivity** and **natural resource use** as well as **economic diversification**".	• Farmers, rural women and private sector entrepreneurs. (female headed households, displaced, landless and handicapped persons) • Woreda administration & Bureaus	• Woreda-based support. • Agricultural research extension and livestock. • Rural roads. • Agric marketing, input supply and rural credit. • Economic diversification. • Institutional strengthening at Regional level.	• More focus on regional capacity building:
Phase II	Jan 2002 to June 2004	**SEK** 250 **Birr** 245 m.	E/Gojjam Zone: 8 Woredas S/Wollo Zone: 8 Woredas,	"Improve the **living conditions** for the rural population of the ANRS through a sustainable increase in **agricultural productivity** and **natural resource** use as well as through **economic diversification**".	• farmers, rural women and private sector entrepreneurs • Woreda administration & Bureaus	• Support to Woredas. • Support to Agricultural production. • Infrastructure and enabling environment. • Institutional support.	• Shift in focus to Woredas.
Phase III	July 2004 to June 08 with an extension to June 2010	**SEK** 300 m. Woreda: 217 m. Bureau: 38 m. Mgmt: 45 m. **Birr** 347 m.	E/Gojjam Zone: All 14 Woredas S/Wollo Zone: All 16 Woredas,	"To contribute to the **poverty reduction** of the Amhara Region by improving **food security** conditions of the population in **30 Woredas** of E. Gojjam and S. Wollo".	• are farmers, rural women and private sector entrepreneurs • Woreda administration & Bureaus	• Agriculture and Natural Resource Management. • Economic Diversification. • Infrastructure and Social Service Development. • Decentralization. • Cross cutting issues.	• Emphasis on direct support to *kebeles* (Community Development Fund).

*Note: Budget figures as in Programme Document (not adjusted).*

Source: SARDP PCU (2008) SARDP III Internal Impact Assessment

97

3.4   Organisation & management

SARDP is an integrated rural development programme planned and implemented by ANRS and assisted by Sida; the two liaise about development policies, financing, planning and follow-up of programme activities. Communities and institutions at the *kebele*, *woreda*, zone and regional levels plan and budget activities on an annual basis, within the framework of programme document, that they themselves will implement and monitor. SARDP is associated with BoFED and has operational 'units' appended to BoFED at the various levels. The program is managed by PCCs at all levels which provides guidance on policy and implementation issues that affect overall programme development; this might include political commitments, formulation of development strategies, allocation of resources and recommendations for major changes in the programme and policy dialogue with the donor. The zone and *woreda* PCCs guide the programme at local level. They work with the beneficiaries of the programme, which are the traditional and formal institutions, interest groups and individuals participating in the programme (see SARDP-PCU, 2005).

PCUs at region and zone levels are mainly responsible to facilitate and coordinate the planning, implementation and monitoring and evaluation of the program. Each beneficiary Bureau and line sectors at *woreda* level have technical counterpart staff. At *woreda* level the program is coordinated by focal persons who are not full time. A technical advisory service provided by an international consulting company through a competitive bidding process. The main role is to build capacity through developing systems, mentoring, and innovations. SARDP strives to make efforts not to overlap with other donors in programme woredas and share its experiences to achieve synergy. A case in point is the Rural Water Supply & Environment Program and Productive Safety-net Program. The program has established M&E system agreed between the region and Sida, albeit with some weaknesses (see Wang & Admassie (2007) and Thompson (2006).

Figure 3: Structure of the administration of SARDP.
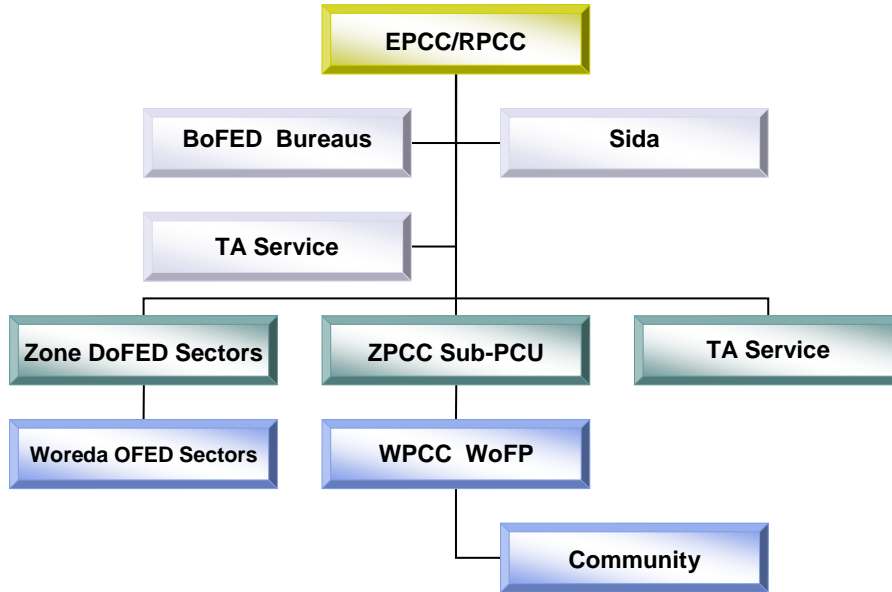
3.5   Budget allocation & utilization

As per the specific agreements made between Sida and the regional government more than 800 million birr has been committed for all phases and about 92% is utilized. The budget allocated to program woredas follows the block grant transfer system adopted by BoFED, especially for capital projects. During the first and second phases, the lion's share of the program budget was earmarked to region level institutional capacity building, rural roads rehabilitation, and agricultural extension and research activities. But in the third phase, there was a complete shift from region to woredas. Only specific projects that could directly or indirectly support the *woredas* effort have been financed at Region level. More than 70% of the program budget was earmarked directly to program woredas. Furthermore, beneficiary communities have contributed at least 25% of the investments cost in the form of labor, material and cash. Table 4 shows the planned and actual utilization of budget of the program.

Table 4: Phase I – III SARDP budget allocation & utilization (in million Birr) 30 June 2008

	Phase	Allocated (Birr)	Utilized (Birr)	%
I	(April 1997 to Dec. 2001)	246,717,000	216,502,649	88
II	(January 2002 to June 2004)	244,679,245	208,166,200	85
III	(July 2004 to June 2008)	379,655,566	375,303,601	99
	Total	**871,051,811**	**799,972,450**	**92**

Source: SARDP (2008) SARDP Impact Assessment & annual reports.

N.B. The budget allocation and utilization for phase III doesn't include, the extension period budget committed by Sida, which is SEK 80 million.

4. Major achievements

4.1 Output level achievements

4.1.1 Agriculture and NRM

One of the most successful interventions of SARDP is the land administration system development. The major objective is to ensure security of land tenure. The pilot program was initiated in 2002. The first and foremost task accomplished was to develop a land administration system. The system was piloted in two *kebeles* in both zones which was carried out successfully. Basically the ground work for establishing land administration committees at *kebele* level was accomplished in a successful way that expedited the replication of such undertaking in other *kebeles* (SARDP-PCU, 2007). It has recently been reported that out of 3.2 million rural land holders nearly (60 %) of land holdings in the region are registered and that 54 % are issued with primary certificates of holdings (Tengnans et al, 2009). Here, it should be noted that there is some data discrepancy as EPLAUA claims more land registered and certificates issued. Some woredas also reported more than 90% coverage of primary land certification, especially in South Wollo Zone.

SARDP has been supporting the promotion of small scale irrigation so as to improve farmers' income and ensure food security, especially in drought-prone areas. The major strategies include, river diversions, spring development for irrigation, pond construction and provision of training for proper management of the water and irrigation agronomy.

On-farm research (OFR) in SARDP has been designed to undertake applied research with farmers in their own environment, aiming at finding adaptable and sustainable solutions for their production constraints. OFR has been conducted on crops, livestock and natural resources. Crops research includes variety adaptation trial in cereals, pulses, oil crops, vegetables, fruits and coffee, and soil fertilization (organic & inorganic), cropping system and crop protection trials. In livestock, OFR activities include beekeeping, poultry management, dairy, fattening, aquaculture, and forage species adaptation.

Secondary seed multiplication schemes (SSMS) were initiated as of September 1997. A seed system proposal was produced and adopted. Seed grower groups were established and strengthened. Seed multiplication, which was started on a pilot basis, is now carried out widely. There has been a strong linkage instituted between the OFR and seed multiplication schemes.

The livestock sub-component has been considered as very critical to an improved livelihood of the community in the Program. In alleviating problems of the low productivity of the livestock sector, several interventions were carried out. Major interventions with regards to this component included the provision of AI services for selected farmers' cows. Considerable support was provided to dairy production and construction of veterinary clinics in many kebeles. Besides, emphasis was laid on forage production. Hundreds of farmers have been engaged in forage production increasing the feed availability for their animals. Some farmers resorted to adopting improved breed, thus being enabled to increase their income many fold. Several strategies were applied to foster natural resource management in program woredas to reverse the alarming situation in the program areas. Model watershed sites selected and integrated activities practiced. Different approaches have been followed to reclaim degraded lands. For instance, in East Gojjam, gully reclamation is dominant while in South Wollo, mainly SWC activities (both biological and physical) are dominant practices. Quite a number of forest nursery sites have also been supported. The detail output achievements under this pillar are depicted in Table 5.

Table 5: ANRM- Major Outputs

S/N	Intervention	Output Indicators	Achievements (end of June,2009)	Challenges
1.	Improved land administration and land use planning	1.1 Primary land certificate issued to a number of households	860,754	• Budget constraint • Shortage of skilled manpower
		1.2 Number of kebeles, land demarcation and registration completed	404	
		1.3 Number of pilot land use plans prepared	27	
		1.4 Number of environmental clubs established/ strengthened	1,206	
2	Crop production technologies promoted, improved seed multiplication system in place	2.1 Ha of land covered by improved seeds multiplication	3387	• Up stream and down stream conflict in irrigation sites • Shortage of improved and basic seed supply and technology multiplication • loose linkage of research and extension
		2.2 Number of seed grower groups established/strengthened	467	
		1.3 Number of FREGs established/strengthened	338	
		1.4 Number of irrigation schemes constructed	River Div. 105, spring 67, upgraded SSI schemes 50	
		1.5 Ha of land covered by modern irrigation	1,295	
		1.5 Number of WUAs established/ strengthened	59	
3	Increase supply of improved livestock technologies	3.1 No. of community & project forage nursery sites established/strengthened	505	• Shortage of improved livestock breeds • Shortage of feed in drought prone areas • Open grazing system • Inadequate veterinary technicians.
		3.1 Number of improved heifers & sheep breeds distributed	467	
		3.4 Number of cows served by AI	2045	
		3.4 Number of Vet clinics constructed and furnished	51	
		3.5 Number of fish ponds established by households	6	
4.	Natural resource management	4.1 Gulley treatment in Ha	546	• Free grazing • Low survival rate • Eucalyptus dominated sites • Expansion of steep slope cultivation.
		4.2 Ha of degraded land rehabilitated	25	
		4.3 Model IWSM sites established	117	
		4.4 check dam, cut of drain, bunds (Km)	1,765	
		4.4 Number of forest Nursery sites established/strengthened	1053	
		4.5 Number of tree seedlings planted (million)	more than 14	
		4.6 Planting seedlings (ha)	353	
5	Strengthen the extension system	5.1 Number of FTC constructed and furnished	51	
		5.2 Number of farmers, DAs, *woreda* experts trained	33,093	
6	Rural energy technologies disseminated	6.1 Household woodlots (ha	251	• Weak institutional support • Low adoption rate
		6.2 Improved stoves distributed to rural HHs	1164	

Source: SARDP annual reports, Results report (2009), SARDP On the ground (Special issue June, 2008)

4.1.2 Infrastructure

To improve access to infrastructure and social services, rural and village roads have been constructed, rehabilitated and maintenance work accomplished. To sustain the constructed roads road care takers have been trained and length-person maintenance system put in place. Moreover, primary schools and primary health posts and health centers have been constructed and upgraded together with constructing additional blocks. School furniture (mainly combine desks) has been distributed to improve the teaching learning process. To increase the potable water supply coverage in rural areas including small towns, a number of springs, hand dug wells, and distribution systems have been constructed. In alleviating problems of failure in sustaining water points, water committees comprising mainly of women in most water supply schemes have been established. Trainings were also provided to community members on management of water supply schemes and maintenance. User fee system is also put in place. Table 6 shows the major outputs achieved under infrastructure & social service pillar.

Table 6: Infrastructure & social service outputs

S/N	Interventions	Output Indicators	Achievements (end of June,2009)	Challenges
1.	Access to road networks increased	1.1 Km of rural roads constructed	1248	▪ Old machineries ▪ Budget constraint for major maintenance work.
		1.2 Road density (km/1000 sq. km)) (base year 0.08)	0.116	
		1.3 Number of bridges constructed	19	
		1.4 Number of fords constructed	161	
		1.5 Number of road foremen trained and organized	501	
2.	Access to primary education increased	2.1. Number of primary schools constructed	240	▪ Quality of school constructions ▪ Price rise for construction materials
		2.2. Number of ABE & satellite schools constructed	80	
		2.3. Number of Combined desks distributed	38,187	
3.	Access to Primary health increased	3.1. Number of primary health posts constructed	216	▪ Quality of health facilities constructed ▪ Price rise for construction materials ▪ Lack of credible local contractors in remote areas.
		3.2. Number of health centers constructed	33	
		3.3. Number of health posts upgraded to health centers	40	
4.	Access to potable water supply increased	4.1. Number of springs developed	526	▪ Ground water depletion in draught prone areas
		4.2. Number of hand dug wells constructed	660	
		4.3. Number of town water supply schemes	7	
		4.4. Number of artisans trained	152	

Source: SARDP annual reports, Results report (2009), SARDP On the ground (Special issue June, 2008)

4.1.3 Economic diversification

The objective of the economic diversification component is to improve the income and job opportunities of the rural poor through promoting non-farm and off-farm activities. The major sub-components include provision of BDS including business consultations and local resource based skill trainings, strengthening of EDF support, strengthening of urban rural linkages, fostering organization and networking among institutions and business operators and LFIs. The major achievements are depicted in Table 7.

Table 7: EDC major outputs

S/N	Interventions	Indicators	Achievements (end of June, 2009)	Challenges
1.	Demand driven BDS strengthened	1.1 Number of businesses consulted & linked to BDS	5133	▪ Dependency syndrome. ▪ Low quality product. ▪ Private BDS providers infant stage ▪ Market problem.
		1.2 Number of beneficiaries participated in local resource based skill trainings provided	6069	
2	Enterprise Development Facility (EDF) Strengthened	2.1 Number of woredas covered by EDF	14	▪ Small loan size. ▪ Inadequate & no alternative funding ▪ Group collateral. ▪ Formal banks lack interest.
		2.2 Number of business plans prepared	1,476	
		2.2 Number of SME operators served through MFIs	1462	
		2.3 Total amount of loan disbursed (Birr)	17.84	
		2.4 Loan repayment rate (%)	96	
3	Organization development & networking	3.1 Number of cooperatives strengthened	448	▪ Capital shortage. ▪ Poor quality of products. ▪ Market problem.
		3.2. Number coop members trained	17,551	
		3.3. Number of specialized coops (dairy, apiary, gum & incense, etc) strengthened	174	
		3.4. Number of women & Youth groups supported through IGAs	263	
4	Urban Rural Linkage strengthened	4.1.Number of market centers established/upgraded	427	▪ Low standard & quality of market centers
5	Local Financial Institutions (LFIs) strengthened	5.1.Number of SaCCOs established/ strengthened	108	▪ Lack of capital ▪ Weak Capacity

Source: SARDP annual reports, Results report (2009), SARDP On the ground (Special issue June, 2008)

EDF is relatively at infant stage launched since 2007 in 14 pilot program woredas (8 in South Wollo and 6 in East Gojjam) with the objective to serve the underserved business operators and tap the region's endowment. The woredas are selected after potential assessment has been done in a participatory manner. The scheme is being guided by a manual agreed upon between the Region and Sida. It is designed in such a way that it incorporates private BDS providers (i.e. Geni and SAK with 27 hired BDS providers), flexible loan guarantee arrangement instituted through agreements made with the respective MFIs (i.e. ACSI and ABAY Ber SACCO Union) following competitive bidding. AMSEIPA at all levels is responsible to manage and coordinate the scheme on behalf of the regional government. A voucher system is also designed & put in place to encourage private business operators to share part of the cost of business plans prepared by private BDS providers. So far operators have covered 15-20% of the cost incurred to prepare business plans. The business plans are further scrutinized by MFIs for lending depending on their policy. The loan ceiling has improved a little bit compared to the regular practice, albeit it is still found to be small. On the other hand, there is increasing demand for more loans both to new businesses start up and expansion. For instance, individual borrowers can secure Birr 10,000-15,000 while group borrowers can get up to Birr 35, 000.

So far about birr 19 million has been allocated and Birr 17 million (94%) disbursed. ACSI has earmarked Birr 7 million from own source as per the loan guarantee arrangement. The repayment rate is so far encouraging (i.e. 96% of the matured loan is repaid as at end of June, 2009). Hitherto, a total of 1431 individual and 31 cooperative operators have been benefited (about 24% are women operators). Sectoral share of businesses is in the order of 17%, 26%, 35%, and 22% for agriculture, manufacturing, trade and services, respectively (SARDP-PCU, 2009). This shows that the operators mainly tend to focus more on trade and service sectors.

SARDP has been supporting the Amhara Credit and Saving Institution (ACSI) mainly through availing loanable funds (43 million birr), especially during phase I and II, and through capacity building (staff training and establishing IT based MIS). The outreach coverage of ACSI has eventually increased. As end of May 2007 ACSI has 1,054,892 clients who had access to credit services. Its *woreda* and *kebele* level coverage reached 100 & 80%, respectively. The saving clients have also reached 99,649 and a total saving balance of Br 416 million is recorded. In SARDP program woredas it has served about 158,323 clients (of which 48% are women). The total saving mobilized in the program woredas was about 53 million (SARDP, 2007). Furthermore, specialized farmers' cooperatives and LFIs have been supported by SARDP.

105

4.1.4 Decentralization & cross cutting issues

SARDP has long been assisting the decentralization process in the Amhara region in general and the two program zones in particular through building institutional capacity at grassroots level and establishing a funding facility called Community Development Fund (CDF). The program is pioneer to introduce *woreda* block grant transfer system in the region. The *woreda* development fund (WDF) and community development fund (CDF) at *woreda* and *kebele* levels, respectively are considered as best practices of SARDP. It has instituted participatory planning, implementation, monitoring and evaluation in the program woredas through trainings and preparation of program documents and annual plans and budget. As a result all program woredas have prepared their rolling plans in a participatory manner.

CDF is a funding facility to promote community initiatives and foster participation during planning and decision making process as well as procurement and financial management. Two kebeles from each program *woreda* have been selected to set up CDF scheme. The program has developed guidelines in the area of planning, procurement and financial management. The planning process is facilitated by the community empowerment steering committees (CESCs) elected by the community itself. Out of five CESC members, at least 2 are women. The Woreda and sector offices are mainly responsible to provide technical support. Most CDF Kebeles have established permanent offices. Beneficiary communities are presumed to contribute a minimum of 25% of the costs of projects as matching fund to what SARDP has committed. So far CDF beneficiaries have contributed 35% of the total investment cost for community projects. So far a total of 145 CDF kebeles have been established and 496 small community projects prepared and executed. The projects are related mainly to primary school construction, health post construction, potable water supply, horticulture and fruit production, gully treatment, *kebele* administration office, and school library. Detailed output level achievements are depicted in the following table.

106

Table 8: Decentralization: Major outputs

S/N	Interventions	Output Indicators	Achievements end of June, 2009	Challenges
1.	Capacity of local governments strengthened	1.1 Number of *woreda* & *kebele* leaders trained in short-term trainings	200	▪ High turnover of staff. ▪ Budget constraint for maintenance of machineries. ▪ Unscheduled meetings
		1.2 Long-term trainings facilitated to woredas (No. of trainees)	128	
		1.3 Number of *woreda* offices constructed	12	
		1.4 Number of tractors & trailers distributed	60	
		1.5 Number of field vehicles distributed to woredas	30	
		1.6 Number of youth centers constructed	10	
2.	CDF promoted and established at k*ebele* level	2.1 Number of CDF kebeles established	145	▪ More focus to basic services, less to IGAs
		2.2 Number of CESCs members trained	978	
		2.3 Number of community projects accomplished	496	
		2.4 Total investment costs (Birr) of projects	21.8	
		2.5 Community Contribution (%)	34.7	
3.	Local Justice & conflict resolution capacity strengthened	3.1. Number of social court judges trained	28,076	
4.	Participation of women in planning& decision making strengthened	4.1. % of women in community committees	25	▪ Gender bias ▪ Lack of commitment ▪ Gender mainstreaming
		4.2 Number of women forums established	118	
		4.3 Number of networking and advocacy groups established	3797	
		4.3 Number of Kebeles that conducted gender analysis	99	
		4.4 Number of HTP/VAW committees established	1150	
		4.5 Number of girl's dormitory constructed and furnished	8	
		4.6 Number of girls' clubs established	1835	
		4.7 Number of women groups supported through IGAs	635	
5.	Capacity to prevent &control HIV/AIDS strengthened	5.1. Number of Community conversations conducted	3930	▪ Stigma and discrimination not yet overcome. ▪ Lack of commitment
		5.2 Number of mobile VCT centers established/supported	3446	
		5.3 Number of anti HIV clubs established/strengthened	1006	
		5.4 Number of PLWHAs & OVCs member supported through IGAs	9676	
6.	Information & documentation centers established	6.1 Number of documentation centers established	32	▪ Shortage of technical staff, ▪ Lack of equipment, ▪ Low coverage at grassroots level
		6.2 Number of centers strengthened through material provision	12	

Source: SARDP annual reports, Results report (2009), SARDP On the ground (Special issue June, 2008)

107

4.2   Capacity building at regional level

Regional institutions have benefited a lot from the program mainly in building institutional capacity. A number of technical staff from Bureaus and similar institutions (e.g. Research & extension) have attended long-term and short-term trainings. Besides, all beneficiary Bureaus were assisted in acquiring computers and vehicles. BoFED and ARRA were the most benefiting institutions as the program has assisted both Bureaus to build offices (SARDP, 2007). BoFED has also established IPIS to improve its data management and regional coordination plan. The land administration and environment protection authority is also the major beneficiary of the program. The establishment of EPLAUAB and the land administration institute under the aegis of the Bahir Dar University is a testimony of this fact. Through the support of SARDP, 25 technical staff, mainly drawn from EPLAUA, have been trained at MSc level through a tripartite MoU made between EPLUA, BDU and KTH, a technical college based in Sweden. The Amhara Mass Media Agency has also benefited from the program. Through the financial support of the program, the Zeghe radio transmission center is established and is serving the public in disseminating information. There are also many other Bureaus that have been supported by SARDP to build their institutional capacity.

4.3   Outcomes
4.3.1 Methodology of program impact assessment & evaluation

The program management and Sida have commissioned three important assessments to evaluate the program outcomes and documenting achievements, lessons learnt, and best practices of SARDP. These are SARDP impact assessment (Gosage et al, 2008) the external evaluation (Tengnans et al, 2009) and updated results report (SARDP-PCU, 2009). The assessments focused mainly on six broad categories: viz, (i) improvements in livelihoods, income and food security, (ii) improvements in agricultural production and productivity, (iii) improvement in the use and access to infrastructure and social services, (iv) improvement in employment as a result of EDC (v) institutional and social improvement and (vi) sustainability. For this particular assessment impact was understood as follows.

"Impact" relates to the "lasting or significant changes (positive or negative, intended or not) in people's lives brought about by" the various interventions supported by the programme. The overall impact of SARDP is therefore primarily concerned with the

lasting reduction in poverty and improvements in livelihoods of the people in the programme-supported areas (Gosage et al, 2008, p.11).

The method followed to conduct impact assessment and external evaluation was in general objective and robust. For the internal impact assessment, the core team was drawn from the program management and two external consultants with rich experience in M&E were recruited. Household questionnaires were designed and administered at *kebele* and household levels. Trained enumerators were recruited to fill questionnaires in 16 first in program woredas embraced since the launching of the program. Interventions were selected with most direct or likely influence on impact from each component. Survey findings were triangulated with indicators of the nearby zones, albeit paucity of data was a major drawback. To reinforce the survey findings, focus group discussions have been conducted in sample woredas by the core team. In addition reviews of secondary sources have been made. A simplified model of change and impact was adapted, and mainly, before and after program approach method applied though it has some limitations to consider the dynamic situation. Before the analysis, data entry and cleaning accomplished to produce result tables for further analysis (Gosage et al, 2008).

Some of the limitations of the impact assessment included: the assessment has focused mainly on 16 first- in program woredas, though findings could reflect realities of other program woredas; difficultly to find detailed, accurate and measured information on actual income, expenditure and production and reliance on recall during a single visit; no control (counter factual) to compare current situations with a situation in the absence of the program; and difficulty to find reliable secondary data for some variables. The team, however, has tried to minimize these limitations through triangulation with information gathered through group discussions.

The external evaluation team followed somehow similar approach to gather information at field level. More qualitative approach was, however, followed to assess the impact of the program at household level. A total of eight sample woredas were selected purposely & based on certain criteria without overlapping with those woredas covered by the internal impact assessment. The team conducted detailed discussions with Sida, OSC, PCU and various beneficiary Bureaus before the field visit. The team was organized in sub-teams and followed slightly different survey methods. The first team focused mainly to evaluate the impact of SARDP as a whole at community, household, and individual levels to do in-depth impact assessment. For this purpose eight woredas and four Kebeles were selected. Structured questionnaires were administered and detailed discussions held.

109

On the other hand, the second team has tried to focus mainly on activities accomplished by SARDP phase three. Office level discussions and field visits in selected sample schemes have been conducted. Moreover, the land administration specialist has made rapid field visits in East Gojjam program zone and two adjacent non-program zones. Stakeholders debriefing session has also been conducted to further refine the findings. The team has also tried to follow Sida's evaluation criterion which is a standard practice to evaluate a program like SARDP. This consist relevance, effectiveness, efficiency, impact and sustainability. The main limitation of the external evaluation was the fact that it was mainly dependent on qualitative information. However, the team has tried to complement and triangulate findings with that of the internal impact assessment.

SARDP result report was another source of information for this paper. The result report was prepared based on annual reports submitted by beneficiary woredas and Bureaus and information gathered through the M&E system directly from program woredas. Effort has also been made to triangulate the *woreda* data with the respective Bureaus statistics (Tengnans, et al, 2009). The limitation of the report is the fact that in some cases, the *woreda* information was inconsistent and some differences have been observed. The team, however, has tried to minimize such difference through triangulation with statistics available at regional level. The issue of "attribution" was also considered. In general, in all cases, it is confirmed that the contribution of SARDP to poverty reduction is commendable.

4.3.2 SARDP outcomes

I.   Improvements in livelihoods, income and food security
- According to the impact assessment report there is some kind of diversification into non-farming activities with trading (including food and drinks) found to be important for around 13 % of households and handicraft being important for 7% of households as compared to 5% and 3%, respectively before the program (Gosage et al, 2008).
- The external evaluation team also concluded that the economic diversification at farm level can be witnessed from planted new crops like durum wheat, new and more vegetables, like sesame and potatoes on a large scale, as well as some other kinds of crops. Within animal husbandry there are improved breeds, especially milk cows, some sheep, modern beehives and even fish. There are also highland fruits as well as fodder plants (Tengnans et al, 2009).

- Household food security has also improved. 78% of households in East Gojjam and 60%of households in South Wollo confirmed that they are able to produce sufficient income or food to cover own annual food requirement compared to 35% and 1% before the program (Gosage et al, 2008).
- Household income was felt to have increased by a majority of 73% of surveyed households in the different areas. Around 17% felt income had increased considerably while 18% felt it had decreased (Ibid).
- Almost half of the surveyed households (52%) have reported to have savings with the majority of households saving a relatively modest amount of around 3,000 Birr (Ibid).
- The literacy rate has improved (74% on average compared to 38%); the ratio of boys to girls at primary school is found to be 49% to 51%. The proportion of household members who had never attended school was also found to have improved considerably compared to the baseline situation (reduced from around 75% to 19%) (Gosage et al, 2008).
- A majority of surveyed households (76%) felt that their overall living condition had improved (18% a "little" and 58% a "lot") over the past five years. Some households, however, felt that it had stayed the same (12%) while 13% felt it had got worse. A relatively small but important number of households (3%) felt that their living standard had declined a lot. An important factor in the decline in living standard for some households appears to be their lack of resilience to withstand the effect of climatic or economic difficulties on their production systems (Ibid.).
- The external evaluation team also concluded that:
 "Over the long implementation period it is apparent in many ways that the living conditions have improved for most people. Some of the baseline information provided a valuable basis for an objective assessment. Examples are parameters on housing standard and school attendance. Further investigation reveal that improvements are also clearly noticeable on health, general awareness on hygiene, family planning, and on food security including diversity of diets (Tengnans et al, 2009).

II. Improvement in agricultural production and productivity
- The external evaluators' team stated that perception of tenure security has increased among those who got some form of land certificate. For other groups, however, those who are deemed to be illegal occupants, the tenure security may de facto have worsened in the process (Tengnans et al, 2009).
- Crop yields and productivity appear to have increased (around 10%) on average and for just over half of the households (51%). SARDP's contribution is significant. The

111

productivity of wheat and maize increased from 16 in 2003/4 to 20.7qt/ha in 2007/8 production year and maize from 17 to 40 in the same comparable years (SARDP-PCU, 2009).

- Crop yields for farmers in East Gojjam with one harvest/year when using all the required inputs increased with about 75% to 150%. Crop yields in south Wollo increased somewhat less, but were still high (Tengnans et al, 2009).

- Farmers with access to irrigated land obtained 3 harvests per year implying an increase of about 200% (IBID, 2009).

- It can be concluded that irrigation has contributed to improved incomes and livelihoods for around 20% of surveyed households and that SARDP has made a major contribution (from 50% to 100% in different areas) (Gosage et al, 2008).

- Around 70% of households reported income from sale of animal products. The sale of livestock was reported as a high priority means of coping with food shortage by 77% of households. (Tengnans et al, 2009).

- An increase in milk production from improved breeds showed a change from about 1 liter to 7-10 liters per day.

- The proportion of households using vet clinics had risen from 30% to 47% but the effectiveness of treatment is not known.

- A total of 14% of households received some support through SARDP for bee keeping, and 68% of those with bees reported improved incomes. Thus livestock continue to provide an important supporting role in the livelihoods of over 90% of households (Gosage et al, 2008).

III. Improvement in employment and income

Local level skills training and other support directly from the programme help the target groups to set up their own micro-enterprises. The most useful courses were said to be metalwork, woodwork, weaving, pottery and food processing.

- Around 45% received some material support and mostly (94%) found this useful. Around 54% were able to access credit from a bank, ACSI or a cooperative while 17% borrowed from friends or relatives (most common in South Wollo) (Gosage et al, 2008) .

- All entrepreneurs reported starting their business and producing some annual income which ranged from 400 to 36,000 Birr (mean 5,254 Birr).

- Around 60% said their income from the business and supplementary sources was sufficient to cover household needs.

- 70% had started repaying their loans.
- Around 53% said they had been able to expand their business or start a new one though this may be optimistic.
- Around 83% of entrepreneurs said that their business had enabled them to improve their living condition though the majority felt there had only been a slight improvement (Gosage et al, 2008).

IV. Improvement in access and use of infrastructures
- Through concerted efforts by all actors, primary education service coverage has increased from 67.8% in 2003/4 to 98.1% in 2007/8 (SARDP-PCU, 2009). The household survey had found that the number of household members who had never been to school had decreased, and literacy had improved since the baseline survey (Gosage et al, 2008).
- The health service coverage has increased from 39.2%, during 2003/4, to 98.9% in 2007/8, though health coverage calculation remains unclear (SARDP-PCU, 2009). Moreover, around 56% of women use contraceptives and 95% of respondents were aware of HIV/AIDS (Tengnans et al, 2009).
- Potable water supply service coverage has increased from 22.3% in 2003/4 to 47.0% at the end of 2007/8 budget year due to all actors operating in program woredas (SARDP-PCU, 2009).
- Around 70% of surveyed households felt that access to safe drinking water had improved. The proportion of households using unsafe water sources (unprotected springs, river and open water) had reduced from 79% to 37% of households. Around 86% of households felt that this had had a beneficial effect on the health of household members (Gosage et al, 2008).
- The road density of program woredas in the base year (2003/4) was 0.085 km/km2. It was planned to increase the density to 0.120 km/km2 at the end of June 2008. With concerted efforts it is possible to increase road density to 0.116 km/km2 at the end of 2007/8 fiscal year. The contribution of SARDP is significant. As a result, 405(49.0%) of the rural kebeles (826) are connected to neighboring kebeles and *woreda* capitals (SARDP-PCU, 2009).
- Surveyed households estimated that the time to reach the nearest market place has been reduced by 28%, health facility by 46%, primary school by 36%, vet clinic by 35%, protected water source by 48%, dry weather road by 45%, and all weather roads by 22% (Gosage et al, 2008).

113

V. Institutional and social development

According to the findings from the impact assessment and external evaluation, the results are both positive and negative.

- From the negative side, though there was significant investment in capacity building, it does not seem to have had as much impact as it should. Capacity, institutional strength and the revenue base remain as issues of concern which need to be addressed (Gosage et al, 2008).

- From the positive side, however, *kebele* and community level institutions on the other hand appear to have improved significantly through the influence of the programme and other factors.

- The "Community Development Fund" which provides cost sharing support (around 35% local contribution) with capacity building for community planned initiatives, appears to have been particularly successful at building local capacity, ownership and confidence and at the same time, providing much needed facilities according to local needs (Ibid, 2008).

- Gender awareness and participation of women had improved at household and community levels though there is still a long way to go. Increased primary school attendance and improved literacy should, however, build further improvements over time (Lopcit, 2008).

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Furthermore, the external evaluation team (Tengnans et al, 2009) made the following conclusions based on Sida's evaluation criteria, particularly with regard to SARDP III.

- **Overall:** The program can be seen as a good example of an area-based program. However, the program is generally better as a doer than as a reporter and analyzer.

- **Relevance:** all have benefited from infrastructure, especially roads connecting them to neighboring kebeles and woredas. Peoples' priorities, expressed as to have close access to schools, health posts, water and markets, have also been fulfilled for many of them.

- Some segments of the farming population has benefited more than others (they are medium and better off farmers). Limited interventions have been developed for the resource poor farmers, to which category many female-headed households belong, which is a drawback.

- Decentralization efforts beginning with support to the regional offices, then to woredas and finally to kebeles must be considered as relevant.

- **Effectiveness:** Investments in agriculture, land, infrastructure, decentralization have all made a difference in the improvement of living conditions. The gender gap has

114

almost been eliminated at primary school level and early marriage and violence against women have been markedly reduced. There are also self help groups to address women's economic, social and empowerment issues.

- **Efficiency:** SARDP has not been able to provide the team with any cost benefit analysis which covers all three phases.
- **Impact:** The fact that the farmers in the zones covered by SARDP have improved their standard of living is visible in the number of houses with corrugated iron roofs, in the variations in people's diet and in the fact that most now seem to eat three meals a day. There is less vulnerability to famines today and poverty has been reduced although this can be attributed to better prices of agricultural produce, the safety net and food aid.
- **Sustainability of results:** Awareness created related to health issues, staffing of health institutions by government, knowledge of improved seeds by farmers producing their own seeds, the use of compost, and of fertilizers are indications of sustainability. The decentralization interventions also contain a certain amount of sustainability in the sense that all the institutions are the government structure. However, staffing model and lack of inbuilt maintenance system for water schemes and roads is a concern.

In general, from the foregoing discussion, it can be inferred that SARDP has made significant contribution to the reduction of poverty in the Amhara Region, especially in the two program zones, even though a lot remains to be done to widely and particularly reach the resource poor farmers like female-headed households. The following section summarizes best practices that the program has achieved.

5   Best practices

Over the years SARDP has collected, compiled and documented a series of "Best Practices". These are interventions that have been positively received by different stakeholders. For agriculture and the farming communities this includes activities and practices that can put more money into their pockets, while for other sectors the best practices concern improved management systems. The following examples can be highlighted:

Land: SARDP has pioneered land administration in Amhara, by having identified and put in place a comprehensive system for demarcation and computerized registration of

individual land holdings, providing land security to the farming community. This land administration system developed in Amhara is now standing as an example to other regions.

Crop production: Mechanisms for seed multiplication and distribution have been established, highland fruits introduced and high value crops identified. Ways of constructing small scale irrigation schemes have been identified, enabling expansion.

Income generation: The introduction of an Enterprise Development Facility (EDF) has enabled a thousand of entrepreneurs and households to start and operate small businesses by getting access to loans and business advice. With additional funding becoming available, EDF has an enormous potential in generating further job opportunities and provide income in rural areas.

Infrastructure: Not only has the programme built rural roads, schools and health clinics, but also established maintenance practices that for the road sector give certain section of the roads to certain communities or better known as "length person system". For water supply systems there are established frameworks for Water Committees and for the irrigation schemes there are Water User's Associations.

Transparency: By systematically establishing model documentation centers in the woredas, citizens can more easily get access to information, contribution to transparency.

Decentralization: The programme has introduced a participatory planning and block grant budget transfer system for the woredas that by now is widely used. In addition, SARDP has introduced a Community Development Fund (CDF) that provides individual communities with resources to undertake small development projects of their choice. As CDF has clearly demonstrated that communities have the capacity to plan and implement such interventions, this is a mechanism for decentralization that needs to become institutionalized.

6.   Challenges

Over the years SARDP had encountered some challenges, both operational and strategic. The following are the major and strategic ones that the program had encountered.

- Of the most inhibiting challenges faced so far is the issue that most of the positions in the *woreda* organizations are still vacant and *woredas* are suffering from staff shortage and staff turnover which contributed to low efficiency in some *woredas*.
- A predominant challenge in SARDP is scaling up and dissemination of best practices. It was indicated earlier that there are very many best practices that emanated from interventions expectedly in the agriculture and natural resource management component. The inability to increase the scope and magnitude of those practices has been a key set-back in SARDP. Good practices are scattered in pocket areas and could not be visibly observed.
- The harmonization of SARDP principles with other development partner approaches like productive safety net is of paramount importance for synchronization of program activities at lower levels. Although attempts have been made and improvements observed it has been a challenge at early stage for the community to perceive the development trends since it is confusing to adopt two sets of different approaches within the same locality. For instance, SARDP encourages a minimum of 25% contribution from the community while the latter effects payments for community works for the target group. Integration with NGOs was also weak.
- Lack of adequate local contractors for construction activities is usually a factor for late implementation of activities. The lack of adequate efforts to build the capacity of local contractors contributes to this challenge.
- The lack of focus and integration of interventions has made it difficult to monitor the impact of the program on beneficiaries. It has also led to scattered resource utilization to attain equity of fund disbursement to localities.
- Unplanned tasks given to the *woredas* and the *woredas* inability to cope with it i.e., poor time management between current so called 'urgent' issues and planned activities is a concern.
- Instituting a simple participatory monitoring and evaluation and database system has also been a challenge for the program. From the *woreda* up to region there is a clear reporting and monitoring mechanism. The challenge is the establishment of clear and community-based monitoring and result-based evaluation system. This emanates basically from the huge coverage and quite many indicators of the program.

117

7.   Lessons learned

A lot could be learned from SARDP, but the following are worth mentioning that can be shared so as to improve future development approaches and poverty reduction outcomes.

- Participation of local communities is one of the most important ways to build local capacity and confidence and build lasting improvements in people's lives. Community involvement in planning and implementation, community contribution of resources (cash or in-kind), making the external resources available as close to community level as possible, and building community capacity through training and learning by doing appear to be key ingredients for success.
- Capacity building and institutional development are best done from within the organization with the authority of the organization. Institutional change is difficult unless there is a clear desire from within the organization and the authority.
- Development of the private sector, micro and small enterprises, input supply, marketing, etc is crucial for the long-term development of the area. Ways must be found for people to obtain their livelihoods off the land and at the same time build rural-urban relationships and synergy which can improve the lives of both rural and urban people.
- The balance between flexibility and focus in programmes such as SARDP which have a wide thematic remit is an important issue for design and implementation. Supporting communities with capacity building and extra development funds for their own activities (as in the "Community Development Fund") does provide flexibility and focus and so resolves the dilemma in one area.
- Focus on proven interventions: While recognising the need for some flexibility to respond to needs within the remit of the programme and its logical framework, it is important also to focus on interventions which have proved to be effective in achieving the objectives and which are also cost effective as an investment.
- Sustainability is essential for the improvements produced through the various programme interventions to continue. An important approach to achieving sustainability is to incorporate a phasing strategy and plan for the evolution and phasing in and out of programme support as a natural and integral part of the design for each intervention and the programme as a whole.
- Harmony with government system: Since its inception SARDP was to operate within the government system rather than being a separate project operating outside the government system. Such a modality has helped the integration of the program as

part of the regional development program. Moreover, it has helped refine the government system.

8. Summary and conclusions

Needless to say the widespread prevalence and severity of poverty in Amhara region and the country at large is alarming and an immediate concern of the government and donors. In the region there are millions of people who still suffer from chronically food insecure situation and lack of capability. This is exacerbated by accelerated environmental degradation, rapid population growth and the spread of HIV/AIDS pandemic. The issue of land tenure security has continued to be contentious over many years. Infrastructure and social service coverage is found to be at low level compared to the national average. The underlying causes are, inter alia, weak institutional capacity at all levels, deep-rooted poverty, and unemployment. Unemployment and income inequality are worsening particularly in urban areas. But in the rural areas too landlessness, especially among the rural youth, is an emerging problem. Cognizant of this fact, the regional government has adopted a comprehensive development and poverty reduction program. The third five year development plan is a case in point which is in tune with the national program called PASDEP and the MDGs. It serves as a road map to coordinate all development actors involved in poverty reduction effort. In order to achieve the objectives of the PASDEP, concerted efforts have been made so far by all development actors including donors.

Sida has been supporting SARDP almost for a decade in the Amhara region, expanding phase by phase particularly in 30 woredas of East Gojjam and South Wollo zones. The program interventions are integrated and designed in such a way that the needs of smallholder farmers, women, marginalized groups, and communities are addressed to improve their livelihoods, service delivery and build local capacity. Among others, land administration system development, promoting economic diversification, infrastructure development and deepening the decentralization process are the major components of SARDP. The program has been spending considerable amount of capital investment and providing technical support to reach the rural poor and communities. Recently conducted assessments and external evaluation reports have, in many instances, revealed that the program has achieved its intended objectives and contributed significantly to the poverty reduction effort of the Amhara region, especially in 30 program woredas. The contribution of the program is mainly exemplified in the areas of land administration, community

empowerment, improving the income and livelihoods of the rural people in general, improving the coverage and access of infrastructure and social services in rural areas and small towns, job creation to the landless youth including women and vulnerable groups. This proves that integrated and area-based rural development approach is still valid in the case of Amhara region as opposed to the counter arguments surrounding this approach. On the other hand, SARDP had encountered some challenges, inter alia, staff shortage and high turnover, lack of focus, inadequate interventions targeted purposely for the resource poor farmers (e.g. asset less female-headed households), weak integration with similar projects & NGOs, lack of strong maintenance system for road, water and irrigation schemes and poorly instituted M&E and data base system are worth mentioning. In general, it can be stated that most SARDP interventions are relevant, effective, have some kind of proven impact and in most cases sustainable as the program is designed, owned and implemented in line with government system. It is hoped that the respective stakeholders could learn from SARDP experience to further fine-tune their development approaches and modalities.

Annex: Scheduled programme year of entry, winding out of the *woreda*, and the final extension period.

Woreda	SARDP 1990	1991	1992	1993	SARDP II 1994	1995	1996	SARDP III 1997	1998	1999	2000	Phase out 2001	2002
Awabel	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▓	▓
D.Sina	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▓	▓
Legambo	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▓	▓
Machakel	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▓	▓
Baso Libon		▨	▨	▨	▨	▨	▨	▨	▨	▨	▨		
Gozamen		▨	▨	▨	▨	▨	▨	▨	▨	▨	▨		
Kellala		▨	▨	▨	▨	▨	▨	▨	▨	▨	▨		
Sayint		▨	▨	▨	▨	▨	▨	▨	▨	▨	▨		
Wogdie		▨	▨	▨	▨	▨	▨	▨	▨	▨	▨		
DebayTilatgin			▨	▨	▨	▨	▨	▨	▨	▨	▨	▓	▓
Dejen			▨	▨	▨	▨	▨	▨	▨	▨	▨	▓	▓
Dessie Zuria			▨	▨	▨	▨	▨	▨	▨	▨	▨	▓	▓
Enarginawega			▨	▨	▨	▨	▨	▨	▨	▨	▨	▓	▓
Enemay			▨	▨	▨	▨	▨	▨	▨	▨	▨	▓	▓
Jemma			▨	▨	▨	▨	▨	▨	▨	▨	▨	▓	▓
Woreilu			▨	▨	▨	▨	▨	▨	▨	▨	▨	▓	▓
Albuko								▨	▨	▨	▨	▨	▨
Debre Elias								▨	▨	▨	▨	▨	▨
Goncha								▨	▨	▨	▨	▨	▨
Hulet Eju Enese								▨	▨	▨	▨	▨	▨
Kalu								▨	▨	▨	▨	▨	▨
Kutaber								▨	▨	▨	▨	▨	▨
Mekdela								▨	▨	▨	▨	▨	▨
Shebel Berenta								▨	▨	▨	▨	▨	▨
Tehulederie								▨	▨	▨	▨	▨	▨
Ambasel										▨	▨	▨	▨
Bibugn										▨	▨	▨	▨
Enabsesarmidir										▨	▨	▨	▨
Tenta										▨	▨	▨	▨
Worebabo										▨	▨	▨	▨
From:	Jul-97	Jul-98	Jul-99	Jul-00	Jul-01	Jul-02	Jul-03	Jul-04	Jul-05	Jul-06	Jul-07	Jul-08	Jul-09
To:	Jun-98	Jun-99	Jun-00	Jun-01	Jun-02	Jun-03	Jun-04	Jun-05	Jun-06	Jun-07	Jun-08	Jun-09	Jun-10

121

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CONTRACT FARMING: THEORETICAL CONCEPTS, OPPORTUNITIES AND CHALLENGES IN MID AND HIGH ALTITUDE AREAS OF NORTHWESTERN ETHIOPIA

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Abstract

Worldwide, contract farming is becoming progressively an important aspect of vertical integration in agribusiness. Market liberalization and opening of international trade have become the main driving forces for expansion of contract farming. Population and income increment, progress in transport facilities and associated logistics, advances in information technology are among important factors that trigger contract farming directly or indirectly. Politically, contract farming is more accepted than other forms of production and market relation in developing countries like Ethiopia where the share of small-scale producers is extensive in agriculture. Contract farming supports development of the agro-industry and export trade in various ways. It introduces new technology and enables farmers to learn new skills that help diversify production and boost productivity. Contract farming arrangements motivate small-scale farmers to use improved and recommended agricultural inputs by guaranteeing market and price. Under contract farming new markets, that otherwise are not accessed by small-scale producers, are opened. For the agribusiness firm that work with small-scale farmers, contract farming overcomes problems of land constraints. Contract arrangement is also more reliable than open market purchases in terms of volume, quality and delivery time. Traceability is also simple with contract farming. In Ethiopia, as indicated in rural development policy and strategy document of the government, well-organized contract farming that offers better and cost effective input utilization, mechanization and extension service system is considered as strategic option to transform the subsistence agriculture to market-oriented commercial farming in the densely populated mid and high altitude areas of the country. Towards realizing this strategy, various attempts are being made in mid to high altitude areas of North Western Ethiopia. Reviewers of this paper have also participated in studies that were focused on assessing possibilities of establishing successful contractual farming between the small-scale farmers and various agribusiness firms. Favorable policy

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environment, expansion of irrigation infrastructure that allows production and year round availability of desired produce, suitability of the agro-ecology for production of diverse high valued produce, flourishing farmers cooperatives that can help as partners in contract farming, availability of public research and extension support etc are enabling environments for contract farming. On the other hand, lack of well organized institutional support, lack of experience in contract farming, inadequate transport and communication facilities, unavailability of seed or planting material specifically for high valued crops, unavailability guidelines and law enforcement mechanisms for contract farming etc are found to be some of the challenges of the emerging contract farming schemes.

1.   Introduction

Contract farming refers to a particular form of supply chain governance adopted by firms to secure access to agricultural products, raw materials and supplies meeting desired quality, quantity, location and timing specification (Silva, 2005). It originated in Africa in the 16th century for the supply of spices for European trading companies and has since been refined and modified to source fruits, vegetables and other agricultural commodities (Rottger, 2004).This production relation had been used as integral part of the food and fiber industry in Japan, North America and Western Europe since the late 19th century. It is still making substantial contribution in the agricultural production of these countries (Rehber, 1998).

Ghee and Dorall, (1992) state that contract farming is further promoted in recent three decades in many of developing countries found in Asia, Latin America and Africa as an institutional innovation to improve agricultural performance. It is some times considered as key element of rural development projects of developing countries. Contract farming is also accepted as a technical strategy that can be used as an institutional framework for delivery of price incentives, technologies and inputs.

Driven by market liberalization and opening of international trade, contract farming is now becoming progressively an important aspect of agribusiness in several developing countries. Consequently, local governments, private local firms, multinational companies and various multilateral and bilateral aid and lending organizations have worked and are working on various contractual farming schemes (Glover, 1994)

In Ethiopia, contract farming got attention at policy level very recently. And it is considered as a strategy to transform subsistence agriculture to commercial market oriented one specifically in the densely populated mid and high altitude areas (FDRE MoI, 2001). Limited experiences, however, were in the central part of the country. In North-western Ethiopia, which represents the West Amhara sub region, contract farming is at its infancy and is restricted to few grain crops. On the other hand, new scale up and scale out initiatives of selected agricultural commodities are being carried out in the region. The intent of these initiatives is to transform the subsistence agriculture to commercial one through transfer of available agricultural technologies in a concerted fashion. These undertakings can be destined to contract farming in order to make them sustainable. Contractual farming can be made between farmers and agribusiness firms which can be market firms or agro-processing plants. These firms can be private or vertically diversified farmers' cooperatives. Though contract farming is believed to have multitudes of advantages, lack of experience in the area may jeopardize its potential contribution. Hence, critical analysis of prevailing condition that helps to properly plan contractual farming schemes is of a paramount importance. Reviewers of this paper have participated in a couple of studies conducted in the region in order to assess availability of enabling environment that allows contractual production of selected commodities. As there has not been any document that provides pertinent information on opportunities and challenges of contract farming in the region, the authors believe that this paper can provide milestone of the background information that favors or hinders the contract farming initiatives.

2. Theoretical concepts: An overview

Contract farming is a kind of vertical integration between farmers and agribusiness firms. As a production relation, it is adopted by the agribusiness firms in order to secure access to desired agricultural products. It is usually preferred when there are no internal or external conducive environments for complete vertical integration in which the firm possesses its own farm for the supply of the produce or when risks and uncertainties are high with open or spot market acquisition of the produce. According to Eaton and Shepherd, (2001) there could be about five contractual farming models. These are the centralized model, the nucleus estate model, the multipartite model, the informal model and the intermediary model. The centralized model involves centralized processor and/or packer buying from a large number of small farmers. It is used to crops; both annual and perennial, poultry, dairy and other products that may require high degree of processing. It involves stringent quality requirement and quota allocation under vertical coordination of the agribusiness firm. The degree of involvement of the firm may range between minimal input provision to control of most

127

production aspects. This model is preferred when quality requirement of the agribusiness firm is too high and the market demand of ultimate consumers necessitates frequent change to the farm technology the centralized model is recommended. The nucleus estate model is a modification of the centralized model where the firm possesses its own central estate to secure its processing plant against irregular supplies. In addition, the central estate is used as research and technology demonstration site. This model is the usually used with resettlement schemes and involves provision of material inputs and management support. The difficulty with this model is the possibility of acquiring land because of various reasons. Under multipartite model, parties other than the farmer and the agribusiness firm have stake in realizing contractual farming. Usually these parties are public or private institutions and they may assist in extension service provision, provision of credit, input supply etc. The informal model applies to small-scale firms which make informal contract with farmers on seasonal basis. It requires government research and extension service . Informal contracts have great risk of extra-contractual marketing. Under the intermediary model the firm sub contracts with intermediate agents who collect and deliver the desired agricultural products to it. These agents could be farmers' cooperatives or other private operators. Apart from these models, experiences indicate that there are a variety of modified models that combine characteristics of one or more of the above models in such away that it can suit a given production environment.[1]

Selection among these models depends on several factors including the type of the commodity to be produced and the specificity of the firm's asset, farmers' production experience, availability of land for central estate, presence of other supportive organizations etc. In the context of mid and high altitude areas of north western Ethiopia, where farmers' average land holding is very low (less than a hectare) and where there are supportive legal institutions to these farmers, the multipartite model seems recommendable.

Based on the decision influenced by the firm and contract specification these models work under three contract types or their combination. These are: market specifying contracts, resource providing contracts and management and income guaranteeing contracts (Rehaber, 1998). Eaton and Shepherd, (2001) add land ownership and land tenure specifying contracts. Market specifying contracts denote pre harvest agreement that binds the parties on timing, quality and volume requirements and price and payment arrangements. The modality of resource providing contract adds provision of resources needed for the production to the market-specifying contract. Usually the resources are variety to be produced, fertilizer, agrochemicals, handling

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[1] For the detail account see Eaton and Shepherd, 2001.

materials, credit etc. Under management and income guaranteeing contracts the contractors agree to produce the desired agricultural produce precisely following particular technical and managerial prescription given to them by the integrator. It usually includes specification of market specifying contract and may not include resource providing contracts. The firm guarantees advanced payments need to undertake the prescription it gives. On the other hand, market and price risks are transferred from farmers to the agribusiness firm. Land ownership and land tenure specifying contracts are extension of management and income guaranteeing contracts. It, however, includes modalities related to land ownership and tenure. The integrator may need to influence farmers' practices such as crop rotation in order to avoid risk of diseases that may endanger long-term supply of the desired produce. It may also include the minimum land size that is considered for contract.

Generally, according to Williamson (1979) three factors contribute to contract farming happening. The first factor is bounded rationality, which describes difference in information between contracting parties. The firm can have excellent information about the market and the farmers may lack this. So the parties need to come together in order to benefit from what they both have. The second factor is opportunism. This describes a situation where both the contracting parties are obliged to work together in order to avoid destruction that can come from opportunistic behavior of either or both parties. For instance, the farmers may think that because of monopsony (a situation where many sellers face one buyer i.e. opposite of monopoly where many buyers face one seller) the firm can offer very low price on open market; and on the other hand, the firm can think that the farmers can unite and increase price of the produce. So in order to overcome this problem they come together to work for mutual benefit avoiding the opportunistic behavior. The third is asset specificity, the degree to which an asset is specialized to a particular product or trade. For instance, land of small scale farmers who produce Jatropha seed has high asset specificity for it is planted with perennial crops that have high cost of shifting it to production of other crops. Similarly, a firm that possesses a plant that processes only Jatropha seed with no flexibility to process other oil seeds has also high asset specificity. Therefore, these parties have to come together through contract farming, particularly when the firm has a problem in acquiring land for plantation or may not need to invest on its own plantation (Fig.1).

2.1   Advantages and disadvantages of contract farming

Contractual farming offers several advantages to small-scale farmers. The agribusiness firms will let the farmers to produce agricultural produce that have market as raw material for processing plants or as export commodities. These new

129

markets would otherwise be unavailable to small-scale farmers because of various reasons. As a vehicle of technology transfer, contractual farming enhances utilization of improved agricultural technologies and modern agricultural inputs with better technical knowledge. Hence, it improves access of small-scale farmers to modern agricultural inputs, improved agricultural technologies, credit and extension service. As there is always a guaranteed market for agricultural produce under the contract scheme, it is expected that the farmers do easily adopt innovations associated with the scheme. Under contractual farming the desired commodities are produced with pre specified volume, delivery time and quality standards. Such practices changes farmers production culture from subsistence farming to commercial farming. With contract farming traceability system can easily be installed and monitoring of quality can also be done cost effectively.

Despite these positive aspects, contract farming can have disadvantages for small-scale farmers. These disadvantages sometimes emanate from unfair advantage taken by the firm i.e. opportunistic behavior or misconducts committed by the staff. The latter can be absence of transparency on pricing, corruption etc. Farmers engaged in contracts lose flexibility on enterprise choice so as to benefit by market opportunities. This can be the case when the firm specifies land use prohibiting farmers, for instance, not to practice intercropping. Sometimes farmers may sacrifice output because of manipulation by production management or input utilization by the firm. Risks like diseases and insect build up associated with monoculture of contracted crops may also be a disadvantage to the small-scale farmers. Easy access to credit may lead to risk of mounting debt on farmers. In the long-term, contracting farmers lose their linkage with market participants other than the firm. This may increase dependence of farmers on the firm and allow it exercise monopsony. In the African context, it may spoil household power relation when the household is represented by male heads and the income is manipulated by them. Many of these disadvantages, however, can be alleviated if adequate institutional support is given to the parties by the public sector.

From the firm's perspective, the contract helps the firm to get reliable supply of the agricultural produce even under social, political, physical and economic environment that does not allow acquisition of land for large scale private farms. Contract farming is politically acceptable in many developing countries where the share of small scale farmers is predominant. With contract farming risks and uncertainties associated with open market purchase is reduced. Sunken cost on infrastructure development, land lease, cost of skilled manpower etc associated with running its own farm will not be there. Transaction costs of dealing with a number of heterogeneous farmers, extra

contractual marketing of the contracted produce or contract breaching etc are some of the disadvantages seen from the side of the agribusiness firm.

When widely practiced, alike any commercial conventional farming practice, contract farming can result in ecological problems such as loss of genetic diversity, environmental pollution associated with heavy use of agro chemicals etc (Yoon, 2006). But it has to be known that contract farming can be used for organic farming with small scale farmers in eco-friendly and economically viable way (Setboonsarng, 2006).

Generally, well-managed, fairly implemented and properly regulated contract farming can bring sustainable and mutual benefits to all the partners. Its implication on the performance of the agricultural sector and the overall economy of the nation can also be understood.

2.2   Driving forces of contract farming

The demand for agricultural products is increasing worldwide. This demand is directly associated with increasing global population, income and urbanization. With urbanization, the segment of the population that needs food produced by the rural communities increases. FAO (2005) forecasts that by the year 2015 more than half of the world population will be at the urban centers. Silva, (2005) points out that this population growth is being complemented by improved income level though the improvement varies from region to region.

Increased demand for agricultural products is scattered all over the world. Therefore predominantly agricultural countries or surplus production regions of the world need to transport and market their agricultural produces in high population areas and regions that have less comparative advantage on agricultural production. This, in turn, necessitates processing agricultural products conveniently to suit distant transportation and marketing. Increasing demand of urban consumers for ready-to-eat foods has also justified processing of agri-food products to frozen, pre-cut, pre-cooked forms (Silva, 2005). Advances in transportation, logistics, information technology etc have also simplified global trade of even unprocessed or partially processed agricultural products. Even though live foods and agricultural products like flowers can be conveniently traded among countries found at different corners of the globe, economic and social advantages associated with trading fully processed or semi processed products can be well understood.

Globalization, which is characterized by free flow of capital, goods, services, and knowledge, is paving the way for simplified global trade through trade liberalization. It has enhanced competition among agribusiness firms alike other sectors of the global economy. These firms are now increasing their efficiency on production, processing and distribution of their agri-food products as one strategy to stay competent. Particularly multinational agribusiness companies called as Trans National Agricultural Conglomerates (TNACs) by Yoon (2006) are aggressively working to boost their profit through foreign direct investment in different countries of the world. These giant firms are working to increase their global market dominance in order to guarantee their survival. Vertical integration through contract farming is one of the strategies they use to increase their efficiency and profit. Transnational organizations like World trade organization (WTO), World Bank, International Monetary Fund (IMF) are reinforcing such developments in the global scale (Yoon, 2006).

With all its advantages and disadvantages, contract farming stays to be one strategic option to entertain the influence of globalization in developing countries like Ethiopia. It helps to converge subsistence farmers in these countries with national and multinational companies as partners. And this will be possible if and only if an enabling environment that allows sustainable and competitive contractual farming is put in place. Failure to do so may have several repercussions on the livelihood of small-scale farmers and the development of the agricultural sector which is the backbone of the national economy (Robbins, 1999).

3.   The policy framework in Ethiopia

Agricultural Development Led Industrialization (ADLI) strategy of the Federal Democratic Republic of Ethiopia recognizes agriculture as a launching pad for development of the other sectors of the economy. This strategy focuses on improving productivity of land, labor and water through enhanced access and use of improved agricultural technologies, investment in irrigation schemes etc (Cramer, et al, 2004; FDRE-MoI, 2001)

In order to meet this development objective, two approaches are prescribed based on agro ecological and demographic situations. In the low land areas, where there is sparse human settlement, large scale mechanized farms by private investors is suggested with improvement on infrastructure. In the mid and high altitude areas where human and animal population is skewed by virtue of their suitability to health, intensification of the agriculture and improving productivity is recommended.

In the mid and high altitude areas, the agricultural land is predominantly occupied by small-scale farmers. This indicates availability of ample labor to improve land productivity. Shortage of cash, inadequate use of agricultural inputs, lack of knowledge on optimal agro techniques etc are supposed to be bridged in two ways. The first is through aggressive public research and extension support, improved access to credit, etc.

The second is through contract farming /out grower schemes. Contract farming with agribusiness firms also helps to improve land and labor productivity through optimized use of improved technologies. This gives chance to the private sector to get advantage of the cheap labor, land, better infrastructure and institutional set ups in these areas. Allowing large scale private farms in these can have unmanageable social, political and economic repercussions in the mid and high altitude areas. Hence, contract farming seems sound strategy to establish better partnership in these areas.

ADLI further focuses on production high valued export agricultural commodities and it also encourages investment in agro-processing firms that add value to primary agricultural commodities. Contract farming, therefore, can help achieve this goal in the mid and high altitude areas.

Land ownership policy indirectly supports contract farming as it indirectly dis-favors establishment of large-scale estate plantation by national or multinational companies through land purchase in mid and high altitude areas. Positive policy environment towards promotion of small-scale farmers' cooperatives is also a good backing to contract farming. As the land holding of small-scale farmers is too small, in absence of farmers' cooperatives, it is uneconomical for agribusiness firms to deal with the heterogeneous farmers to get a produce of economic scale. Cooperatives can be partners for agribusiness firms to easily reach the small-scale farmers (Coulter *et al*, 1999).

Nigel and Runsten, (1999) and many other authors describe reduced public expenditure as one advantage of contract farming. In Ethiopia services like agricultural research and extension are offered by public resources. Hence, these services help to reduce transaction cost of the agribusiness firm that otherwise would fully provide this service alone in contract farming. Hence, it is believed that the public research and extension services encourage agribusiness firms and the subsistence small-scale farmers to enter to contractual farming venture.

Ratification of intellectual property right IPR allows appropriate use of patented agro inputs such as improved crop varieties.

Generally the government is undertaking economic restructuring and is investing in infrastructure. Negotiations started towards membership of world trade organization and economic incentives already available for sectors producing export priority products, are believed to attract foreign investors.

4.   Opportunities for contract farming

Cereals, pulses, oil crops, spices and a variety of horticultural crops are grown in the mid to high altitude areas of North-western Ethiopia. Among cereals *teff*, wheat, maize and barley are the most important ones in terms of area coverage and production. As staple food crops of the nation, these commodities are mainly produced for domestic market. In northern Ethiopia, despite conducive agro ecology and centuries old production experience, contractual farming is a recent development and is restricted to very few crops such as bread wheat. There have been similar initiations on durum wheat and malt barley. Currently, over two-thirds of barley malt requirement of six breweries in the country and the entire requirement of durum wheat for large number of pasta and macaroni factories are being met by importation from abroad with hard currency that the country needs very much. In Peru breweries that once were buying barley from world market are now supplied by contract farmers in the country (Rehber, 1998). Such experiences indicate that there is a possibility of substituting imported products by home-grown ones. Even though, pulse crops are among export commodities produced widely in the Western provinces of the Amhara region, they are exported with little or partial processing. Importing countries of these crops are re-exporting our produce with value addition. The farming community of the region principally grows oil crops for cash. However, oil seeds are either largely exported or used by inefficient and small scale processing plants that operate with centuries-old processing technologies. These plants are using spot market in their vicinity to acquire raw material. Wijnands *et al*, (2007) reported that refining capacities of larger oil refineries in the country are heavily under-utilized, mostly only 30 to 40% of the full capacity. This industry is rather confronted with competitive imports of refined oils of palm oil from Malaysia and soybean oil, often donated as food aid.

Production of high valued seed spices that are exported to international trade is also at traditional level. Because of lengthy channel in the market, alike many other similar commodities, the price that the producers get for these crops is very low. This has not been motivating farmers to improve their productivity. Contract farming of such commodities with firms may help to improve production and productivity and thereby increase mutual benefit of the partners and the country's foreign exchange earning.

As farmers have ample production experience for the above mentioned crops it is believed serious technical difficulties cannot be faced if contract farming is initiated on these crops.

Authors like Minot, (1993) who prescribe contract farming only for, bulky, perishable and labor intensive agricultural products may argue against contract farming of grain crops suggested above. Underlying reason of these authors is that grain crops have high value: bulk ratio and they can be collected from spot markets of large geographical area. However, the experience in North-western Ethiopia shows that there are other determining factors that make contract farming of grain crops necessary. The typical example is contract farming of wheat between small-scale farmers and a wheat flourmill. Before the scheme was launched the mills used to introduce wheat from other parts of the country crossing a distance of over 600 kilometers. On the other hand, several thousand hectares of land are covered by wheat annually in the region. The reason for introduction is the assumption that 'wheat produced in the North-western part is not suitable for quality bread'. Though the reason is unscientific it was what happened. Lately, it was proved that the causes were quality problems associated with physical mixture of different wheat varieties, adulteration, and poor pre-harvest and post-harvest management practices. Finally, contract farming of selected bread wheat varieties was made possible between the factory and the farmers' cooperatives with strong technical support of the research, extension and other public institutions and development organizations. This experience indicated that agribusiness firms may need to enter into contractual farming of grain crops that have high value: bulk ratio in order to obtain quality produce. This form of vertical integration can also be cost effective as it minimizes transaction cost incurred in order to collect the produce from large area of land.

Unavailability of selected seeds for many agricultural commodities produced in the region is a major production constraint that hinders productivity. The formal seed sector could support only insignificant proportion of selected seed demand of the region, indicating the untapped opportunity to launch contract seed production schemes with small-scale farmers. This experience has already been established even though it is still in its infancy.

Development of several small-scale and some medium-scale irrigation project is taking place in the sub region. Improvement work on the efficiency of traditional small-scale peasant irrigation schemes is also taking place. This investment, however, does not lead to enhanced productivity and improved income unless it is complemented with optimal use of inputs, and horizontal diversification is made to

include production of high-value non-traditional crops. Irrigation helps for year-round production and supply of export vegetable crops.

The recently opened market outlet to Sudan via Metama and improvement on the road infrastructure is also creating opportunities for marketing of a variety of agricultural commodities.

Bahir Dar and Gondar are growing urban centers that harbor, relatively, nutritionally conscious and economically better middle class society. Moreover, these towns are important touristic centers. Expansion of higher learning institutions is also taking place at and around these towns. These developments can be considered as opportunity to create contractual farming of various models between producers, and restaurants, super markets, higher education institutes, hospitals, prisons etc. And yet it has to be known that this market is confined and the culture of paying for quality is not well developed.

The wide gap between the actual productivity and potential yield that can be obtained from many of the crops grown in this area indicates wide opportunity of boosting production and supply produce of economic scale for the agribusiness firms, provided the farmers get market and reasonable price through contract farming.

Global market for organic products is increasing from time to time. Production of these products can be profitably made by small scale farmers. Contract farming of organic products cannot be constrained by certification requirements and traceability problems because of ease of monitoring and simplicity to specify resource and management. These have been a profitable business to organic rice growers of south East Asia (Setboonsarng, 2006).

5.   Availability of enabling environment

5.1   Infrastructure

It is believed that road accessibility helps to easily transport the produce to where it is desired and deliver inputs to the farmers. It also simplifies extension service delivery and monitoring. Even though there is a tremendous improvement on development of roads, since recent past, many of the production areas are at considerable distance from roads. Under the existing situation, agricultural produces and inputs are transported by pack animals, animal drawn carts and humans. The role of trucks is mainly restricted to the highway and their rare use along the production areas is season and space dependent. Yet contract farming initiatives can be started at and in

the vicinity of accessible areas along highways, towns and newly established irrigated projects where road and related market infrastructure are developed. And yet the road density has to increase rapidly to benefit the vast small scale farmers of the region who travel long hours to market their agricultural produce.

If forthcoming irrigations schemes are made adequately productive, domestic markets in the region can not absorb produces that come from the schemes. As most of the high valued export commodities are easily perishable, fast and reliable transport and handling etc services have to be provided in the proximity of the schemes. Launching cargo aviation custom and other related services are vital to start export trade of these commodities. Clustered services that include quality control and certification also have to be there.

Better telecommunication service helps to simplify communication among various parties involved in contractual farming arrangements. The wireless telephone and mobile cell phone technologies and services are expanding to the rural villages or production areas. For instance, over 90 % of the rural kebeles have got the wireless telephone service in Awi administrative zone. It is expected that the current power problem shall be solved shortly.

5.2   Institutional environment

i) Research Service: Contract farming usually involves production of non-traditional commodities needed on international market. Research back stopping is needed to generate technologies that go with the dynamic market need. Even though, technological outputs of the research centers mandated to the sub region are limited, they can allow early and easy entry to the contractual farming of the traditional crops and at least for some of the non-traditional crops. Yet much has to be done on which crop or variety to grow, when, which and how to apply chemicals, when and how to water, weed, hoe, space, rotate etc of non-traditional crops.

ii) Extension service: In Ethiopia the major constraint on successful vertical diversification into processing primary commodities is the challenge of securing a reliable supply of high quality raw material inputs (Cramer et al, 2004). This is partly linked with the subsistence production system that prevailed in the country for several decades. Under the attempt of transforming the subsistence agriculture to market-oriented commercial agriculture, the government has adopted a new extension approach that involves training and advisory service for farmers at farmers training centers (FTC). The training centers are expected to harness farmers with modern production techniques and concepts of farming for market through training and

technical advice they offer. They will also assist in input arrangement, utilization and marketing of agricultural produce. In contract farming scheme they can have additional roles in field and farmers selection, implementing the right crop management practices. Currently, many peasants' associations in the sub region have got the FTCs in place. The FTCs are staffed with three development agents trained at diploma level and specialized in areas of crop production, livestock production and natural resource management. If they are capacitated with the necessary facilities and are trained in concepts and principles of contractual farming, and agro techniques of non- traditional crops, the FTCs may be able to implement the contractual farming. But as contract farming is sensitive to quality, time and volume it needs proper planning, timely implementation and monitoring of farm. Hence, development agent to farmer ratio has to be optimized. This is particularly important because all growers in an area, whether contracted or not contracted, deserve the support of the public extension. When there is diversity of crops, other than the contracted ones in a peasant association, the development agent can be over stretched. Minot (1993) suggests the farmer to extension agent ratio not to exceed 200:1 for contract farming. Obviously, in North western Ethiopia the farmer to extension agent ratio for crop production alone is about 800:1.

iii) Input supply: To establish competitive contractual farming scheme, availability of modern agricultural inputs at the desired amount, quality and reasonable price is a prerequisite. Under the existing situation, there have always been limitations in supply of selected seeds for traditional and non-traditional crops. Supply of agro chemicals including fertilizers, pesticides etc has also problems in terms of type, quality and quantity. Without improvement on the input supply and transfer of knowledge and practice on their proper use, transforming the agriculture can be a difficult task. In this regard the booming floriculture industry has now introduced the country with supply and use of modern agricultural inputs. Thanks to this industry, production technologies and associated knowledge are also being transferred. With inception of market-oriented and intensive contractual production schemes, it is believed that, these suppliers will be attracted by demand to operate in the region.

Farmers' cooperatives, NGOs, parastatal organizations, pubic institutions, and contracting agribusiness firms can also synergistically work in order to in crease and sustain utilization of modern inputs particularly seed/planting material, agrochemicals.

iv) Farmers' organizations: Multipurpose agricultural cooperatives and unions, Irrigation water users cooperatives, saving and credit cooperatives (SACCOs) etc are cooperative forms that are currently operating in the agricultural sector in the area. As these cooperatives are formally organized and legally registered or recognized

entities they are serving as a bridge to get access to the community in any kind of development endeavor. Most often, these cooperatives participate in the provision and supply of agricultural inputs and marketing of agricultural products.

The average land holding per households in the area is too small. Because of this the number of heterogeneous farmers that should come to the contractual scheme will be too high to acquire area of economic scale that has to be covered by the desired crop. Hence farmers cooperative are ideal partners in dealing with the agribusiness firm in contractual farming (Coulter *et al*, 1999). The cooperatives have several roles in this regard; these can be representation of members in signing the contract to produce and deliver desired volume of produce at the right time and quality. Moreover, the co-operatives may help in purchase and distribution of inputs, arranging credit for farmers from their own source or other financial institutions. By doing so they can avoid exclusion of resource poor members of the cooperatives from contracting as agribusiness firms usually prefer resourceful farmers who are supposed to be reliable partners (Nigel and Runsten, 1999). In addition, cooperatives can use their bylaws to prevent default of their members from the contract. As the bargaining power of individual small-scale farmers is obviously poor, cooperatives can improve this weak bargaining power in contractual farming. Cooperatives are also helpful in mobilizing their members for communal interests like maintenance and management of feeder roads, irrigation ditches, etc. But they are not always able to institutionalize collective action like involving their members in contract farming. This situation can directly affect performance of a given contractual scheme. With increased support and assistance, cooperatives can reach the capacity of counter balancing policies and regulations that may dis-favor the interest of small-scale farmers (Rehber, 1998). Fig. 1 indicates alternative schematic illustration of farmers-firm form of vertical integration.

However many of the cooperatives have no well-developed experience and managerial skill in contractual production management. Most of them do not have sufficient financial strength to provide credit or supply input. Their logistical capacity is also limited. In order to take advantage of the potential role of the cooperatives, they need extensive capacity building in planning, implementing and monitoring of contractual production schemes. Coverage of farmers' cooperatives has to be increased in order to supply production of economic scale for the contract.

139

Figure 1: Schematic illustration of applicable contractual farming model & initiating factors
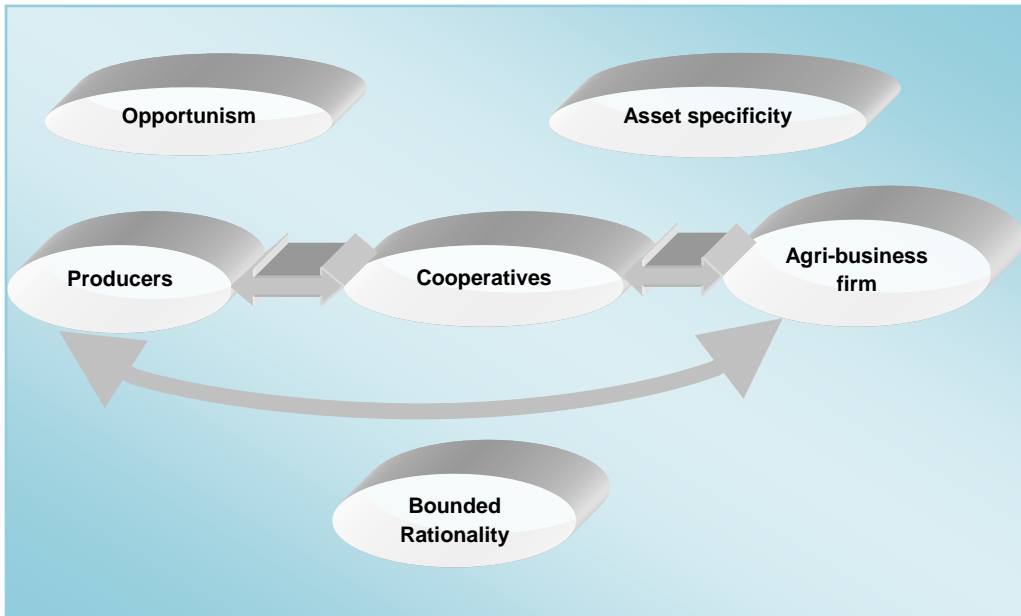
v) Credit facility: Shortage of cash is considered to be one of the factors that hinder farmers' adoption of new technologies. Lack of credit service with reasonable interest rate and pay back period is one of the farmers' problems in this sub region. Production of non-traditional commodities involves costly agro inputs. Cooperatives have financial constraint to overcome this problem. Hence, they need to be supported by the agribusiness firm, NGOs or relevant financial institutes. In the long-run, the SACCOs, which are considered to be emerging local banks of farmers, and other forms of cooperatives, are expected to be acceptable source of credit to the farmers. Contracting agribusiness firms can also be more reliable lenders to the farmers. The latter, if fairly made, avoids transaction cost, eliminates collateral requirement, and helps to improve the relationship between the parties.

vi) Legal and other related issues: In Ethiopia contracts are supposed to be made between parties in accordance with the provisions of general anti-trust contract laws stated in the 1960s civil code. Even though, there has not been ample experience in contractual production schemes and damages caused by the non-performance of the partners; studies made by these reviewers indicate that there are few newly initiated contract farming schemes that had suffered from such consequences. No cost

effective legal enforcement mechanism is in place to suit the contract in agricultural production. Arbitration body is also not clearly indicated with the consent of the parties and defined guidelines. Sometimes, the contracting parties may fail to clearly state the object and specification of the contract because of technical gaps associated with unavailability of responsible body put in place to provide this service. As a result, contracts may end with controversies and divorce after several resources have been used to realize them. There is also conflict of interest where other parties who consider themselves 'losers' in the contractual production scheme, usually the traders, perform illegally to obstruct the contractual production schemes. This has to be dealt with through state intervention.

Examining the existing law and formulating specialized anti-trust regulations that suit agricultural contracts may be helpful. Kunkel and Larison (2007) suggest agricultural contract regulations governing contracting parties should include provisions providing resolution of disputes by mediation, or arbitration. They also add that the regulation should address issues related to recovery of investment. When the contract requires a producer to make a capital investment in building or equipments having a useful life of certain years, the regulation should protect the producer to be reimbursed for damage incurred by the investment. It also should protect producers of perishable agricultural commodities in particular by placing laws that demand the purchaser to provide bond. Laws should also be enacted on notice of termination of agricultural contracts. As production of agricultural commodities involve biological process, decisions on termination of contract in response to the notice is definitely costly or difficult on the side of the producer. Hence, termination law that should provide provisions of time, and related factors to forward notice of termination should be ratified. Apart from increasing bargaining power of farmers through establishment of farmers associations, laws that enable the government to play a role in price regulation to overcome abuse of market power by the agribusiness firms can also be suggested.

Rehber, (1998) emphasizes importance of agricultural commodities insurance for farmers and firms to reduce risks associated with contract farming. Nigel and Runsten, (1999) stress particularly insurance for non-traditional agricultural commodities which are grown by small scale farmers. These authors argue that non-traditional commodities are more susceptible to local environmental conditions and biological factors as compared to popular and widely grown crops. In addition, production of many of the non-traditional crops demands high cost; if crop failure is encountered the loss it incurs to the farmers will be definitely high.

141

5.   Conclusion and recommendations

Alike many other developing countries, contractual farming has got a good political support from the government, FDRE. Currently, it is considered as an important strategic option available to transform the subsistence and traditional agriculture in mid to high altitude areas to market-oriented agriculture. Other supportive policies and strategies are also making favorable environment to contractual farming.

In mid and high altitude areas of North-western Ethiopia the average land holding is very small, i.e. about one hectare. The situation in which the firm directly integrates with these small-scale farmers involves very high transaction cost and can also be unmanageable. The firm needs to formally deal with farmers through their cooperatives. The cooperatives are expected to organize farmers to produce and avail the produce in desired volume, quality and time in collaboration with other parties like the public extension service. In addition, they can assist the firm in credit and   in put supply, delivery of produce etc. Hence in order to get advantage of these roles of cooperatives, their managerial capacity and financial strength has to be improved. Cooperatives also need to improve their coverage in order to follow this model. In areas where there are significant non-members of cooperatives, farmers need to be organized into working groups so as to alleviate complications that the integrator may face.

Proper implementation of the contractual schemes cannot be realized without responsible, well integrated, and long-term institutional support given to it. Therefore, contract farming needs to have a principal institute that spearheads overall promotion and support it needs. This will help to properly plan and allocate the necessary resource it needs. Assigning principal institute, however, should not pass up working in partnership. Partners should have defined roles and must be accountable for it. This is useful to establish efficient public service and attract agribusiness firms that need to get advantage of such support.

The public extension service is expected to play a fundamental role in implementing contractual farming schemes. Hence, extension agents at grassroots level should be fully capacitated with the knowledge and resources needed. The agents should be responsible for field and farmer selection, training and advising, supervising fields, input utilization, scheduling and monitoring various practices etc. The firm can have its own highly specialized personnel to train the extension agents and assist in planning, and monitoring of production.

In order to build confidence between the producers and the firm and among various parties involved in the scheme, the formal agreement is suggested as best option.

Formal agreement will be made between the firm and farmers cooperatives or farmers working groups when applicable. The agreement should indicate contract specification and detailed conditions and obligations of the parties. Once the farmers' cooperative makes the formal agreement with the firm, it can again make agreement with the farmers. This agreement can be formal or informal. Since the cooperatives can use their internal regulations to let their members abide by the contract regulation, they can make informal agreement, which can be simple registration. On the other hand, in addition to private firms, vertically diversified farmers cooperatives that work as market firm or processing plant owner, can vertically integrate with producer cooperatives in contract farming.

Alike the support given to the floriculture industry, land for nucleus farms of agribusiness firms should be provided for two reasons. It helps to buffer inconsistent supplies from contract farmers and at the same time it serves as technology demonstration sites to the small scale farmers.

The important reasons behind failure of contractual farming schemes are availability of alternatives for the firm to secure the agricultural produce it needs or option that may trigger the farmers for extra contractual marketing. Therefore, the contract needs to be carefully handled based on periodic price review and reasonable profit sharing.

Conflict of interest among agribusiness firms involved in contract farming and traders (who were part of the market chain and are likely to lose their benefit) has to also be addressed through state intervention.

Without legal enforcement mechanism agribusiness firms and the farmers may lose interest to work in contract farming venture. By default this could be failure of the strategy. Hence, the government has to put guidelines for dispute resolution and arbitration and enacting regulations that bring simple and unbureaucratic legal enforcement mechanisms that sustainably benefit all the parties.

On the other hand, problems related to infrastructure situation, specifically; accessibility of production areas by feeder roads has to be anticipated if expanding contract farming is aspired. Easy entry can, however, be made to newly developed and forthcoming irrigation schemes and along the high ways that have well developed road and related infrastructure. Similarly, contract farming of non perishable and non-traditional crops can be done beyond areas specified above. For contract farming other the rest non-traditional crops, better transport, temporary storage and handling facilities and materials have to be considered.

143

Lack of technological inputs has to be addressed through investment on research, i.e. research facilities, specialized trainings that assist knowledge and technology transfer. And exploitation of commercial genetic resources under the frame work of IPR has to be made as entry point.

There is lack of experience in contract farming among farmers and public development institutions in the region. Hence, the role of NGOs and other development partners as facilitators of contract farming has to be increased. These roles can be capacity building for the cooperatives management, provision of training and other technical assistance to farmers and development agents, improving financial strength of cooperatives, contract evaluation and discussion with farmers, arbitration and dispute resolution, etc.

Generally, as Cramer *et al* (2004) summarized, the objective of contract farming must be securing reliable supply of quality raw material inputs for agro processing plant or export commodities for market firms, competitively, and securing export market through reputation and branding. Therefore, efforts in installing effective contractual schemes have to focus n setting up infrastructural and institutional requirements that help to meet the above objectives.

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FERTILITY DECISIONS OF HOUSEHOLDS IN RESPONSE TO ENVIRONMENTAL GOODS SCARCITY: THE CASE OF SEKOTA DISTRICT, WAG HIMRA ADMINISTRATIVE ZONE OF THE AMHARA REGION, ETHIOPIA

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Abstract

The current population boom unparalleled in human history is largely concentrated in developing countries. Population growth rate, particularly high fertility rate, in these countries is perhaps related to unacceptable risk of child death, extreme poverty related to the deterioration of natural resource base like potable water, fodder and fuel wood. In many empirical studies, population increase is considered as one of the most important factors contributing to environmental degradation. However, the reverse effect has not been well documented. Therefore, the general objective of this study is to analyze the relationship between the levels of environmental goods scarcity and fertility decisions of households. Both primary and secondary data sources were used for this purpose. The data were analyzed using the Tobit model. It was found that fuel wood and water scarcity, part of environmental good scarcity, affect fertility negatively. Another variable, which is also related to environmental good scarcity, was risk of child mortality rate that affects fertility positively. In addition to these factors other than environmental goods that affect fertility were household calorie intake per capita, women age category, and education of women. As far as the responsiveness of these factors is concerned, it was found that fuel wood scarcity is the major determinant of fertility decisions of households in absolute value followed by household calorie intake per capita. Water scarcity, rate of child mortality risk, women age category, and women's education were the third, fourth, fifth and sixth determinants of the fertility decisions of households in absolute value, respectively.

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1.   Introduction

The current population boom unparalleled in human history is largely concentrated in developing countries. These countries account for more than 95% of the total increment of world population. The key element behind the change in population of these countries where the growth is so rapid, is the level and patterns of fertility

Population growth rate, particularly high fertility rate in these countries, is perhaps related to unacceptable risk of child death, and extreme poverty related to the deterioration of natural resource base like potable water, fodder and fuel wood. That is, if the natural resources and customary ownership of common property for the society are deteriorated, it calls for high fertility rates related to child labour.

Bromley and Cernea (1999) argued that even in a situation of common property ownership, increase in the demand for common property resources through population growth may lead to unrestricted access to these resources. The foregoing situation will result in deterioration, or undermine the institutional arrangements. As a result, the traditional uncontrolled and free ridings of the natural resources result in severe degradation.

In addition, labor productivity is low in the region in general and in the study area in particular not only because capital is scarce, but also the environmental resources are scarce too. As a result, each household needs many hands, and the overall usefulness of each additional hand increases with declining resource availability. When environmental goods are scarce, households will have to spend more time collecting these products, which significantly increases the work burden of women and children.

The major concern for this framework is related to the importance of children as resource collectors and decisions related to the risk associated to high child and infant mortality. In poor countries children are useful as income earning assets. Poor countries are for the most part biomass based subsistence economies. Households in environmental degraded areas, particularly in low-income countries and rural areas do not have access to the source of domestic energy and water on tap (Desgupta, 1993). This means that the relative prices of alternative sources of energy and water faced by rural households are often prohibitively expensive. This provides a link between high fertility and degradation of the environmental resource base of the rural community.

According to Aggarwal *et al* (2001), resource scarcity is likely to affect fertility in two ways. The first is through the effect of resource degradation on the production of child quality and the second is through its effect on the production of aggregate good. With the first effect alone, an increase in resource scarcity can be viewed as increasing the price of child quality, hence leading to a fall in demand for child quality. The fall in child quality would lead to an increase /or decrease/ in the demand for children depending on whether quantity and quality are perceived as substitutes (complements) in preferences. In the second effect, an increase in resource scarcity leads to a fall in the production of the aggregate food and a fall in marginal productivity of adults and children.

Nerlove (1993) also argues that environment is assumed to affect fertility decisions through its effect on survival probability of birth and/or the ability of surviving children to support their parents. If parents' utility depends only on the number of surviving children and is concave function of that number, and there are no ex-ante costs of childbirth, the utility maximizing birth can be shown to be a decreasing function of the probability that a birth will survive.

Nerlove (1993) also suggested another interesting way through which resource degradation may affect fertility. He pointed out that those children in less developed countries have a comparative advantage, relative to adults, in animal husbandry as opposed to crop production. Since poorer quality environments have a large component of livestock production than crop production, this leads to a higher demand for children. Some form of resource degradation may also exert a significant positive influence on mortality risk (for instance, in the form of greater incidence of water born disease due to the supply of deteriorated quality of drinking water). Increasing mortality risk is, in turn, likely to affect fertility rates, though the sign of this effect is generally regarded as being ambiguous.

Given the multiple ways, the effect of resource degradation on fertility is quite complex. Nerlove (1991) argues that positive relation between resource degradation and fertility rates is more likely to be observed at low level of resource degradation. According to Nerlove, with continued deterioration of the resource base, this relationship must eventually turn from positive to negative. This could be due to a number of reasons. In highly degraded environments, the perceived costs of raising children may exceed the benefits they provide as producer of goods. Also at high level of resource degradation death rates may raise sharply but fertility rate may not continue to rise as there is an upper limit on the number of children a woman can have. This suggests that the relationship between resource degradation and fertility is

149

likely to differ across regions and also within the same region in its different stage of development. This makes it an interesting empirical issue.

Filmers and Prithet (1996) and Desgupta (1992) also argue that greater environmental degradation could lead to increase in population growth if increased scarcity of environment resources goods leads to a higher relative value of children. This is possible if the comparative advantage of having children, as household producers, in the acquisition of environment resources for the family does not incur the full cost (for example, collection of fuel wood, fetching water, or grazing of livestock from an open access land). This would be possible if the increase in relative value of children in face of increased scarcity of environmental goods could outweigh the increase in productivity effects from privately owned resources and lead to a higher demand for children.

According to Filmer and Prithet (1996) and Muller and Cohn (1977), it is possible that at stages of low population density initial increases in population density will lead to greater demand for children. This population demand in turn accelerates environmental degradation and raises the scarcity value of the open access resources. As long as the resources remain open access this will (or empirically may) lead to the increase in the demand for children. Once an environment is privatized, the negative externality disappears and is internalized by the household. From that point on, households respond to further deterioration in availability by reducing their demand for children.

Exploring part of the vicious circle, the link between population growth and the environment, has emerged as an important area of research in recent years (Aggarwal *et al*, 2001). The focus of most of this research has been on the impact that an exogenously given increase in population would have on the environment. However, the situation could also be analyzed from the opposite angle, the impact of environmental degradation on the demand for children, in turn population growth. Therefore, the main aim of this study is to analyze the effect of environmental good scarcity on the demand for children by families.

As indicated by many empirical studies, population pressure is considered as one of the most important factors contributing to environmental degradation. However, whether environmental degradation has effect on population pressure has not been well documented. Besides, the relationship between socioeconomic factors and fertility decisions of households are complex in developing countries. The results are not always consistent across populations in terms of the strength and the direction of the effects of these factors on fertility (Farooq and DeGraff, 1988). This underscores

the importance of conducting a case study in line with available theoretical and empirical knowledge while taking account of the local situation. Consequently, this study is intended to analyze the socio-economic factors and environmental resource scarcity on households' fertility decisions.

1.1 Objectives of the Study

The general objective of this study is to analyze the relationship between the levels of environmental goods scarcity and demand for children by households. The specific objective is to determine the effect of environmental goods scarcity and other socio-economics factors on the fertility decisions of farm households.

2. Methodology of the study

2.1 The study area

Sekota is located between $12^0 23^1$ and $13^0 16^1$ north longitudes and $38^0 44^1$ and $39^0 21^0$ east latitudes. It extends for about 98 km in the north south direction and 67 km in the east west direction. It has a compact shape and an area of 3058 km^2 (SERA, 2001). The district is located in the eastern part of Wag Himra Administrative Zone (WHAZ) of the Amhara National Regional State (ANRS). WHAZ, which is one of the 11 administrative zones in ANRS, represents the Agew ethnic group and comprises of three districts: Sekota, Dehana & Zequala. Sekota shares borders with Zequala district in the west, Dahna district in the south and southwest, Tigray National Regional State in the north and east, North Wollo Zone in the south. Sekota town, the capital of the zone, is 795 km north of Addis Ababa and 540 km northeast of the regional state capital, Bahir Dar. The area is characterized by Sub-moist major agro-ecological zone with SM$_2$ (tepid to cool sub moist mid highland) and SM$_1$ (hot to warm sub moist lowland).

The results of the 1994 population and housing census also show the total population of Sekota as 130,229 in the year 1994 and projected to reach 167,504 in the year 2005. As far as the rural population of the district is concerned it is projected to reach 153, 539 in the year 2005 (BOPaED, 2004). According to this projection it is expected that about 92 % of the population live in rural areas. The density of the rural population is 50 people per km^2.

It is expected that the rural national average as well as the regional average of population density is higher than the rural district of Sekota. But it does not mean the rural district has no population pressure relative to the national and the regional

average. Because the landscape and soil in the area are not much suitable for agriculture, the already existing population is more than the caring capacity. When we see the topography, a quarter of the district has a slope less than 2 % while 37 % of the district has a slope more than 30 %. Areas that lie on these groups are not suitable for agriculture (SERA, 2001).

The people in Sekota district are suffering from continuous food, fuel wood, water, and grazing land shortage. The topography of the district is characterized by rugged and a chain of mountain terrains most of which are covered by patchy grasses during the small rainy season. For the remaining season the terrain has been covered by bare rock. The forest and bush cover of the area is concentrated in specific areas most of which are communally owned or are the property of the church.

For all households, firewood is the most important source of energy for cooking followed by dung. The depletion of firewood has currently led to the extraction of former vegetation cover. The area has virtually been stripped of vegetation and shortage of grazing and fuel wood scarcity is ever increasing. In spite of the effort of the extension program to popularize tree planting and encourage establishment and proper management of farm wood lots it has registered little success.

The study undertaken by SERA (2001) indicated that shortage of grazing is most widespread as reported by 75% of the households in the study. All grazing areas belong to the PAs and all households are using it as communal grazing grounds. These unregulated communal grazing plots have a character of open access property regime, which resulted in over exploitation, and degradation of the pasture.

As far as the infrastructure of the area is concerned, road network and public transportation system are extremely underdeveloped. The electric power and telecommunication network is concentrated only in the district capital, Sekota town. In the whole district, the scarcity of potable water is a common phenomenon including the capital town.

Crop production in the area is not a promising enterprise due to shortage of farmland, depletion of soil fertility, and moisture stress. However the area is known from its relatively high small ruminant and poultry population even if one of the food insecure district in the region as well as in the nation.

2.2   Types of data and methods of data collection

The study was conducted in three PAs in Sekota district of the ANRS. The sampling units were wives and husbands of the household members. A two-stage cluster sampling procedure was adopted to select three PAs, namely Zarota, Addis Alem and Mahebere Selassie. In the first stage, the whole rural area was categorized into three clusters based on the level of environmental goods scarcity and availability. This was done based on the information from key informants and secondary data. From the categorized three clusters one PA was randomly selected for each. A peasant association provided the sampling frame of households having wives in the age interval of 15-49 years old, while respondents were selected randomly. In Zarota, Addis Alem and Mahebere Selassie PA's 32, 46 and 44 households were selected for formal survey, respectively.

In this study, households were selected on the condition that the men and women live under one roof and that the age of women is in the range of 15-49 years. The households having women in the specified ages should not be windowed and/or remarried. So the sampling unit is men and women satisfying aforementioned criteria and the sampling frame are households satisfying the criteria. The data made available for this study in different clusters were aggregated and analyzed to the household levels. Some parameters were used to characterize the demographic features as well as the environmental goods scarcity level differences among the clusters.

The data used for this study were obtained both from primary and secondary sources. Primary data were collected through structured questionnaire. This was conducted in two stages. First, a preliminary survey was conducted to obtain general information about the PAs such as the level of environmental good availability and scarcity, population distribution pattern and agricultural system of the area. During the preliminary survey, lists of relevant guidelines were used and guided discussions were held with respondents. The result of this survey was used to develop workable hypothesis and structure questionnaire for the formal survey. Moreover, the result of the preliminary survey provides a general background of the study area regarding environmental goods scarcity and fertility decisions of the households.

Following the preliminary survey, structured questionnaire was developed for the formal survey. The developed survey questionnaire was administered in pilot survey using trained enumerators. This helps to pre-test the survey instrument, identify any shortcoming and make modification in some question before the actual data collection. The second stage was the basic data collection, which includes

demographic characteristics, income and assets, environmental goods scarcity, and the observed mortality and fertility of the households. Secondary data were obtained from reports and other official documents.

2.3 Theoretical framework

To develop a model for demand for children by households, it is assumed that children are demanded both for the consumption they provide as well as their contribution to household production (Schultz, 1981; Desgupta 1993; Aggarwal *et al.,* 2000). That is, the household's demand for children can be categorized into consumer demand and producer demand. So we can postulate that the household maximizes a long-run concave utility (U) derived from the number of children (N), child quality (q), and final un-traded consumption good (z). Following Aggarwal *et al* (2001); and Schultz (1981), the mathematical model for demand for children is given as follows.

$$U=U(N, q, z) \qquad U_i > 0 \text{ for } i = 1, 2, 3 \qquad \textbf{(1)}$$

Where U_i is the the marginal utility .

This utility function is maximized subject to the production function for number of children (N), child quality (q), final un-traded consumption commodities (z), time constraint for women (T), men (M) and children (t), and a full income constraint. For simplicity it is assumed that child bearing is a women's activity (which is a common phenomenon in Ethiopia); the non-separable households are subsistence farmers, and production of the number of children is a function of a fixed input technology of women's time (T_N) and purchased good (x_N) required in the bearing of each child.

The child quality model denotes the health and nutritional status of the child. Thus, higher levels of child quality also imply higher chance of survival. Households may take care about child quality because it gives higher consumer and producer demand for the households. It is assumed that quality per child is constant across siblings and it is a function of the inputs of women's time to keep the quality of the child (T_q), purchased good to keep the quality of the child (z_q), and measure of the state of resource scarcity (s).

$$q = q(T_q, x_q, s), \qquad q_1 > 0, \quad q_2 > 0, \quad q_3 < 0 \qquad \textbf{(2)}$$

Where q_1, q_2, q_3 are marginal values for T_q, x_q and s, respectively.

154

Note that, in the above formulation, child quality is assumed to be a decreasing function of s. This is consistent with the growth evidence that resource degradation exerts a negative influence on child health. Finally the production of the final un-traded consumption commodities, z, is given as

$$z = z(T_z, t_z, x_z, H_z, s) \qquad z_1 > 0, \quad z_2 > 0, z_3 > 0, \quad z_4 > 0 \quad z_5 < 0 \qquad (3)$$

Where T_z is women's time input in the production of z, t_z is children time input in the production of z, x_z is purchased good in the production of z and M_z is men's time input in the production of z. z can be thought as final un-traded consumption commodities that are valued by the households. Among these consumption goods is cooked food, which requires raw food, fuel, water, labor as inputs. Given this interpretation, it seems reasonable to include s as inputs in the production of z. It is assumed that a more degraded environment leads to a lower z and lower marginal products of other inputs ($z_{i5} < 0$, for i= 1, 2, 3, 4). Also note that children contribute to the production of this aggregate good. Therefore, they are demanded not only as consumption good but also a productive asset.

Women allocate their total time (T) between the following activities: Child bearing (T_N), investing in child quality (T_q), in the production of final un-traded consumption commodities (T_z) and working in the labor market (T_L)

$$T = NT_N + NT_q + T_z + T_L \qquad (4)$$

It is also assumed that children allocate their total time (t) to production of final un-traded consumption commodities. Note that the productivity of children depends on their quality. So, in the quality units children's time constraint is given as

$$t_z = Nqt \qquad (5)$$

Men allocate their total time (M) in the production of final un-traded consumption commodities (M_z) and working in the labor market (M_L).

$$M = M_z + M_L \qquad (6)$$

The full income budget constraint is given as

$$p(Nx_q + x_z + Nx_N) = w_w T_L + w_h M_L + V \qquad (7)$$

Where p is price of purchased goods, w_w, and w_M are the wage rate for women and men; and V is non human wealth of the households.

Maximizing (1) subject to (3)-(7), or maximize (8), with respect to the decision variables, number of children the households desire to have (N), mothers time allocation for child quality (T_q), and amount of goods purchased for child quality (x_q) and decision of mother working in the labor market (T_L), gives equation (9)-(12), respectively.

Equation 1 can be written as

$$U = U \left[(N,\ q\ (T_q,\ x_q,\ s),\ z \left[(T - NT_N - NT_q - T_L).Nqt.\frac{W_W}{p}.T_L + \frac{W_M}{p}.ML + \frac{V}{p} - N.X_q - N X_N.M - M_z,\ S) \right] \right] \tag{8}$$

$$U_1 - U_3z_1\ (T_N + T_q) + U_3z_2qt - U_3z_3\ (x_q + x_N) = 0 \tag{9}$$

$$U_2q_1 - U_3z_1N + U_3z_2Ntq_1 = 0 \tag{10}$$

$$U_2q_2 - U_3z_3\ N + U_3z_2Ntq_2 = 0 \tag{11}$$

$$U_2q_1 - U_3z_3w_w/p - U_3z_1 = 0 \tag{12}$$

Manipulating equation (10)-(12) yields

$$z_1/z_3 = q_1/\ q_2 = w_w\ /p \tag{13}$$

This is the standard condition that the marginal rate of substitution between time and market inputs in the production of final un-traded consumption good, z, and the production of child quality, q, is equal to the ratio of their opportunity costs (w_w/p)

Equation (9) can be written as

$$U_1 + U_3z_2qt = U_3z_1\ (T_N + T_q) + U_3z_3\ (x_q + x_N) \tag{14}$$

The left hand side of this equation represents the marginal benefits from the dual function of children as pure consumption good and as producers' goods. The right hand side represents the marginal cost of children in terms of the foregone consumption of mother's time and market goods that are used up in the bearing of an additional child and investing in child quality.

The system of equation (9) – (12) can be solved to get the reduced form equation which expresses the various endogenous variables in the system (N, q, z, x_N, x_q, x_z, T_N, T_q, T_z, T_L, t_z, H_L, H_z, as a function of the exogenous variables (s, w_w, p, V). The key equation of interest here is the reduced form equation for the demand for children given as

$$N^* = N^*(s, w_w, p, v) \tag{15}$$

Where- N* is the derived number of children

2.4   Econometrics model

Qualitative response models are numerous that are applied in different situations. What they have in common is that they are models in which the dependent variables have discrete outcomes, such as 'yes' or 'no' decision, so that conventional regression methods are inappropriate for analyzing this type of data. A conventional regression method also fails to account for the qualitative difference between limit (zero observation) and non-limit (continuous) observation (Maddala, 1997).

In addition, the discrete outcomes may have also censoring of values in certain ranges. A very common problem in micro-economic data is censoring of the dependent variable. When the dependent variable is censored, values in a certain range are all transformed to (or reported as) a single value. A conventional regression method is biased towards the censored value, in our case is, zero. For many studies a dependent variable that has a significant fraction of zero or some constant values of observations has used Tobit model (Green, 2000).

The major reason to use the Tobit model in this study was due to the fact that 22.1% and 16.4% of the sample households have zero birth of child in the five years and ten years, respectively. The actual time for year's gap, five and ten were used as a dependent variable for comparison. The last analysis of the Tobit model was children ever born before ten years to estimate fertility.

When data are censored, the distribution that applied to the sample data is a mixture of discrete and continuous distributions. To analyze the distribution of observed variable, y , we can transform y to the latent variable, y * , by

$$y_i{}^* = \beta' x_i + \varepsilon_i,$$

Where   **Y = 0**   if **$y^* \leq 0$**

Y = y*   if **y* > 0**

Where, y is observed variable and y* latent variable or unobserved.

The distribution of observed variable has two categories, that is, if

$$\text{Prob}(y = 0) = \text{prob}(y^* \leq 0) = \Phi\left(\frac{-\mu}{\sigma}\right) = 1 - \Phi\left(\frac{\mu}{\sigma}\right),\ \text{if}\ y^* > 0\ \text{then}\ y\ \text{has the density of}$$

y*, and $y^* \sim N(\mu, \sigma^2)$. So the general formulation is given by

$$y_i^* = \beta' x_i + \varepsilon_i,$$

$$y_i = 0 \qquad \text{if} \quad y_i^* < 0 \tag{16}$$

$$y_i = y_i^* \quad \text{if} \quad y_i^* > 0$$

Where: y_i^* _ $K \times 1$ vector of latent dependent variable, in this case desire to give birth;

β _ $K \times 1$ vector of unknown parameters;

x_i _ $K \times 1$ vector of explanatory variables;

y_i _ the vector of observed dependent variable(observed fertility);

ε_i _ Residuals that are independently and normally distributed, with mean zero and
common variance σ^2.

For an observation randomly drawn from a population which may or may not be censored the conditional mean of y_i is

$$E(y_i | x_i) = \Phi(\frac{\beta' x_i}{\sigma})(\beta' x_i + \sigma \lambda_i) \tag{17}$$

Where $\lambda_i = \dfrac{\phi(\beta' x_i / \sigma)}{\Phi(\beta' x_i / \sigma)}$ and ϕ and Φ are probability density function (PDF) and cumulative density function (CDF) of the standard normal, respectively.

To calculate the conditional mean of equation (17) there is a need to know the parameters β and σ^2. So the task here is to estimate β and σ^2 on the basis of N observations on x_i and y_i. For their estimation the usual log likelihood was followed. The likelihood function of the Tobit model is

158

$$L = \prod_0 \left[1-\Phi\left(\beta' x_i\right)\right] + \prod_1 \frac{1}{(2\pi\sigma^2)^{1/2}} e^{-(1/2\sigma^2)(y_i-\beta' x_i)^2} \tag{18}$$

Where the first product is over the N_0 observations for which $Y_i=0$ and the second product is over the N_1 observations for which $Y_i>0$

$$LogL = \sum_0 \left(\left[1-\Phi\left(\beta' x_i\right)\right]\right) + \sum_1 \log\frac{1}{(2\pi\sigma^2)^{1/2}} - \sum_1 \frac{1}{2\sigma^2}(y_i-\beta' x_i)^2 \tag{19}$$

The summation $\sum_0$ is over the N_o observations for which $y_i = 0$ and the second summation is over the N_1 observations for which $y_i > 0$. By taking the first derivatives of log L with respect β and σ, we can estimate the parameters β and σ.

To determine the elasticity of the significant variables (determinants of fertility), the formula for derivatives was used. In this part of analysis the exogenous variables, which had only significant effect on the demand for children was considered. For marginal effect of the explanatory variables, the following equation was used.

In censoring regression model with latent regression $y^* = \beta' x_i + \varepsilon$ and observed dependent variable $y=a$ if $y^* \le a$, $y = b$ if $y^* \ge b, and\ y = y^*$ otherwise, where a and b are constants, let $F(\varepsilon)\ and\ f(\varepsilon)$ denotes CDF and PDF of ε. Assuming that ε is a continuous random variable with mean 0 and variance σ^2, and $f(\varepsilon|x) = f(\varepsilon) = 0$ then

$$\frac{\partial E(y|x_i)}{\partial x} = \beta \times prob\left[a < y^* < b\right] \tag{20}$$

Note that this general result includes the censoring in either or both tails of the distribution and it does not assume that ε is normally distributed. For the standard case with censoring at zero and normally distributed disturbances, the result specifies to

$$\frac{\partial E(y_i|x_i)}{\partial x_i} = \beta\Phi\frac{(\beta' x_i)}{\sigma} \tag{21}$$

The above marginal effect of the change in x has the following decomposition

$$\frac{\partial E(y_i \mid x_i)}{\partial xi} = prob(y_i > 0)\frac{\partial E(y_i \mid x_i, y_i > 0)}{\partial xi}$$

$$+ E(y_i \mid x_i, y_i > 0)\frac{prob(y_i > 0)}{\partial xi}$$

(22)

Thus, a change in x_i has two effects; it affects the conditional mean of y_i* in the positive part of the distribution and it affects the probability that the observation will fall in the part of the distribution.

2.4   Hypothesis (variables expected to affect fertility)

In the estimation of fertility we used the number of ever born children in the last ten years (NEBCTY) and the number of ever born children in the last five years (NEBCFY) per women in the sample.

In the theoretical part of this study (Equation 15), we have seen that the demand for children is a function of the women's wage rate, price of different commodities, households' non-human wealth and the state of the environment. The task here is to identify the proxy variables of the above factors from the survey data.

Education of women (EDWF): - Education of woman is a dummy variable that takes one if she is literate, and zero otherwise. Almost all the sample rural households do not participate in formal labor market and so wage rate data are not available for most women. It is a common practice to use complete years of schooling as a proxy for women's wages (Aggarwal *et al*, 2001; Schultz, 1981). However, women's education may also have several independent effects on fertility other than as a proxy of wages. Female education often delays the age at marriage. It may also alter preferences. In particular, it may lead mothers to place higher value on the education of their children and thus induce a shift from quantity to quality of children. Female education is also commonly found to be associated with higher probabilities of child survival. This may reduce fertility in so far as fewer births are required to meet a desired family size. Education may also increase the ability to effectively use family planning services. All of these channels imply a negative relation between fertility and women's education. Therefore, it is expected that this variable is negatively related to the rate of fertility.

Price of fodder (PRCFOD): -This variable reflects the status of availability of animal feed, and is used as a proxy for the scarcity of natural resource, natural pasture. Environmental good scarcities increase the value of children to parents and will result in higher rate of fertility. However, according to Farina *et al* (2001); and Nerlove

(1993) frequent drought and environmental resource degradation and food scarcity are often recognized as factors reducing impact of fertility in less developing countries. Price of fodder, as a proxy for pasture scarcity, is an alternative measure of other factors of pasture scarcity. These are distance to pasture area, amount of bundle of fodder collected per pulses and cereals produced and amount of bundle of fodder used per livestock holding. Among the possible alternative measurements of scarcity of natural pasture, price of fodder is selected due to the exogenous nature of the variable. Whereas, the other possible alternatives are functions of households' decisions; therefore, they are endogenous from the theoretical background. As a proxy for pasture scarcity, price of fodder is expected to positively relate to fertility decisions.

Distance to drinking water sources (DISTWTR): -Distance to drinking water sources can be used as proxy for water resource scarcity. For the scarcity of environmental goods, which are under communal ownership, distance is not the only indicator of the scarcity of the good. Rather, it is the weighted sum of the distance travelled to the source and the time required to collect or fetch. The latter factor is a function of population density and the concentration of the good per unit area. According to the results of the preliminary survey, however, the density of the population per unit of the resource and/ or the concentration of drinking water per unit area is homogeneous in the rural *Sekota.* Therefore, only distance of this resource is used as proxy for scarcity of the good. As a proxy for a natural resource scarcity, distance to drinking water sources is also expected to positively relate to fertility rate or demand for children (Aggarwal *et al.* 2000).

Time required collecting a bundle of firewood (TMFRWOOD): - Scarcity of fuel wood can be proxied by time required to collect a bundle of firewood (Filmers and Prithet, 1996). As the scarcity of this fuel wood increases, the time required to collect per bundle increases. The time spent in collecting firewood is an indicator of resource scarcity and, therefore, is expected to positively relate to fertility rate.

Mortality of children (PNCED): - The state of the environments also affects child quality, and hence, indirectly, the demand for children. To measure child quality, Aggarwal *et al* (2000) believe the use of anthropometrical data on the height and weight of children or their nutritional intakes are most appropriate. Schultz (1981); Farooq, and DeGraff (1988) believe the use of athletics performance, school age and IQ standards are most appropriate. However, all these variables need sufficient time and resource to measure and collect; and it was difficult to do so in this study. Therefore, child mortality rate was used as a proxy for quality of children.

161

The effect of mortality risk on fertility depends, amongst other things, on the curvature of the utility function, the perceived risk of mortality and the cost of an additional child (Schultz, 1981; Aggarwal *et al.* 2000). It was hypothesized that the risk of child mortality rate is positively related to fertility rate, in which demand for children is price inelastic. On the other hand, it is negatively related to fertility when demand for children is price elastic. The demand elasticity of children depends on the type of utility they provide to households. If children were sought by parents only as a household financial investment, for their supply of labor and as a future means of assuring parental old age support, the demand for children could be quite elastic with respect to the changes in cost of the survivor (Schultz, 1981). On the other hand, if households consider children only as consumption good, the demand for children could be inelastic with respect to changes in cost of survivor. Therefore, it is difficult to hypothesize the direction of risk of child mortality rate effects on demand for children.

Age of women (AGEWIFE): - As the age of women increases the demand for children may increase or decrease depending on different situations. First, an increase of age may result in increase in demand for children for old age security, and at the same time decrease the demand for children presumably due to couples adopting one or another method of birth control toward end of their child bearing year. It is believed that at onset of marriage households will not respond to control their fertility. So it is difficult to hypothesize the effect of age of wife on the demand for children a priori.

Distance to health services (DISTHEAL): This variables is also expected to have impact on the demand for children through better access to modern contraceptive and family planning. So it is hypothesized that access to family planning/ health organization is negatively related to demand for children (Filmers and Prithet, 1996).

Household calorie intake per adult (CALPCAP): -Among the very poor, increase in income reduces malnutrition and disease, and thus improves the ability of women to bear children. After threshold level of income is reached, fairly early, any further increases in income are expected to lead to fertility decline (Farina *et al*, 2001). It is hypothesized that as this ratio increases the households tend to increase demand for children. We expect that increase in income of households proxy by the household calorie intake per adult, is positively related to the demand for children (Schultz, 1981).

3.   Results and discussion

In the theoretical model, resource scarcity affects demand for children in two principal channels. It directly affects the productivity of children as resource collectors (Equation 3). Resource scarcity also affects child quality (Equation (2), and hence, indirectly, the demand for children. To measure child quality, the use of anthropometrical data on the height and weight of children or their nutritional intake are most appropriate. It is also believed that the use of athletics performance, school age and IQ standards are most appropriate.

However, data on the above are almost non-existent except school age. School age cannot appropriately measure the quality of children given highly subsidized on the education of children of the nation at large. In addition, almost all of the schools of *Sekota* district are beneficiaries of school feeding program. So, as an alternative, data on child mortality rate was used as proxy for child quality.

Under the assumption that households' preferences have rigid target of a minimum number of survivors at a certain age of their life cycle (as old age security or otherwise), parents seek only survivor child. So the mortality effect determines fertility by changing the potential biological supply of births to parents and by changing their behavioral demand for children. Factors operating on the supply side include primarily biological process and it is stochastic effects that are not associated with the preferences of a couple (Schultz, 1981). Whereas factors affecting demand include couples preferences on the number of children given the probability of deaths of children in their life. That is hoarding, ex-ante response to expected mortality, and replacement, ex-post response to experienced mortality. It is useful to draw the distinction between the demand for surviving children and the demand for births. In this study we emphasized on the demand for births given a goal of surviving children. Households' preferred level of fertility responds to variation in experienced and expected child mortality. So the objective of the study is to identify determinants of fertility decisions of households (demand for births) given the expected and experienced child mortality rate; the availability and scarcity of environmental goods and other socio economic factors.

Given the potential endogenous of child mortality on household fertility decisions, the Haussian test of endogenous was checked. The result showed that the null hypothesis of probability limit of d (b_{IV} −b_{LS}) = 0 (where b_{IV} is the estimates of the parameter coefficient using instrumental variable method and b_{LS} is the estimates of the parameter coefficient using least square method) was rejected using the Wald statistics. As a result, the instrumental variable method was used to estimate the

fertility equation. A set of variables such as age of wife, education of women, livestock holding, private owned land area, distance of health center, cleanness of water dummy, calorie intake per adult equivalent and education of men have been identified to influence mortality. The predicted value of child mortality regressed on explanatory variables, which had no impact on fertility but had significant effect on mortality, has been used as one explanatory variable to estimate fertility. Hence, only the structural form of fertility estimation is presented.

In the theoretical model, it is also shown that the number of children demanded (Equation 15) is a function of non-human wealth. However, in our sampled household data it was not possible to accurately identify the different sources of non-human wealth. It can be proxy by household calorie intake per household calorie requirements, livestock holding and total area cultivated. These explanatory variables have some correlation in each other from theoretical background. Therefore, using these variables simultaneously as a proxy for non-human wealth may create multicolinearity. From these alternative proxies for non-human wealth, household calorie intake per capita requirement was used for its comprehensiveness. However, this variable is not exogenous to household fertility decisions from the theoretical background. Parents may decide to increase their consumption foregone of bearing child and vice versa. So it is necessary to test the exogenous of these variables in the Tobit model. It was found that the exogenous of household expenditure was rejected using the Haussian test of the Wald statistics.

Therefore, to get unbiased and consistent estimator, the predicted household calorie intake per requirement was used as an explanatory variable of the usual instrumental variable techniques. Therefore in the estimation of fertility the structural form of the regression was used.

Table 1: Regression of household calorie intake in pulses and cereal equivalents per household requirements

Variable	Coefficient	Standard Error	t-ratio	Mean of X
Constant	0.62***	0.20	3.098	
Age of husband	-0.76E-02*	0.41E-02	-1.84	40.62
Education of husband dummy=1 if literate	-0.11E-01	0.66E-01	-0.16	0.37
Private area cultivated in ha	0.21E-01	0.13E-01	1.570	5.00
Share crop in area cultivated in ha	0.23E-01**	0.81E-02	2.847	3.35
Adults per total household number	0.56***	0.19	2.917	0.44
Dummy of PA=1 if Zarota	0.39***	0.78E-01	5.06	0.26
Dummy of PA=1 if Maheber Selassie	-0.82E-01	0.74E-01	-1.108	0.36
Adjusted R-squared	0.28885***			
Number of Observations	122			

The predicted household calorie intake per requirement was highly significant and some explanatory variables used in the prediction of this variable were found significant. So the predicted value of the variable was well explained by the explanatory variables.

In this study, the observed fertility was used to measure the desired family size. Observed fertility is a result of the interaction between demand and supply of children. However, there is insufficient information to separately identify demand and supply factors. Hence the model of observed fertility that we estimated includes both demand and supply factors (Aggarwal *et al.* 2000). So it is important to regress the observed fertility of different woman's age groups separately to avoid the supply bias of the fertility decisions of households. However, due to the smallness of the sample households, dividing into different women's age groups will result in inefficient log likelihood estimates (Maddala, 1997; and Green, 2000). So, to avoid the supply side bias and to have large sample size, women's age group dummies were included as an explanatory variable rather than simply women's age.

In estimation of fertility decisions of households in response to environmental goods, different levels and criteria of environmental good scarcity measurements are hypothesized. These are distance travel to sources of water for drinking water scarcity, time required to collect a bundle of firewood for scarcity of fuel wood and price of a bundle of fodder for scarcity of natural pasture. A potential problem with the measurement of these resource scarcities was that they do not capture the inter-seasonal variation in resource availability in a given community. This is due to, for example, the fact that water and wood for domestic use cannot generally be stored over an extended period. However, the collection of fodder has no problem in this regard. Therefore, the measure of resource scarcity concerning fuel wood and drinking water in our data did not reflect seasonal variation of the goods that the community faces. The data collected for the specific period, amount of bundle of firewood collected within a week for example, does not take in to account the season's variation. However, it is plausible to assume that the scarcity of these resources vary within seasons uniformly among individuals within a cluster and/ or among clusters. So there is no significant difference in taking either the annual season averages or specific seasons or days of a year.

Another important problem with this measurement was an exogenously given level of stress posed by the local environment and the households' response to this stress. Thus, for instance, due to scarcity of the pasture for the specific season of the year, households may use different areas for the sources of this natural pasture; as a result they may respond different distance of pasture but facing the same level of scarcity of

the good. Another example, it is possible for two households who face the same level of exogenous scarcity of water and firewood, to report different time requirement per trip to fetch water or to collect the same bundle of firewood.

The proxy for pasture scarcity, price of fodder, however has no problem regarding to endogenous to households decisions. As far as the scarcity of fuel wood and drinking water are concerned, which have proxy by time required to collect firewood and to fetch water respectively have an endogenous problem. A theoretical better alternative would be to eliminate the resource scarcity variable of the household level effect and isolate a cluster specific measure of scarcity by running cluster level regression (Aggarwal *et al.* 2000). To reduce the endogenous problem, it would be to look at cluster average of these variables which in turn implies the assumption that all households within a given cluster face the same exogenous level of scarcity. The two environmental good scarcity variables were regressed in the following fashion (see Equation 23). The structural of these resource scarcity variables used for the estimation of fertility.

$$RS_{ij} = a_j + X_{ij} + u_{ij} \quad \text{where } j = 1,2,3 \tag{23}$$

Where RS_{ij} was resource scarcity in cluster j and household i, X_{ij} was the explanatory variables that may affect the households respond to scarcity in specific cluster variables, a_j is the cluster specific fixed effect and u_{ij} is a random disturbance term with mean zero and constant variance σ^2. To predict water and fuel wood scarcity, women's education level, dependency ratio and predicted household consumption were used as an explanatory variable for the three clusters. For scarcity of pasture, price of fodder was taken as exogenously on the assumption that households' decision to purchasing and selling of fodder has no effect on the price of fodder.

There is also a potential problem with examining the impact of resource scarcity on fertility rates through the estimation procedure. The problem is that fertility rates in a given community are important components of its population level. Neither the population growth rate nor the intensity of environmental resource use is exogenously given. They are determined jointly by complex combination of history, opportunities, human motivation, ecological opportunities and chance factors (Boserup, 1990). So if population level affects resource use, or if there are omitted variables that affect both, the estimated parameters will be biased. For example, it is often observed that those social norms and other community factors play a very important role in determining fertility rates.

Often neglected institutional forms that arguably play major roles in agrarian economy and demographic outcomes are family and gender systems, village and community structures, government's administrative arrangements and legal systems (McNicoll and Cain, 1990). Cultural factors also influence the use and management of common resources. However, as information on cultural factors is not available, the estimated coefficients on the resource scarcity variables may reflect either the impact of resource scarcity or difference in cultural factors. To avoid such bias we used cluster/ PA as dummy variable, on the assumption that social norms and community natural resource managements are homogenous within the cluster/ PA level.

Before households' decision on fertility was estimated, multicolinearity check up was made on the explanatory variables. The multicolinearity test was undertaken using variance inflation factor (VIF) for continuous variables and contingency coefficients (CC) for the discrete variables. It was found that no multicolinearity problems for all the explanatory variables that we used.

3.1   Descriptive analysis of the variables

The variables considered in the model are:
- NEBCTY= Number of Ever Born Children in the last Ten Years
- NEBCFY= Number of Ever Born Children in the last Five Years
- EDUWM= Education of women
- CALPERCA= Household calorie intake per adult
- PNCED = Mortality of children
- PRCFOD = Price of fodder
- DISTWTR= Distance to drinking water sources
- TMFRWOOD = Time required collecting a bundle of firewood
- DISTHEAL = DISTHEAL
- AGWSCOH =Age of women second category (a dummy variable)
- AGWTHDCO = Age of women third category (a dummy variable)
- AGWFOR = Age of women fourth category (a dummy variable)
- AGEWIFIV = Age of women fifth category (a dummy variable)
- AGEWSIXC = Age of women sixth category (a dummy variable)
- ZAROT = *Zarota* PA (a dummy variable)
- MAHEB = *Maheber Selassie* PA (a dummy variable)

Table 2 summarizes mean value of the explanatory variables used in the estimation of Number of Ever Born Children in the last Ten Years (NEBCTY) and Number of Ever Born Children in the last Five Years (NEBCFY) period specifications. It

167

summarizes the mean value of each explanatory variable in the three clusters and provides the general average value for the district. The dependent variables are NEBCTY and NEBCFY. NEBCTY was highest in PA1 (2.87 children per woman), followed by PA2 (2.85 children per woman) and the smallest in PA3 (2.77 children per woman). The sample households' birth on average was 2.83 children per woman in the last ten years. Likewise, the NEBCFY was highest in PA3 (1.52), followed by PA2 (1.5) and the smallest birth in PA1 (1.47). The sample households' birth per woman on average was 1.5 children in the last five years. All the explanatory variables that are used in the estimation of fertility were presented in the table both the sample households and cluster mean level.

Education of women (EDWN): - Education of women is a dummy variable that takes one if she is literate, and zero otherwise. It was 0%, 9% and 4% in PA1, PA2 and PA3 respectively; and 5% for the district average

Price of fodder (PRCFOD): -This variable reflecting the status of availability of animal feed, is used as a proxy for the scarcity of natural resource, natural pasture. Price of fodder, as a proxy namely for pasture scarcity, is an alternative measure of other pasture scarcities. These are distance to pasture area, amount of bundle of fodder collected per pulses and cereals produced and amount of bundle of fodder used per livestock holding. Among the possible alternative measurements of scarcity of natural pasture, price of fodder is selected due to the exogenous nature of the variable. Whereas, the other possible alternatives are functions of households' decisions; therefore, they are endogenous from the theoretical background. It was found that the price was 8.08, 8.00 and 9.52 Birr/ bundle in PA1, PA2 and PA3, respectively. The district average was 8.57.

Distance to drinking water sources (DISWT): -Distance to drinking water sources can be used as proxy for water resource scarcity. For the scarcity of environmental goods, which are under communal ownership, distance is not the only indicator of the scarcity of the good. Rather, it is the weighted sum of the distance travelled to the source and the time required to collect or fetch. The latter factor is a function of population density and the concentration of the good per unit area. According to the results of the preliminary survey, however, the density of the population per unit of the resource and/ or the concentration of drinking water per unit area are homogeneous in the rural *Sekota.* Therefore, only distance of this resource is used as proxy for scarcity of the good. Distance of drinking water was 0.29, 0.44 and 0.39 hrs in one way walking in PA1, PA2 and PA3 respectively; 0.38 is the district avegae.

Table 2: Mean Value of Explanatory Variables Used in the Estimation of Fertility

Variables	Mean Values			
	PA1	PA2	PA3	Total
NEBCFY	1.4688	1.5000	1.5227	1.5000
NEBCTY	2.87	2.85	2.77	2.83
EDUWM	0.00	.09	.04	.05
CALPERCA	4.54	0.81	0.83	0.83
PNCED	0.81	0.58	0.65	0.63
PRCFOD	8.08	8.00	9.52	8.57
DISTWTR	0.29	0.44	0.39	0.38
DISTHEAL	2.76	1.81	2.29	2.23
TMFRWOOD	2.43	1.51	2.06	1.95
AGWSCOH	0.22	0.15	0.27	0.21
AGWTHDCO	0.22	0.33	0.23	0.26
AGWFOR	0.25	0.26	0.18	0.23
AGEWIFIV	0.22	0.15	0.14	0.16
AGEWSIXC	0.06	0.07	0.09	0.07
ZAROT	1.00	0.00	0.00	0.26
MAHEB	0.00	0.00	1.00	0.36

Time required for collecting a bundle of firewood (TMRCFRWD): - Scarcity of fuel wood can be proxied by time required to collect a bundle of firewood (Filmers and Prithet, 1996). As the scarcity of this fuelwood increases, the time required to collect per bundle increases. The time spent in collecting firewood was 2.43, 1.51 and 2.06 hrs/ bundle in PA1, Pa2 and PA3 respectively; and the district average was 1.95 hrs/ bundle

Mortality of children (PNCED):- The state of the environment also affects child quality, and hence, indirectly, the demand for children. To measure child quality, Aggarwal *et al* (2000) believe the use of anthropometrical data on the height and weight of children or their nutritional intakes is most appropriate. Schultz (1981); Farooq, and DeGraff (1988) believe the use of athletics performance, school age and IQ standards is most appropriate. However, all these variables need sufficient time and resource to measure and collect; and it was difficult to do so in this study. Therefore, child mortality rate was used as a proxy for quality of children.

The effect of mortality risk on fertility depends, amongst other things, on the curvature of the utility function, the perceived risk of mortality and the cost of an additional child (Schultz, 1981; Aggarwal *et al.* 2000). It was hypothesized that the risk of child mortality rate is positively related to fertility rate, in which demand for children is price inelastic. On the other hand, it is negatively related to fertility when demand for children is price elastic. The demand elasticity of children depends on the type of

utility they provide to households. If children were sought by parents only as a household financial investment, for their supply of labor and as a future means of assuring parental old age support, the demand for children could be quite elastic with respect to the changes in cost of the survivor (Schultz, 1981). On the other hand, if households consider children only as consumption good, the demand for children could be inelastic with respect to changes in cost of survivor. Therefore, it is difficult to hypothesize the direction of risk of child mortality rate effects on demand for children.

Household calorie intake per adult (CALPCAP):- Household calorie intake per adult is used as a proxy for income of the households. Among the very poor, increase in income reduces malnutrition and disease, and thus improves the ability of women to bear children. After threshold level of income is reached, fairly early, any further increases in income are expected to lead to fertility decline (Farina *et al*, 2001). We expect that increase in income of households proxy by the household calorie intake per adult, is positively related to the demand for children (Schultz, 1981). Calorie per capita (CALPERCA) was highest in PA1, 4.5 kcal/ per person, followed by PA3, 0.83 kcal/ per person, and the lowest in PA2, 0.81; and the district average was 0.83 kcal/ per person.

Age of women (AGEWIFE):- As the age of wife increases the demand for children may increase or decrease depending on different situations. First, an increase of age may result in increase in demand for children for old age security, and at the same time decrease the demand for children presumably due to couples adopting one or another method of birth control toward the end of their child bearing year. It is believed that at onset of marriage households will not respond to control of their fertility. So it is difficult to hypothesize the effect of age of wife on the demand for children a priori.

Distance to health services (DISTHEAL):- This variable is also expected to have impact on the demand for children through better access to modern contraceptive and family planning. Distance of health was 2.76, 1.81 and 2.29 hours in one way walking in PA1, PA2 and PA3 respectively; and it was 2.23 for the district average.

3.2   Results of the Tobit estimates of fertility

The result of the Tobit estimation of fertility is presented in Table 3. According to these results the coefficient of the predicted number of children ever died (PNCED) was found to be negative and significant to determine household's decision on their fertility in both NEBCFY and NEBCTY specification.

Households' response to child mortality can be categorized as hoarding and replacement. Hoarding is the ex-ante response to expected mortality of offspring while replacement is the ex-post response to experienced mortality. Households respond to a sequential decision to fertility taking into account both types of responses. It is also true that these effects of mortality risk relate to fertility. When the time gap of replacement, experienced child mortality of households to respond to fertility, is minimal (or nil) , the effect of mortality risk may not be significant though households respond to hoarding. However, in the NEBCTY and NEBCFY specifications, both the replacement and hoarding have enough time to respond to the fertility of households. Hence predicted mortality has significant effect on fertility in NEBCTY. Its effect is significant at (α <10%).

Table 3: Tobit estimation of household fertility in the past ten and five years

Explanatory variables	NEBCTY	NEBCFY	Mean of X
Constant	12.54***	9.45***	
	(2.26)	(2.04)	
EDWF (dummy)=1 if literate	-0.98***	0.22	0.49E-01
	(0.37)	(0.34)	
DISTHEAL	-0.17	-0.86E-01	2.23
	(0.10)	(0.93E-01)	
PRCFOD	0.14	0.11	8.36
	(0.16)	(0.14)	
TMFRWOOD	-4.44***	-3.23***	1.95
	(0.70)	(0.64)	
DISTWTR	-3.19**	-3.50**	0.38
	(1.30)	(1.17)	
PNCED	-0.73*	-0.83*	0.63
	(0.39)	(0.35)	
CALPCAP	-2.41***	-1.46*	0.82
	(0.76)	(0.68)	
AGWSC (dummy)=1 if age is 21-26	1.38***	0.73*	0.21
	(0.40)	(0.35)	
AGWTHD (dummy)=1 if age is 27-32	1.90***	0.59	0.26
	(0.43)	(0.38)	
AGWFOR (dummy)=1 if age is33-38	1.29**	0.33	0.23
	(0.46)	(0.41)	
AGEWIFIV (dummy)=1 if age is 39-44	1.22**	0.27	0.16
	(0.53)	(0.47)	
AGEWSIXC (dummy)=1 if age is 45-49	0.52	-0.58	0.74E-01
	(0.65)	(0.60)	
ZAROT (dummy)=1 if PA1	2.87***	1.77***	0.26
	(0.44)	(0.39)	
MAHEB (dummy)=1 if PA3	-0.73***	-0.53**	0.36
	(0.23)	(0.21	
Log likelihood function	-152.06	-136.95	
Number of observation	122	122	

*Note: ***Significant at 1% level, **significant at 5 % level, *significant at 10 % level*
The parentheses are the standard errors of the estimates.

The possible reason for the negative relationship between child mortality and fertility might be the demand for children is price inelastic and associated to a desired to offset experienced or anticipated child mortality. Parents seem to respond to an increase in child mortality by having more births, perhaps to some extent because of biological effect of an infant's death, which interrupts lactation and shortens the mother's sterility following a birth.

The effect of calorie consumed per capita was also found to be highly significant ($\alpha <$ 1%) on the demand for children in ten years period specification. In five years specification, it is significant at a significant level of ($\alpha <$ 10%).

However, calorie intake per capita in both children ever born in the last ten years and in the last five years was negatively related in this study. This might be related to the principal individual level strategy for copping with pasture shortage. In rural *Sekota,* the copping strategy for pasture shortage is to move to other areas. This response to the pasture scarcity might have major consequences for the demographic behavior of the community. Livestock owners of the rural *Sekota* are more mobile in the season or years of pasture scarcity. Even though children are the main herders of the livestock for the normal period, adult males are the main herders in seasons or years of pasture scarcity. The community arranges groups from adults, mostly household heads, to herd the livestock of the community in areas where there is ample pasture in that season. Households having large herd will be more responsible for migrate/ move the livestock in different areas. It is expected that the household that have more livestock will have a probability of high calorie intake per adult.

In prolonged pasture scarcity, adults, probably household heads temporarily move their livestock to neighboring PA or even go to other districts or administrative zones that have ample pasture for this season. This coping mechanism of the community to pasture scarcity results separation of husband and wife in longer period; as a result reducing fertility will occur. So the possible reasons for the negative relationship between household calorie intake per adult and fertility might be related to migration of husbands in pasture deficit season's intern long abstinence of the couples.

However, non-holders of livestock or those who have less number of livestock will not move in pasture deficit season. It is true that they migrate in food deficit seasons. The separation of the couples and the whole family in non-livestock owners is minimal for food deficit seasons (SERA, 2001).

The time required to collect firewood per bundle (proxy measure of fuel wood scarcity) was found to affect fertility negatively and highly significant ($\alpha <$ 1%) in both

periods' specifications. This variable was found negatively related to the fertility of households within ten years and five years period specifications. The difference in the relative value of human time, particularly the opportunity costs of women's that commonly is thought to contribute a substantial share of the total cost of child rearing. This negative relation between fuel wood scarcity and fertility may be due to the division of labor in case of high scarcity. We have seen that as this resource becomes scarcer adults' especially male adults were the main collectors of this good. We have also seen that the main collectors of fuel wood are female and male adults. High scarcity of this good is equivalent to say high shadow price of the good, increase the opportunity costs of women's time as long as women's are the main collectors of this good. Therefore, households have no incentive to have additional child on the assumption that children will not participate in the collection of fuel wood or the participation of children in fuel wood collection is minimal.

Table 4: Partial derivatives of the expected values of the dependent variables with respect to the explanatory variables.

Explanatory variables	NEBCTY	NEBCFY	Mean of X
EDWF (dummy)=1 if literate	-0.94***	NS	0.49E-01
	(0.35)		
DISTHEAL	NS	NS	2.23
PRCFOD	NS	NS	8.36
TMFRWOOD	-4.26***	-3.05***	1.95
	(0.67)	(0.60)	
DISTWTR	-3.02**	-3.24**	0.38
	(1.23)	(1.08)	
PNCED	-0.68*	-0.75*	0.63
	(0.36)	(0.32)	
CALPCAP	-2.31***	-1.32*	0.82
	(0.73)	(0.62)	
AGWSC (dummy)=1 if age is 21-26	1.32***	0.66*	0.21
	(0.38)	(0.32)	
AGWTHD (dummy)=1 if age is 27-32	1.82***	NS	0.26
	(0.41)		
AGWFOR (dummy)=1 if age is 33-38	1.22**	NS	0.23
	(0.43)		
AGEWIFIV (dummy)=1 if age is 39-44	1.15**	NS	0.16
	(0.50)		
AGEWSIXC (dummy)=1 if age is 45-49	NS	NS	0.74E-01
ZAROT (dummy)=1 if PA1	2.76***	1.67***	0.26
	(0.42)	(0.37)	
MAHEB (dummy)=1 if PA3	-0.70***	-0.49**	0.36
	(0.22)	(0.20)	
Log likelihood function			
Number of observation			

Note: ***Significant at 1% level, **significant at 5 % level, *significant at 10 % level

The parentheses are the standard errors of the estimates.

It is consistent with Nerlove (1991). He argues that a positive relation between resource degradation and fertility is more likely to be observed at low levels of resource degradation. According to him, with continued deterioration of the resource base, this relationship must eventually turn from positive to negative. This would be due to highly degraded environment; the perceived costs of raising children may exceed the benefit they provide as producers of goods. So demand for children will rise only if the increase in perceived benefits of children due to increase in resource scarcity is greater than the cost of additional child.

Among environmental good variables, scarcity of water that has been proxy by distance to drinking water was also found significant at a significant level of $\alpha < 5\%$ in both period specifications.

The sign of this variable was also negatively related to the fertility decisions of households. This relation might be due to the same reason we have discussed in fuel wood scarcity.

As expected, education of women affects fertility negatively in NEBCTY specification and the relationship was significant at $\alpha < 1\%$. That is, certain level of women's education was found to decrease the observed fertility, other things held constant.

Age of women was also found to significantly affect fertility for some age of women's category. Its effect was found positive and significant for the women's age category of 2, 3, 4 and 5 in the fertility of women in last ten years period specifications. It was significant for a significant level of $\alpha < 1\%$, $\alpha < 1\%$, $\alpha < 5\%$ and $\alpha < 5\%$, respectively. While, it was not significant for the last women's age category and unobserved dummy /benchmark/ (women's age ranges between 15-20 years) in this specification. It was found that all of the women's age categories affect fertility positively, set unobserved dummy = 0 coefficients. As far as in NEBCFY specification is concerned, it was found significant only in the second women's age category (age =21-26) at a significant level of $\alpha < 10\%$.

The other explanatory variables that affect fertility were the clusters dummies, that is the specific fixed effect in the two PAs, those factors that are not identified and not included in the estimation of fertility, was highly significant ($\alpha < 1\%$). In Table 4 the marginal values of the explanatory variables are presented.

Table 5: Point elasticity

Explanatory variables	NEBCTY	NEBCFY	Mean of X
EDWF (dummy)=1 if literate	-0.016***	NS	0.49E-01
DISTHEAL	NS	NS	2.23
PRCFOD	NS	NS	8.36
TMFRWOOD	-2.94***	-3.96***	1.95
DISTWTR	-0.43**	-0.82**	0.38
PNCED	-0.15*	-0.31*	0.63
CALPCAP	-0.67***	-0.72*	0.82
AGWSC (dummy)=1 if age is 21-26	0.1***	0.09*	0.21
AGWTHD (dummy)=1 if age is 27-32	0.17***	NS	0.26
AGWFOR (dummy)=1 if age is 33-38	0.1**	NS	0.23
AGEWIFIV (dummy)=1 if age is 39-44	0.06**	NS	0.16
AGEWSIXC (dummy)=1 if age is 45-49	NS	NS	0.74E-01
ZAROT (dummy)=1 if PA1	0.25***	0.29***	0.26
MAHEB (dummy)=1 if PA3	-0.09***	-0.12**	0.36

It is calculated on mean of the explanatory variables and mean of NEBCTY=2.83 and NEBCTY=1.5

Table 5 summarizes the point elasticity of fertility with respect to the resource scarcity variables and some other explanatory variables that significantly affect the fertility estimates. The purpose here is to get a better perspective on the magnitude of impact of resource scarcity and other variables. As shown in the table, the point elasticity of the time required to collect bundle of firewood was around –2.94 at the sample mean level in ten years period specification. As compared to this, elasticity of education of women was found to be -0.016. While the elasticity of calorie intake per capita was -0.67, this means a 1% increase of time required to collect fuel wood per bundle on the average results decreases of 2.94 percent on the prevailing average fertility. Comparing to the other environmental goods, drinking water, and a 1% increase distance of drinking water results a decrease of the prevailing rate of fertility by 0.43%. While a 1% increases of the education status of the women will result in a decreases of 0.016% of the existing fertility level, and the same percentage increases of calorie per adult equivalent will result a decreases of fertility by 0.67%. Likewise a 1% increase of child mortality will result 0.15 decrease of the prevailing fertility rate.

It was found that the elasticity of fuel wood scarcity, TMFRWOOD, (2.94) is greater than almost four and half times the elasticity of predicted calorie intake per capita, CALPCAP (0.67). If we compare this to water scarcity, the elasticity of TMFRWOOD is almost seven times greater than elasticity of water scarcity, DISTWTR, (0.43). It is also greater than almost twenty times the elasticity of predicted mortality, PNCED, (0.15). When we compare the elasticity of the women's age categories, it is highest in

the third age category (27-32) of the women (0.17), followed by the second and fourth age category, each of which has an elasticity of 0.1. While the elasticity of the fifth women's age category has an elasticity of (0.06)

Looked at another way if the time taken to collect firewood decreases from the present level of around 1.95 hrs to 0.975 hrs, number of children ever born in the last ten years (NCEBTY) will increase from the present level of 2.83 children per women to 4.3 children per women. Similarly a 50% decrease of DISTWTRW, proxy for scarcity of drinking water, (that is from the present level of 0.38 hours to 0.19 hours), the present level of fertility increases from 2.83 to 3.045 children per woman. A decrease of predicted consumption from the present level of 0.82 to 0.41 (the same percentage decrease of firewood, 50%) will also result in an increase of NCEBTY from the present level of 2.83 children per women to 3.165 children per women.

If the predicted number of children ever died (PNCED) decrease from the present level of 0.63 to 0.31, the expected fertility will decrease from the present level of 2.83 children per women to 2.755 children per women. The increase in women's education from the present level of 4.9% to 7.35% (50% changes in women's education) will result in the decrease of NEBCTY from the preset level of 2.83 children per woman to only 2.807 children per woman. This shows how the women's education is less responsible for the reduction of fertility for the rural *Sekota*.

If the existing proportion of women's age category increases or decreases, there would result a change of the average total fertility rate per specific period. For example, if the existing proportion of the second women's age category, AGWSC, decreases from 21% to 10.5%, the level of fertility decreases from the present level of 2.83 to 2.69 children per woman. As compared to the other women's age category, the same percentage decrease of proportions women's age category, 23% to 11.5% for the fourth women's age category, AGWFOR, will result the same change to second age category. While the same proportional decrease of the third women's age category, AGWTHD, in the population (from 26% to 13%) will result a decrease of the present level 2.83 to 2.59 children per woman. Likewise, a 50% decrease of the proportion of the fifth women's age category, AGEWIFIV, from 16% to 8% will result in a decrease of the existing women's fertility of 2.83 to 2.75 children per women.

4.   Summary and conclusion

In this study, the impact of environmental good scarcity on demand for children was analyzed. Resource scarcity is likely to affect on the production of child quality. In this study, the impact of fuel wood, water and pasture scarcity on fertility rate was

examined using household data from rural *Sekota*. An individual choice model of fertility was estimated in which resource scarcity effect on the demand for children through its effect on child mortality and productivity of children as resource collectors. It was found that part of environmental goods, drinking water scarcity and fuel wood scarcity variables, have a negative and significant effect on fertility. The other variable, which has also directly or indirectly related to environmental good scarcity and that affects fertility, was risk of child mortality rate. Other variables, which have also affect fertility other than environmental goods, were calorie intake per capita, education of women and age of women categories.

As far as women' education is concerned, the result from our estimate indicated that it was negatively related to NEBCTY specification. Although this variable is highly significant, the fertility reduction or the success of family planning will not impact on the improvements of women's education in the future. This is due to the fact that from the total sample households only 4.9% of the women are literate. For instance by some program or project if the women's education increases by 100%, say 9.8% of the women were literate, then the existing fertility will only decrease by only 0.05 children per women in the population, that is from 2.83 to 2.78 children per women in ten years period of women's fertility. So from different angles, it is difficult to conclude that improvements in fertility decisions of women can be achieved solely from an increase of women's education.

Another ambiguous and unexpected result regarding the fertility decisions of households in rural *Sekota* was that household consumption level affects fertility negatively. Further decrease of household consumption level as well as long migration for adult male for coping with the pasture shortage might have a negative effect on human fertility and may indeed adversely affect the growth and survival of small children. The indirect and long-term demographic consequences of the drought on degraded areas, such as rural *Sekota*, are therefore, probably much more important than any direct effect linked to temporary increases or reduction in fertility.

Among the explanatory variables that affect fertility decisions of households, scarcity of fuel wood, TMRFWOD, was found to be the major determinant in absolute value, 2.94, followed by household calorie intake per requirements, CALPCAP, 0.67and the third important determinant was drinking water scarcity, DISTWTR, 0.43.

Most of the family planning objective, whether it uses modern contraceptive or the natural infecundibility, is to control or minimize the fertility potential (fecund-ability) of women. The elasticity of different women's age group dummy indicates the probability responsiveness of each woman's age category to fertility. So to achieve the objective

efficiently, the family planning should emphasize on the middle age groups. But it doesn't mean that the first and last age group of women is left aside.

It is also true that, where family planning programs provided a service that few as yet wanted, they have expended resources to little effect. The NPP of Ethiopia has developed strategies and programs to get the objectives of the policy. The programs launched in educational and health sectors have taken the participation of women in education and the health of women as well as the expansion of reproductive health and family planning as the major strategies. However, from this case study, we have seen that distance to family planning, a proxy for access to health service, has no significant effect on fertility. It is also true that, the education level of women has significant effect on fertility; however, its responsiveness to fertility is minimal. So the NPP of Ethiopia has also taken in to alternative strategies to areas that have the same agro ecological and socio economic settings to rural *Sekota*. This does not mean that the program has no appropriate strategies at national level. This strategy might be suitable for other areas, though it is less appropriate for the study area. The following particular strategies should be taken into account as components of the NPP of Ethiopia for areas like the rural *Sekota*.

1. Child health: - In this study, child mortality has a significant effect on the fertility of women in rural *Sekota*. It is not only significant but also the fourth important determinant of fertility.
2. Education of Child: -Environmental good scarcity, like scarcity of fuel wood and scarcity of drinking water, was found to be negatively related to fertility of households. These variables are the first and third most important determinants of fertility. The negative relation between resource degradation and fertility is more likely to be observed at highly deterioration of the resource base. This would be due to in highly degraded environments; the perceived costs of raising children may exceed the benefit they provide as producer goods. So demand for children will rise only if the increase in perceived benefits of children due to increase in resource scarcity is greater than the cost of additional child. So it is plausible to assume that households' demand for children in rural *Sekota* is for consumption only. Consumer demands for children have a diminishing tendency to reply parents' investments in terms of market goods and services. Thus, the marginal (consumer) benefits to additional children might decline. Parents might want to school their children for more years, and achieving this goal might be viewed as a good substitute for having additional child. Parents will further decrease their demand for children in highly degraded areas provided that they have the opportunity and potential to teach their child run.

178

In addition to the above policy options, the following research options should be considered as long as the fertility decisions of households in response to environmental good scarcity is concerned. These are: -

1. Use of panel data: - It is believed that the different specifications to control the endogenous effect may have some drawback on the results of the fertility estimation. Besides, the most serious limitation to this study is the fact that the cross sectional data from a single year to examine what is essentially a dynamic response of households to the continually changing resource bases. A panel data set over a relatively longer period of time, say for ten years, or even longer, would be more appropriate for the purpose of the study.

2. Consider wider areas for the level of environmental good scarcity and socio-economic settings: - It is also important to consider wider areas that cover a wide range of agro- ecological zones to have different natural resource settings. This helps to have the resultant matrix of the explanatory variables, both socio-economic and environmental good availability and scarcity levels, capture a wider range of values with respect to woman's fertility and child mortality rates.

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