Assessment of the Impact of Productive Safety Net Program on Households Asset Building and Soil Conservation Activities: The Case of Lemo District, Haddiya Zone, Southern Ethiopia

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As thesis research advisor, I hereby certify that I have read and evaluated this thesis prepared, under my guidance, **Dessalegn Anshiso** entitled **"Assessment of the Impact of Productive Safety Net Program on Households Asset Building and Soil Conservation Activities: The Case Of Lemo District, Haddiya Zone, Southern Ethiopia"**. I recommend that it be submitted as fulfilling the thesis requirement.

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ABSTRACT

Assessment of the Impact of Productive Safety Net Program on Households Asset Building and Soil Conservation Activities: The Case of Lemo District, Haddiya Zone, Southern Ethiopia

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PSNP in Ethiopia is intended to bring about a significant change and to better respond to the needs of food insecure households and create productive investments to strengthen rural economic growth and environmental rehabilitation. In relation to the impact of PSNP at country level; several endeavors have been done to assess its general impact, but at local levels, especially in the Lemo District there are inadequate empirical evidence on the program expected outcomes like on asset building and investment in soil conservation activities by the beneficiaries of the program. Therefore, the objective of this study was to assess the impact of PSNP on asset building and soil and water conservations activities at Lemo district, Haddiya zone, Southern Ethiopia. The cross-sectional survey data was gathered from 181sample households which were taken from intervention and non-intervention groups. A propensity score matching method was applied to assess the impact of the program on outcome variables (asset building and SWC activities) for the beneficiary households. As a result, kernel matching estimator of band width 0.25 was selected as best matching algorithm which hold large matched size and low Pseudo R^2. *After matching only 167 matched respondents, 91 from beneficiaries and 67 non- beneficiaries, were used to come up with the final decision. The ATT estimation result was indicates that participation in PSNP did not lead to strong and significant effect on individual's household's asset building and practicing of SWC activities by the beneficiaries. Therefore, re-thinking or re-evaluating the program objectives at national, regional, and other operational levels is inevitable to actualize desired objectives.*

Key Words: PSNP, Impact, Propensity Score Matching, Households, Asset Building and SWC Activities, Southern Ethiopia

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ACRONYMS AND ABBREVATIONS

CSA	Central Statistics Authority
DFID	Department for International Development
FDRE	Federal Democratic Republic of Ethiopia
Ha	Hector
HH	Household
HZFDMD	Hadiya Zone Finance and Development main Department
Km	Kilometer
MoARD	Ministry of Agriculture and Rural Development
MoFED	Ministry of Finance and Economic Development
NGO	Non- Governmental Organizations
PAs	Peasant Associations
PS	Propensity Score
PSM	Propensity Score Matching
PSNP	Productive Safety Net Program
SNNRP	South Nation and Nationalities Regional People
SLM	Sustainable Land Management Practice
SSA	Sub Saharan Africa
SWC	Soil and Water Conservation
TLU	Tropical Livestock Unit
WFP	World Food Program

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1. INTRODUCTION

1.1 Background of the Study

In Africa, especially in Sub- Saharan countries, many people are still suffering from chronic food insecurity due to, recurrent drought, low input and output of subsistence agriculture, and widespread poverty (Fekadu and Ignatius, 2009). According to Samuel (2006), different food security programs had been designed and instituted to alleviate such a challenge and to timely respond to this persistent threat. Most of these interventions are formal programs, meant to benefit individuals and households, who are chronically food insecure, unable to work, or experience temporary decline in purchasing power, by providing them with income or a substitute for income. Such programs include; cash and in-kind transfer programs, subsidies, and labor-intensive public work (Samuel, 2006).

Ethiopia has been experiencing both chronic and acute food insecurity problems (Gilligan *et al.*, 2008). It has been one of the defining features of rural poverty, in the country. However, the magnitude is much greater in drought-prone rural areas than in urban areas. The problem of food insecurity in recent years has worsened with around 14 million people requiring emergency food aid (MoARD, 2006). The major causes of food insecurity in Ethiopia includes rapid population growth, small size and fragmented land, poor infrastructure, traditional agricultural practices and implements, shortage of farm land, poor distribution of agricultural inputs, land degradation, recurrent drought, and other personal characteristics of the producers (Seyoum *et al.*, 1998; MoFED, 2002; Bekele and Holden, 2000).

In response, the Government of Ethiopia has decided to address the basic food needs of food insecure households remarkably in 2005. As the result, Productive Safety Net program was launched as an alternative intervention, to address the needs of chronically food insecure households (MoARD, 2006). PSNP is financed through multi-year predictable resources, rather than through a system dominated by emergency humanitarian aid. In addition, the government seeks to shift the financing of the program gradually from food based financing to cash based financing. Thus,

PSNP in Ethiopia is an international flagship program both in its scope and in its partnership approach, having reoriented a rural safety net to better respond to the needs of food insecure households and create productive investments to strengthen rural economic growth and environmental rehabilitation. This has been expected to be achieved through: (i) the predictable provision of adequate food and cash transfers to targeted beneficiary households, with this to allow effective consumption smoothing and avoiding asset depletion; and (ii) the creation of productive and sustainable community assets that contribute to the rehabilitation of severely degraded areas and increase household productivity (Julie *et al.*, 2009).

Lemo District, which is the study area, was one of the District in Ethiopia targeted as the operational area of food security programs. The District is still characterized by persistent food insecurity due to erratic rainfall, crop disease, expensive inputs and the late delivery of inputs (particularly fertilizer) and high population density. In order to alleviate this problem, different food security programs which are supported by government and non- government organization were operationalized. Of these, PSNP is one, which transfers resources in the form cash or incentive mechanism for development works, which includes asset building and restoration of degraded natural resources, since 2006, with its all-inclusive coverage.

Despite the fact that, the program is still functional with its objectives of incentive provision, for the expected outcomes (like in the area of asset building and soil and water conservation[1] activities), it needs an impact evaluation for the contributions rendered. Therefore, the central question of this study attempts to address the impact of the PSNP on asset building and practicing of SWC activities by farmers who benefit from the program.

[1] In this study, soil conservation, and soil and water conservation (SWC) are the same and have the same meaning.

1.2. Statement of the problem

The government of Ethiopia has made several interventions by recognizing problems food security and land degradation as a major environmental and socio-economic problem. These different interventions carried out with the support of the WFP (World Food Program) and other potential donors. However, such projects funded by the WFP and others have been criticized in addressing the problem and in improving soil and water conservation activities (Aklilu and De Graaff, 2004). Despite the fact that, the efforts of the government and other organizations to reduce land degradation and to promote effective adoption of soil and water conservation practices by farmers; the soil loose and environmental imbalances have continued to threat the agricultural system.

In line with this, in the past decades the government of Ethiopia in response to food security has been exerted efforts on emergency food-based interventions. However, ignorance of integrating these food aids deliveries with natural resource management have resulted little to prevent households' asset depletion. By being aware of this, the government of Ethiopia changed the emergency food based assistance to multi-year PSNP in 2005. PSNP (Productive Safety Net Program) is one which is implemented in different districts of the country including the study area. The program provides farmers with cash payment for their public work participation in the planned SWC activities. This form of transfers aimed at breaking dependency of those food insecure households on food aid, in the long term. Additionally, these transfers are expected to be used partly to meet immediate consumption needs and partly invested in farming and enterprise activities (Devereux *et al.*, 2006). In the study area, the focus of the PSNP is protecting depletion of livelihood asset at household and community level and increasing productivity of the land through investing on land management practices (dominantly by SWC activities).

In relation to the impact of PSNP at country level; several endeavors have been done to assess its general impact. However, at the local levels there are inadequate empirical evidences on the program impact to the expected outcomes particularly on asset building and investment in soil and water conservation activities by the beneficiaries of the program. Similarly, this same impact evaluation studies were not

conducted in Lemo District, where the program is still running. Hence, this study was focused on assessing the impact of PSNP, particularly on asset building and soil and water conservation practices being undertaken by program, through examining the change brought between the beneficiaries the program and non-beneficiaries ,with the fixed period of time in Lemo district, Hadiya Zone of SNNRP, Ethiopia.

1.3 Objectives of the Study

The overall objective of this study was to assess the impact of productive safety net program vis-a-vis beneficiaries' asset building and practices of soil and water conservation activities.

The specific objectives are:

1. To analyze the impact of PSNP on households asset building process in Lemo District :
2. To study the impact of PSNP on households soil and water conservation activities in the study area:

1.4. Research Questions

1. Does the participation on PSNP contribute for improving households asset building and soil and water conservation activities or not?

1.5. Significance of the Study

This study can provide important information about PSNP impact on beneficiaries. This means that the study helps to know the effect of provision of incentives to enhance asset building and soil and water conservation activities. Moreover, the findings of the study help as baseline documents of PSNP impact on particular activities for the future researchers.

The study can help the government office (Agricultural office) and other supporting NGOs in decision making process to see change brought by participation in the program. This is due the fact, that the information helps them to rationalize whether or not further interventions are required.

On top of this, it also shows direction of future improvement on the program implementation to policy makers and others concerned body. This is because, the knowledge obtained from impact evaluation studies will also provide critical input to the appropriate design of future programs and projects.

1.6. Scope and Limitations of the Study

PSNP program implementation is expected to bring-about positive outcomes on protection of asset depletion of the beneficiaries and the investment on sustainable land management. However, the researcher in this study has looked the impact of the program only on asset building and soil and water conservation activities (i.e dominantly practiced in the study area). In addition, this study was focused only in one District and originally on181 households from five Kebeles, with a given time frame and budget availability. Besides, the researcher has intended to see the outcome of the program on specific activities rather than its comprehensive objectives.

With regard to limitations of this study, households production and durable assets were measured in number, not in terms of Birr (value) (which is, what economists are mostly interested with). The reason behind this was the challenge to find the actual price of each asset, with an intention to set-up a constant inflationary gap across the time horizon, before the implementation of the program.

2. LITERATURE REVIEW

2.1. Conceptual Literature

2.1.1. Social Safety Net

Public Social Safety Nets (SSNs) program defined as a set of programs designed to help individuals or households mitigate or cope with chronic poverty or transient declines in income that would cause them to live in a situation of poverty or worsening poverty World Bank (World Bank, 2001).As such, they help alleviate poverty and reduce vulnerability to poverty. SSNs generally have two components:

I. Social assistance programs, such as transfers, subsidies, and workfare, designed to help individuals or households cope with income risks or situations of chronic poverty; and

II. Social insurance schemes, such as publicly-provided or mandated insurance for unemployment, old age (pensions), disability, survivorship, sickness, etc., which are designed to help mitigate income risks. An adequate public social safety net (SSN) is an important element of a comprehensive poverty reduction strategy (World Bank, 2001).

Public SSNs complement informal and formal market-based strategies for mitigating and coping with income risks. Informal strategies include income diversification, inter-household transfers, and investments in social capital. Formal market-based strategies include private insurance and financial services (World Bank, 2000).

Timothy *et al.* (2003), define safety nets as those public interventions which are designed to serve two key functions: i) to play a redistributive role transferring resources toward the poorer members of society to bring them out of poverty, and ii) to provide greater opportunities for individuals to mitigate risks from unforeseen contingencies. Such risks can operate at the level of the household, say through an unexpected death or unemployment of the household head, but also at the community or national level due to natural disasters, financial crisis, and terms-of-trade deteriorations. The correct balance between the redistributive and risk reduction roles of safety nets will ultimately depend upon country-specific factors. Types of social

safety net include cash transfers, In-kind transfers and Informal safety nets (Timothy *et al.*, 2003).

2.1.2. Productive Safety Net Program in Ethiopia

Productive safety net program aims to reduce the number of people who rely on annual humanitarian appeals, by providing predictable and timely cash and food. It aims to shift away from a focus on short-term food needs met through emergency relief to addressing the underlying causes of household food-insecurity (DFID, 2007). According to, FAO (2006), the program was started in 2005 in the country, has been supporting 7.2 million Ethiopians who are vulnerable to shocks such as droughts and floods. The Program tries to reduce the vulnerability of households that do not have enough to eat even when the weather and harvest is good.

PSNP has special features; one of these is types of transfers. This may be cash only, both cash and food or food only based on specific situation of the safety net areas. On top of this, the program has its own objectives, principles and components and they are described below (FDRE, 2006).

2.1.2.1. Objectives, principles and components of PSNP

The objective of the Productive Safety Net Programme.

> *'To assure food consumption and prevent asset depletion for food insecure households in chronically food insecure woredas, while stimulating markets, improving access to services and natural resources, and rehabilitating and enhancing the natural environment'(MoARD, 2010).*

This objective arises from the PSNP logical framework, which is the strategic planning tool used by the PSNP to ensure that what will be done to implement PSNP to achieve the desired objective of the program.

Principles of PSNP Implementation .To ensures that PSNP is effective in achieving its objectives it needs to be implemented in a certain way. According to MoARD (2010), the following are principles to be applied at all times:

1. Fair and transparent client selection. Clients are selected through community-based targeting, with an effective appeal mechanism to address inclusion or exclusion errors.

2. Timely, predictable and appropriate transfers. A transfer is timely if it provided to clients at the point in time during the year when they need the support. Transfers can be considered predictable if PSNP clients have timely knowledge of their eligibility for the program, and they know what type, how much and when they transfer they will receive. A transfer is appropriate if it meets the needs of households: cash is provided in settings where markets function, while food is provided in areas where there is no food to purchase or food prices are extremely high and both have the value.

3. Primacy of transfers. Transfers should not be delayed for operational reasons, including those related to public works implementation, under any circumstances.

4. Productive safety net. The PSNP is a productive safety net which means that it is not only interested in providing a safety net that protects food consumption and household assets, but it is also interested in addressing the underlying causes of food insecurity and contributing to economic growth in its own right. The productive element comes from local infrastructure created through PSNP Public Works and from the multiplier effects of cash transfers on the local economy.

5. Integrated into local systems. PSNP plans are integrated into wider development plans at woreda, zone, region and Federal levels.

6. Scalable safety net. The PSNP is scaled up when needed in the event of shocks to ensure assistance is available to those households who need it most in PSNP woredas, to prevent them from becoming more food insecure.

7. Cash first principle. When possible, cash should be the primary form of transfer. This assists with the stimulation of markets – since people spend their cash in local markets – and the move away from food aid. Food transfers are provided at times and places when food is not available in the market, or where market prices for food are very high. This protects PSNP clients from food shortages and asset depletion.

8. Gender Responsively. Gender responsively should be criteria at all phases of the program as they make up the majorities of the vulnerable people and they have a lot of knowledge for rehabilitation of the environment. Accordingly, it is expected to enable women to participate and benefit from the program by reducing their regular work burden and increase access to productive assets so that we can ensure the sustainability and effectiveness of the program. (MoARD, 2010).

Components of PSNP. According to MoARD (2010), the components are other important feature of PSNP. Accordingly, PSNP has two components such as public work and direct support. Public works is the most popular and it aimed at the provision of counter-cyclical employment on rural infrastructure projects such as road construction and maintenance, soil and water conservation activities, small-scale irrigation and reforestation. . it is aimed to address the underlying causes of food insecurity in PSNP woredas by addressing the severe environmental degradation and limited access to infrastructure. The availability of labour from able-bodied PSNP clients is used to construct and ensure maintenance and future sustainability of appropriate priority local infrastructure and soil and water conservation activities.
Direct support is aimed at provision of direct unconditional transfers of cash or food to vulnerable households with no able-bodied members who can participate in public works projects (FDRE, 2006).

Principles of PSNP Public Works.

The public works falls within the PSNP and therefore all public works are bound by the general Principles of the PSNP described above. According to MoARD (2010), PSNP public works has its own set of principles:

I. **Labour-based**: Works must require as much labour and use simple tools as much as possible. The labour requirements do not have to be for physically intensive works, such as building roads, and can include works that are less physically demanding, such as caring for children.

II. **Participation**: the community participates in the selection, planning, monitoring and evaluation of projects.

III. **Predictability**: Public works are provided through a multi-annual resource framework. PSNP clients should be aware of the timing of public works, which should be scheduled to avoid period of peak agricultural labour.

IV. **Proximity**: Public works are provided as much as possible in the immediate localities of the people in need.

V. **Integration**: Public works are integrated into Woreda development plans and planned on an inter-sectoral basis.

VI. **Gender Sensitivity**: Public works are designed to enable women to participate and benefit from the program, and priority is given to works which reduce women's regular work burden. It must be flexible to adapt to women's activities.

VII. **Watershed Approach**: Public Works will be planned according to the community based watershed management development approach outlined in MoARD related guidelines. This ensures a holistic approach to managing a watershed ensuring that activities upstream and downstream complement each other, and incorporates mitigation activities into activities (such a road construction) which may create environmental risks.

The overall objective of community based watershed management development approach is to improve the livelihood of community/households in rural Ethiopia through comprehensive and integrated natural resource development. It aims at productivity enhancement measures for improved income generation opportunities, enhanced livelihood support systems and high resilience to shocks. The second objective is to optimize the use of existing natural resources and untapped potentials in both already degraded areas and in the remaining potential areas in the country.

More specifically for conserving soil, rainwater and vegetation effectively for productive uses; Promoting sustainable farming and stabilize crop yields by adopting suitable soil, water, nutrient and crop management practices; and Rehabilitating and reclaim marginal lands through appropriate conservation measures and mix of trees, shrubs and grasses, based on land potential etc.

2.1.3. Asset and Asset Building

Assets are things that provide the means to generate livelihoods and buffer the impact of common disasters such as drought, flooding, and disease that afflict most African countries (McPeak, 2004). A growing body of research has demonstrated how assets may contribute to the well-being of families in SSA (Barrett & Reardon, 2000). Given these research, many development interventions have focused on helping families to build assets as a way of enhancing household well-being. In SSA households have a limited capacity to confront development challenges because they lack pathways to asset accumulation. Accessibility barriers include gender-biased inheritance and

traditional laws, lack of employment, lack of access to credit and saving services, and lack of education.

Households and individuals hold and invest in different type's assets; this may be tangible in the form of dwellings, farmland, livestock, and equipment, or intangible in the form of knowledge, skills, and social capital (World Bank, 2003). These different forms of asset holdings have been categorized as; **Natural resource capital** (land, water, trees, genetic resources, soil fertility); **Physical capital** (agricultural and business equipment, houses, consumer durables, vehicles and transportation, water supply and sanitation facilities, and communications infrastructure); **Human capital** (education, skills, knowledge, health, nutrition; these are embodied in the labor of individuals); and **Financial capital** (savings, credit, and inflows (state transfers and remittances)); and **Social capital** (membership in organizations and groups, social and professional networks). Households with assets in various forms are better able to provide income for families, provide nutrition, other basic needs and to make investments in future generations through health care, education, and training (Zhan & Sherraden, 2003). Those lacking assets are more vulnerable to poverty and less able to recover from periodic disasters.

In the context of farming household related to PSNP, asset includes all livestock owned, productive assets, household assets, and consumer durable assets that belong to the household. Although there is a variation in owning of these assets in Ethiopia, and they can be: **Livestock assets**: (cattle, sheep and goat, poultry and equines), **Productive assets**: (all asset used to produce crop and livestock like ploughing equipments, water pump, sickle, spade, beehives, cart, pick axes and axes), **Household assets**: (stove, and other cooking materials, **Consumer durable assets/goods**: (telephone, radio, bed, home, bicycle, etc) (Tadelle, 2011).
Household asset building in the context of PSNP means enhancing the availability of these assets for households over the specified time. The specified period is usually the period of time for which a program or an intervention that is expected to bring asset accumulation once it implemented.

2.1.4. Sustainable Land Management Technologies

The concept of SLM in the context of Ethiopian focuses on three development components: (1) the use of different technologies/practices and integration among them to solve ecological and socio-economic constraints; (2) the need for participatory land management planning to meet community needs and use of the renewable natural resources in a sustainable way without compromising their environmental functions; (3) the need for an appropriate policy environment to undertake the above major tasks on an equitable basis (Gete *et al.*, 2006).

According to Gete *et al.* (2006), SLM technologies that have been practiced in the country divided in two broad types. These are indigenous and introduced technologies and they are with different degrees of acceptability, area coverage and benefits. Both of these categories include five main practices: First, physical soil and water conservation measures (dominant in the country); second, biological soil conservation measures; Third, soil fertility improvement measures; Fourth, agricultural water management a measure; Fifth and the last is, grassland management measures and forestry and agro-forestry measures. Hence, this study was focused on the locally practiced soil and water conservation activities by the farmers.

2.1.4. 1.Need for Soil and Water Conservation

According to Scoones and Toulmin (1999), a decline in the rate at which land yields products useful to local livelihoods is caused by land degradation. In low-input agricultural systems, the most important forms of land degradation are soil and vegetation degradation (Mazzucato and Niemeijer, 2000). Human impact affects about 1094 million ha on the earth. 43% is caused by deforestation and removal of natural vegetation, 29% through overgrazing, 24% caused by bad management and 4% by overexploitation of the natural vegetation (Scoones and Toulmin 1999). As described by Pimentel (2000), the main cause of soil fertility decline is soil erosion and the resulting decline in land productivity, due to the loss of fertile topsoil, which contains plant nutrients, is the main driving force behind reductions in soil fertility status. Therefore, those process/measures used to offset this decline in land productivity are called soil and water conservation (SWC). Hence, it is groundwork of

sustainable land management, because "availability and quality of soil and water are crucial for food production and a healthy environment" (Kessler, 2006).

2.1.4.2. Need for Intervention/Incentives on SWC Activities

The results of many SWC projects internationally have been disappointing, since SWC technology adoption rates is low, though " several of literature suggests that many SWC technologies do reduce soil loss and increase both productivity and production" (Hellin and Schrader, 2003). Many scholars accredited these low adoption rates is due to certain constraints, such as lack of capital of farmers and the risk farmers face to invest in a SWC technology. However, the way out suggested for this problem is the use of (mostly direct) incentives, which can overcome these constraints. In this regard, Governmental Organizations and Non Governmental Organizations can use incentives to speed up implementation of SWC measures. Beside farmer oriented rationales, scholars state that incentives are justified when a greater benefit for society is achieved. If the society benefits from the avoidance of silting dams and polluted rivers and therefore can give farmers payments or other incentives to reduce their soil loss or pollution (Giger ,1999). So, incentives are clearly linked to the problem of natural resource degradation. Below, PSNP is taken as incentive/intervention for this study is described as follows;

2.1.5. Relation between Asset Building and Investment on SWC Activities

The creation of productive and sustainable community assets that contribute to the rehabilitation of severely degraded areas and increase household productivity is one of the major objectives of PSNP (Julie *et al.*, 2009). From this one can understood that households those have more asset can invest more on land productivity improvement practices like SWC activities. On the other hand, Soil and water conservation practices are related with food security enhancement in the countries like Ethiopia. This because the food productivity mainly depends on agricultural land management practices and this in turn related to asset building and/or asset protection. By recognizing this, recently in the PSNP implementation attention is given to rehabilitation to degraded environment as one objective (MoARD, 2006). The different types of soil and water conservation practices have been identified in different part of the country. This includes the indigenous and improved SWC

practices, and they are what the farmers exclusively practices traditionally and the use of improved methods of soil and water conservation measures by recent developments interventions of both the government and NGOs. These measures are aimed at increasing the productivity of the land which has direct contribution for the farmer's asset building (Elen, 2008).

2.2. Empirical Studies

2.2.1. Studies on Impact of Productive Safety Net Program

Impact assessing of the social protection on food security and coping mechanisms in Ethiopia's PSNPs conducted by Gilligan *et al.* (2008), used PSM methods and they found that participation in the public works component of the PSNP (defined as receipt of at least 100 Birr) in payments over the first five months has modest effects. It improves food security by 0.40 months and increases growth in livestock holdings by 0.28 Tropical Livestock Units (TLU). Relative to non-beneficiaries, beneficiary households perceive that their welfare has improved. However, it also leads to an increase of 4.4 percentage points in the likelihood that a household is forced to make a distress asset sale.

Additionally, study carried in analyzing the PSNP impact on households' livestock and eucalyptus trees holding in Amhara region, Ethiopia by Andersson *et al.* (2009). Their result shows that there was no indication that participation in PSNP leads households to disinvest in livestock or trees. In fact, households that participated in the program increased the number of trees planted, but there was no increase in their livestock holdings. They found no evidence that the PSNP protects livestock in times of shock. Shocks appear to lead households to disinvest in livestock, but not in trees.

Another study was made by Tadelle (2011), on evaluating impact of productive safety net program on asset accumulation and sustainable land management practices in the central rift valley: The case of Adamitulu Jido Kombolcha and Meskan districts. His result shows that participation in PSNP had not brought any significant impact on both asset accumulation and sustainable land management practices.

2.2.2. Studies Used Propensity Score Matching

There are different researchers have used PSM technique to evaluate an impact of new development interventions in the country and elsewhere in the world. From this some of the most recent studies are described as follows:

Yibeltal (2008) used the PSM technique to assess the impact of integrated food security program on household food poverty in Ibnat –Belessa districts of Amhara region. He found that the program had a significant positive impact on the participating households calorie intake 30% than the non-participating.

Alemu (2010), conducted study on impact assessment of input and output market development interventions by IPMS project: The case of Gomma woreda. He found that participation in market development interventions has a significant, positive and robust impact on the outcome variables measured using different indicators.

Moreover, the scholar's work that provided as empirical evidences in the PSNP impact part of the study by Gilligan *et al.* (2008); Andersson *et al.* (2009); Tadelle, (2011) was also applied PSM techniques. Therefore, they can be used as interchangeable in both section *2.2.1* and *2.2.2* of this study as earlier work findings.

2.3. Impact Evaluation Methods

An evaluation impact is the method that used to examine the level to which a project has caused desired/ undesired changes on the beneficiaries. It is concerned with identifying the net impact of an intervention/ program on the participants that can be attributable exclusively and only to that specific intervention (Baker, 2000). Therefore, impact evaluation is assessing the change/ outcome due to the intervention and not.

According to the Ezemenari *et al.*, (1999), the key question in impact assessment of a program is an identification of what would have happened without the intervention of a specific program. However, most of the time, many development activities or intervention is not carried out exclusively. Rather, other programs are also conducted on a society. Thus, there may be others changes might have contributed for the

observed impact. So, it is necessary to estimate the counterfactual in impact evaluation. This helps to answer the question "what would have happened if the intervention had not taken place?" (Baker, 2000).

2.3.1. Approaches in Impact Assessment Study

The "netting out" the effect of the project from other factors is facilitated if control groups are introduced or constructed from non-beneficiaries. Control groups consist of a comparator group of individuals or households who did not receive the treatment, but have similar characteristics as those receiving the intervention called the treatment groups, the only difference between groups is being project participation. The comparison group should be identical to the treatment group except that the treated group receives the intervention and the non treated ones do not. They make it possible to control for other factors that affect the outcome(confounding factor).Identifying these groups correctly is a key to identifying what would have occurred in the absence of the intervention (Ezemenari *et al.*, 1999; Gilligan *et al.*, 2008).

As the same authors described, however, this is difficult to achieve for two reasons. First, beneficiaries of the intervention may be selected on the basis of certain characteristics (purposive targeting) based. If these characteristics are observed then a comparison group with the same characteristics can be selected. But if they are unobserved then in principle only a randomized approach can eliminate selection bias. Second, the comparison group may be contaminated either by spillover effects from the intervention or a similar intervention being undertaken in the comparison area by another agency.

According to Baker (2000), there are two main quantitative methods in impact assessment through forming control and treatment group. These are randomized (experimental) designs and quasi-experimental (non-randomized) designs.

2.3.1.1. Experimental Methods (Design)

This method is also referred as randomization method. An approach is used to randomly assign both participants and non participants of an intervention before the implementation of the program. In this case randomly allocating the intervention among eligible beneficiaries, the assignment process itself creates comparable

treatment and control groups that are statistically equivalent to one another, given appropriate sample sizes (Baker, 2000).

In a randomized experiment both the intervention and control samples are randomly drawn from the same population. In simple expression, individuals are randomly placed into two groups, namely, those that receive treatment and those that do not. In this case observable and unobservable characteristics get uncorrelated thus no selection bias problem arises. This allows the researcher to determine project impact by comparing means of outcome variable for the two groups which yields an unbiased estimate of impact (Nssah, 2006).

Moreover, random allocation of individuals to treatment and non-treatment groups ensures that on average any difference in outcomes of the two groups after the intervention can be attributed to the intervention (i.e. both observed and unobserved characteristics is the same for both the treated and the control group) (Ezemenari *et al.*, 1999). In this approach, the two groups are statistically similar (drawn from same distribution) in both observable and unobservable characteristics, thus avoiding program placement and self-selection biases. If implemented appropriately, this design ensures that potential confounders are balanced across program (intervention) and control units and therefore any differences in the outcomes between the two can be attributed to the program (Bernard *et al.*, 2010).

Experimental designs are considered the most advantageous approach to estimate intervention /program impact due to the capability of removing selection bias. However, in practice, there are several problems. These includes, it may be unethical to randomly assign eligible members as a control group and exclude them from benefits, political difficulty to provide benefits to one group and exclude another, it is difficult to obtain control groups for programs implemented in large scale that involve all groups,, individuals in control groups may change certain identifying characteristics during the experiment that could invalidate or contaminate the results, it may be difficult to ensure that assignment is truly random and not time and cost effective, especially in the collection of new data (Ravillion, 2005; Bernard *et al.*, 2010, and Baker 2000).

2.3.1.2. Quasi-experimental Method

This design also referred as non-experimental method and used to conduct an assessment when not possible to apply randomization (i.e. not possible to construct treatment and comparison group through experiment). According to Jalan and Ravallionn (2003), those projects that are introduced at large scale or national wide; it is common to only have access to a single cross-sectional survey done after the project is introduced.

In non- experimental method, both treatment and comparison groups are usually selected after the intervention by using non-random methods. Sometimes a comparison group is also chosen before the treatment group. Hence, applying of statistical controls is must to deal with differences between the treatment and comparison groups and sophisticated matching techniques should be used to construct a comparison group that is more or less similar to the treatment group (Gilligan *et al.*, 2008).

According to Jalan and Ravallionn (2003), the non- experimental method used when there is no baseline survey and randomization is not possible alternative for impact evaluation. The merits of this method over that of the randomization are they can draw on existing data sources; they often quicker and cheaper for implementation. Additionally, it can be performed after a program has been implemented if sufficient data exist. On the other hand, it has also some weakness. This includes, the reliability of the results is often reduced as the methodology is less robust statistically, the statistically complexity and a problem of selection bias that yields inaccurate results (Baker, 2000). As described by Foster (2003), these weakness cause methodological challenge in non-experimental evaluation methods. Moreover, this affects the reliability of results when generating a comparison groups. However, there different econometric approaches have been employed to avoid or reduce these problems, and they are described as follows:

Double difference or difference-in-differences (DID) methods: The method enables evaluators used to compare an intervention group and comparison group prior and after a program. It can be done by identifying potential participants and collecting data from them. Nevertheless, only a random sub-sample of these individuals is

actually allowed to participate in a certain project. The identified participants who do not actually participate in the project form the counterfactual. Besides, DID method can help to reduce the potential selection bias and the impact of other factors exogenous to the program on observable characteristics. This is through analyzing the difference in outcome of intervention groups relative to the difference in outcome of control groups. Additionally, the methods come across at the difference in indicators for the both treatment and comparison group at the end of the program relative to the difference in indicators at the commencement (Jalan and Ravallion, 2003; Baker, 2000).

A reflexive comparison: This methods used in which a baseline survey of treatment groups is conducted before to the intervention and a follow-up survey is done later. It can give a measure the impact through the change in impact indicators before and after the project/program. In this case, the beneficiaries who actually receive the intervention are compared to themselves prior to and after the receiving the intervention. They serve as both intervention and control group. However the method is applied for evaluating full-coverage nationwide policies and intervention in which the whole population participates and there is no scope for a control group (Baker, 2000).

Propensity Score Matching (PSM): From the non-experimental evaluation techniques matched comparison techniques are generally taken as a second best option to randomization (Baker, 2000). PSM is used to find a comparison group that is similar to the experiment group in all respects except the prohibiting from the intervention. As described by Ravallion (2005), PSM is practical to evaluators when there is a time constraint and lacks baseline data, but use a single cross-sectional data. Besides, in the practical application the potential problem is often how to define "similar" Matching of groups may be done on many characteristics and it is not clear whether a match has to be similar in all these characteristics, and (if not) what weight should be given to each characteristic (Caliendo and Kopeinig, 2005).

Matching the treated and the control subjects becomes difficult when there is a multidimensional vector of characteristics. The PSM solves this type of problem by summarizing the pre-treatment characteristics of each subject into a single index

variable, and then using the propensity score (PS) to match similar individuals. This includes the probability of assignment to treatment conditional on pre-treatment variables (Rosenbaum and Rubin, 1983).

Furthermore, the matching estimates reliability is depend on if participants and controls groups should have the same distribution of observed and unobserved characteristics; the same questionnaire is administered to both groups; and treated and control groups should be selected from the same economic environment. If not, the difference in mean impact of the treatment and matched non-participants is biased estimate of the mean impact of the intervention (Jalan and Ravallion, 2003).

Besides, the PSM methods application has its own weakness. The first one is the requirement of large amounts of data both on the universe of variables that could potentially confound the relationship between outcome and intervention and on large numbers of observations to maximize efficiency (Bernard *et al.*, 2010). Second, it is non-parametric. Therefore, any functional form assumptions like logit and probit, empirical analyses tend to find impact estimates. Additionally, this method is not capable to address the bias, if it is caused by unobservable characteristics that also affect the outcomes (Ravallion, 2005). Furthermore, one can never be completely confident for actually inclusion of all relevant covariates in the first stage of the matching model and effectively satisfied the conditional independence assumption. In spite of these limitations, PSM is widely used in the current literature on economic impact evaluation (Jalan and Ravallion 2003). It is very engaged to evaluators with time constraints and working lacks the use of baseline data given that it can be used with a single cross-section of data. Hence, this study was employed the PSM assess impact of PSNP project on beneficiaries asset building and SWC activities.

2.4. Conceptual Frame Work

The conceptual framework shows several factors; like personal, socio-economic, institutional and bio-physical factors that affects household participation in PSNP. These factors in turn also affect household asset building and investment on soil and water conservation activities.

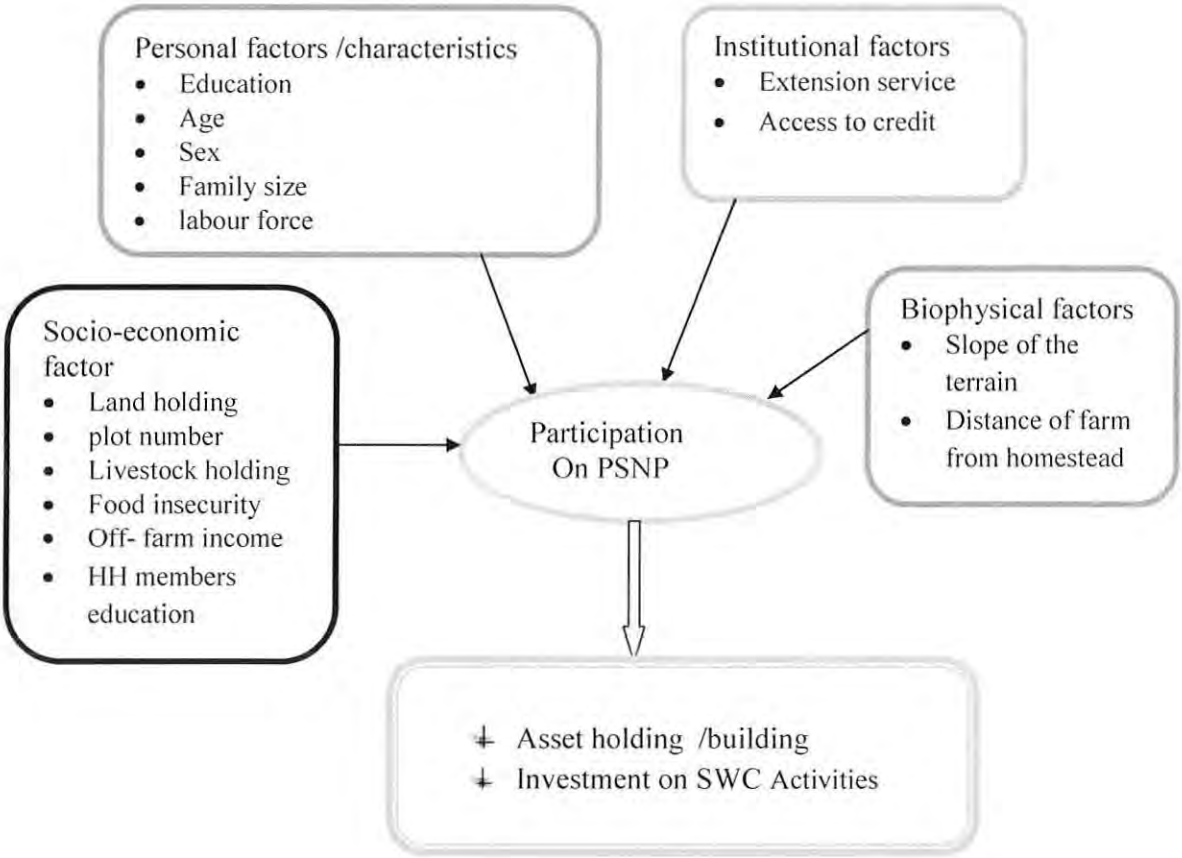


Figure 1. Conceptual framework

It shows determinants of participation on PSNP, and enhancing asset holding and investment on soil and water conservation practices.

3. METHODOLOGY

3.1. Description of the Productive Safety Net Program in the Study Area

The Productive safety net program (PSNP) was launched since 2006 in Lemmo District with its full converge. Since then, the PSNP has been implemented in 27 food insecure rural *kebeles* of the 33 total *kebeles*. The program has two components; direct support and public work component. The payment mode in the District is in cash. The amount of payment was ETB 6 in the starting time of the program and has increased to ETB 12 per day per individual since 2012 in the District. The selection criteria of beneficiaries in the District as confirmed by both sample households and the respective District food security task forces shows that a community selection based on asset ranking (especially ownership of oxen) and other livestock and almost no bias for selection.

The public work PSNP households participate in labor intensive works such as hillside terracing in erosion prone areas on communal lands, preparation of seedling in nursery site, fencing and construction of schools, and construction of feeder roads in the District. The public working schedule is from January to May of each year. The participants work for six days per month for four hours per day in District. However, the payment is not only for participating individuals in the household rather multiplied by the number of family members. Cash credit and dairy cows purchased from local market or cash to purchase cows are usually offered to PSNP households of in the District.

3.2. Description of the Study Area

Lemo District is one of the 10 Districts found in Hadiya Zone of SNNP Regional State. It is located at 230 km South of Addis Ababa, and 160km west of Awasa, Hossana is the capital of both the Zone and the District. Lemo is bordered with Kambata Tembaro Zone in the South, Silte zone in the North, Misha District of the Zone in the North East, Soro District of the Zone in the South West and Sheshogo District of the Zone in the East.

Geographically, the District is located between 7^0 23'02" to $7^0$56'00" Latitude North and $37^0$50'00" to $38^0$07'00" Longitude East. Moreover, the District is characterized by highland feature, similar socio-economy base and agro-ecology zone among the PAs (HZFDMD, 2011).

Climatic condition composition of the District categorized as many parties of Ethiopia. Accordingly, mean maximum temperature of the Disrcit is about 22^0 c, while its mean minimum temperature is about 13^0C and mean annual temperature being 18^0C. The study area has two rainy seasons, the long rains (Kremt) from June to September; dry season from October to February (Bega); and small rainy season from March to May (Belg). The amount of average annual rainfall is 1200mm with minimum and maximum rainfall 900mm and 1400mm, respectively.

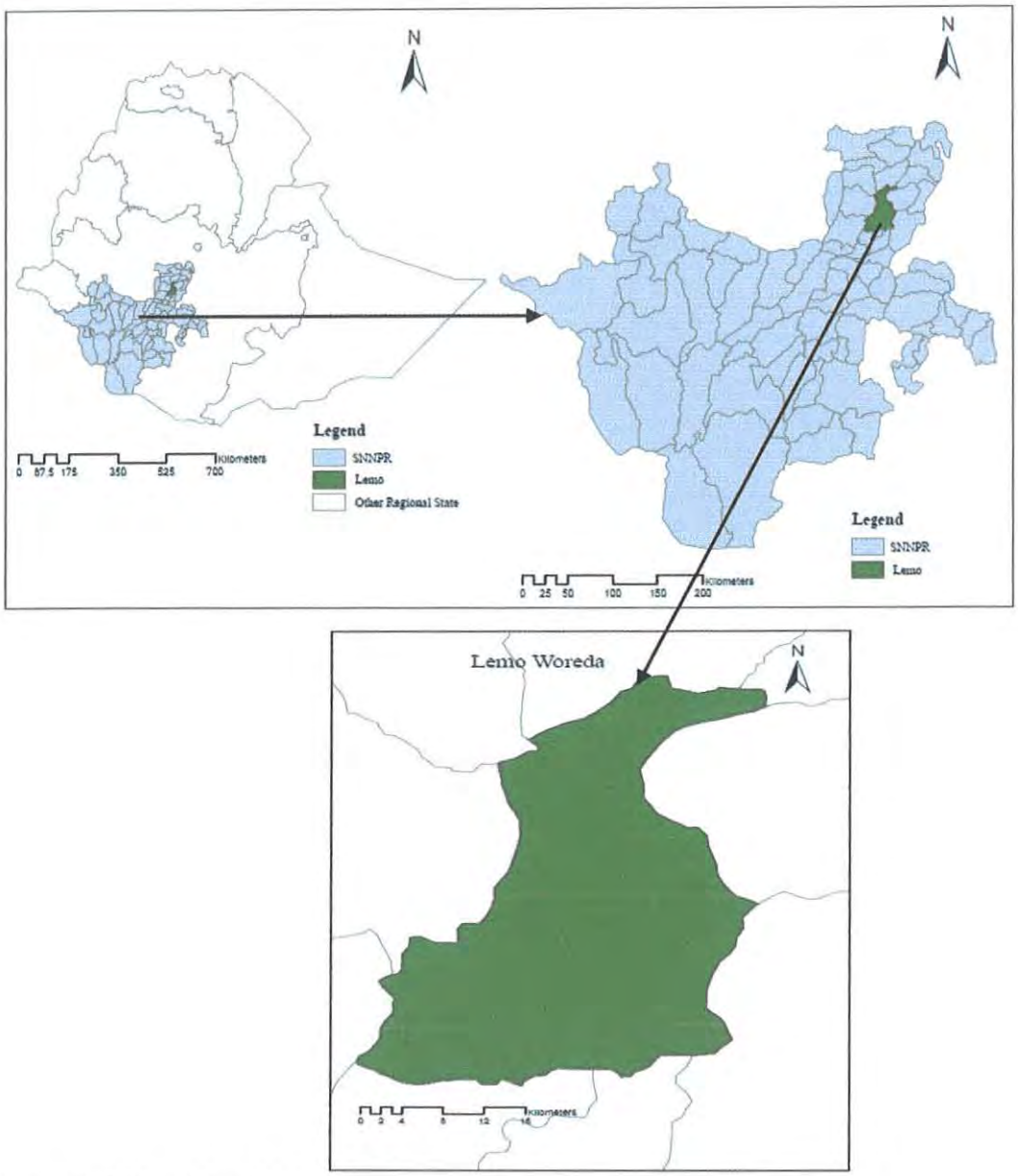
Lemo District population density is estimated to be 426 persons per square kilometer. As of CSA`s census of Ethiopia the total population of the District is 118,578 in July 2007 of which 58,104 were males and 60,474 were females. Of these peoples only 7% of the total population of the District is urban dwellers and 93% rural dwellers (CSA, 2007).

The District covers an area of 49,450 ha (454.5`sq.km), and divided in to 33 rural Kebels. The soil is characterized with light clay to clay loam soil texture and gray, red and black soil type. Agriculture is the dominant economic activity engaging 90% of the labor force. However, the productivity is said to be poor due to less utilization of inputs like fertilizer and improved seed, and extreme climatic condition. Virtually all agriculture practices in the District heavily depend on rainfall which is erratic and unpredictable (HZFDMD, 2011).

The major crops produced in the area according to their importance are *enset*, wheat, potato, barely, beans, and peas. Vegetable like: cabbage, tomato, beet root, onion, and spices are also produced. Livestock is an integral part of farming system like most of Ethiopian farmers. It provides, power, milk and meat, and their manure are used for fuel and fertilizer (HZFDMD, 2011).

Concerning vegetations, the area exhibits a considerable presence of cultural vegetation such eucalyptus and *enset*, which together with crop covered fields give the impression that the land is overwhelmingly green especially during the pre-harvest season. The natural vegetation is almost removed due to rapid population growth and expansion of agricultural land particularly field crop cultivation (HZFDMD, 2011). All natural forest trees those were met the demand of society now replaced with eucalyptus, thus "... it would be hard to imagine how life could be possible in the Hadiya given its rather huge pressure of population on land" (Solomon, 2008).

Generally, the District is characterized by persistent food insecurity because of erratic rainfall, crop disease, expensive inputs and the late delivery of inputs (particularly fertilizer). In order to decrease this problem in the District, there are different food security programs which are supported by government and non- government organization.



Source: CSA, Atlas, 2011
Figure 2. Map of the study area (Lemo district)

3.3. Research Design

This research study was conducted by employing the quasi-experimental design. This design also referred as non-experimental method and used to conduct an assessment when not possible to apply randomization (i.e. not possible to construct treatment and comparison group through experiment). According to Jalan and Ravallionn (2003), those projects that are introduced at large scale or national wide; it is common to only have access to a single cross-sectional survey done after the project is introduced.

Therefore, for this study, sample of both beneficiaries and non- beneficiaries of the program was selected after the intervention, and cross sectional household survey, which comprise quantitative (mostly) and qualitative data, was used to assess the impact of PSNP.

3.4. Sources and Methods of Data Collection

This study was employed both primary and secondary data sources. Primary data was collected from sample households of PSNP beneficiaries and non-beneficiaries. Secondary data was collected from concerned line offices like office of agriculture, and PSNP coordination offices.

Structural questionnaires were administrated to gather the primary data from sample households. The questionnaires were include the household characteristics (such as family size, education, sex and age, etc), land holding, availability of labour, SWC practices used by farmers, participation in PSNP programs, access to credit services, livestock and non-livestock asset ownership before and after the intervention, non-farm employment and other socioeconomic factor. A pre-test of the questionnaire was conducted before actual data collection is made, though the interview using households identified for the purpose. Enumerators were trained on the subject matter of the questionnaire for facilitation of the data collection.

3.5. Sampling Technique and Sample Size

In the study, multi-stage sampling technique was used to select the sampled households. Accordingly, first the District was chosen purposively among 10 PSNP operational Districts in the Zone. Following this, Kebeles of PSNP beneficiaries and non- beneficiaries were identified. Per the identification, 27 Kebeles out of the total (33) were Kebeles of beneficiaries and 6 were kebeles of non-beneficiaries of program. In fact, the entire households in the intervention Kebeles were not beneficiaries of the program. And then, five Kebeles were identified randomly from beneficiaries (intervention)[2] Kebeles for selecting sample respondents. In this case,

[2] In this study the phrase, "treatment-group", "experiment-group", "intervention-group", or words like: "participants" and "beneficiaries" are the same and used interchangeably as an indication of

sample respondents were selected both from the beneficiary and non- beneficiary households from five Kebeles (for this study they taken as intervention and control group, respectively). Fourthly, from the total proportion of beneficiary household of these kebeles, about 15% was taken as a representative sample. Accordingly, this proportion has given 91 sample households from intervention group as sample respondents. Based on the "rule of matching", about 90 household was taken as respondent from the control group (i.e a large and roughly equal number of participants and non-participant observations required for effectiveness of PSM and to found substantial region of common support, (Shahidur, R *et al.*,2010). Hence, the total sample size from the two groups was "181 households". Lastly, respondent samples were selected randomly from two groups based on proportionality to sample size. Accordingly, the following table shows this method.

Table 1. Determination of sample households from the District Kebeles

Sample Kebeles	PSNP beneficiaries HH	Sample HH	Non- PSNP HH	Sample HH	Total HH number
Ambicho Gode	94 (14 DS*)	12	702	24	796
Lembuda	136 (28 DS*)	16	579	19	715
Lisana Kusa	173 (12 DS*)	24	480	16	653
L/Kode Duna	215(40 DS*)	26	360	12	575
T/Ambicho	86 (3 DS*)	13	564	19	650
Total	607	91	2685	90	3389

Note: Numbers in parenthesis shows that those households who are directly supported by the program, and "DS*" means directly supported households, for they are disable to participate in public work. Therefore, they are not included as sample respondent for this study, because they are not expected to participate in SWC activities.

3.6. Data Analysis

This study was analyzed by applying both descriptive statistics and econometric model. Descriptive statistics includes mean, standard deviation, frequency, t-test and

PSNP beneficiaries. While phrases, like;" control-group", "comparison-group", "non-PSNP", "non-participants", and "non- beneficiaries" are used for indication of none-beneficiaries of PSNP.

chi-square etc. In applying the Propensity Score Matching, for the first and second objective the econometric model was employed. Likewise, multiple regression model estimation was used to analyze the third objective. **Stata** 11 version statically software package was used for data manipulation. Hence, it is described below as follows;

Empirical specification of Propensity score matching (PSM) method

Propensity score matching was employed to analyze the first and second objectives (to analyze the effect of participation in PSNP on asset building and soil and water conservation activities through by comparing the participants and non-participants in the program). As it is described in the literature review, PSM selected among other non- experimental methods since it does not require baseline data, the treatment assignment is not random and considered as second-best alternative to experimental design in minimizing selection biases. Moreover, PSM as compared to regression analysis it ensures that participating and non-participating individuals are comparable, something that is not guaranteed in the regression analysis. The detail of Empirical specification of Propensity Score Matching (PSM) method and necessary steps followed was explicitly described as follows.

According to Caliendo and Kopeinig (2005), the implementation of PSM involves five steps. These are: PSM Estimation; Choosing Matching Algorithm, Checking for Overlap (Common Support); Matching Quality (Effect) Estimation and ATT estimation and Sensitivity Analysis.

I. Propensity score estimation procedure: The first step in PSM technique estimation of propensity score. According to Rosenbaum and Rubin (1983) matching can be performed conditioning only on P(X) rather than on X, where P(X) = Prob $(D=1|X)$ is the probability of participating in the program conditional on X. The same authors explained that, if outcomes without the intervention are independent of participation given X, then they are also independent of participation given P(X) which reduces a multidimensional matching problem to a single dimensional problem.

To obtain the estimated the propensity score we have to choose the model for the estimation and variables that should be incorporated in the model. The models that are

used to estimate the probability of participation against non-participation households are logit and probit models. Moreover, the two models provide the same result (Gujarati, 2004). According to Caliendo and Kopeinig (2005), Logit model is easier compute than that of probit model and it is widely used. Hence, due this merit in this study the logit model was used for estimating the Propensity score.

In estimating the logit model, the dependent variable is participation which takes a value of 1 if the household participated in a program and 0 otherwise (Gujarati, 2004). Thus, mathematically the logit model is formulated as follows:

$$Pi = \frac{e^{Zi}}{1+e^{Zi}} \quad (1)$$

Where, P_i is the probability of participation in the productive safety net program

$$Zi=\beta o + \sum \beta i xi + ui \quad (2)$$

Where,

i = 1, 2, 3, - --, n

$\beta 0$ = intercept

βi =regression coefficients to be estimated

Ui = a disturbance term, and

Xi =pre-intervention characteristics

The probability that a household belongs to the non participant group is:

$$1-Pi = \frac{1}{1+e^{Zi}} \quad (3)$$

Then the odds ratio can be written as:

$$\frac{Pi}{1-Pi} = \frac{1+e^{Zi}}{1+e^{-Zi}} = e^{Zi} \quad (4)$$

The left hand side of equation (4), $\frac{Pi}{1-Pi}$ is simply the odds ratio in favour of participating in PSNP. It is the ratio of the probability that the household would participate in the PSNP to the probability that he/she would not participate in the

PSNP. Lastly, by taking the natural log of equation (9) the log of odds ratio can be written as:

$$Li = \text{Ln}\left(\frac{Pi}{1-Pi]}\right) = Ln\left(e^{\beta o + \sum_{j=1}^{n} \beta jxji}\right) = Z_i \quad (5)$$

$$Zi = \beta o + \sum_{j=1}^{n} \beta jxji + \mathcal{E}i \quad (6)$$

Where, L_i is log of the odds ratio in favour of participation in the PSNP, which is not only linear in X_j, but also linear in the parameters.

Matching theory in the propensity score generated through the logit model should include predictor variables that influence the selection procedure or participation in the program and the outcome of interest (Rosenbaum and Robin, 1983; Bryson *et al.*, 2002; Jalan and Ravallion, 2003).

II. Matching estimators/algorithm: the next step after the estimation of propensity score is choosing between different matching estimators. There are various matching estimators of PSM are available. However, they all provide consistent estimates of the ATT under the CIA and the overlap condition (Caliendo and Kopeinig, 2005). Below, only the most commonly applied matching estimators are describe for this study.

A. Nearest neighbor matching (NNM): NNM is the most important straightforward matching estimator. According to the Caliendo and Kopeinig, (2005), the individual from the control group is chosen as a matching partner for an intervention individual that is closest in terms of propensity score. This matching can be done with or without replacement option. In the case of with replacement, an untreated individual can serve more than once as a match, whereas in the case of without replacement they considered once only. NNM with replacement increases the average quality of matching and decreases precision of estimation while the turn round is correct in the case of NN without replacement. Nearest neighbor with replacement is preferred to without when there are big differences between treated and untreated groups to reduce the risk of bad matching (Caliendo and Kopeinig, 2005).

B. Caliper matching: The use NN matching may cause the risk of bad matches when the closest neighbor is far away. Researchers use this method as next alternative to overcome the weakness. Caliper matching refers that an individual from the

comparison group is chosen as a matching partner for a treated individual that lies within the caliper (propensity range) and is closest in terms of propensity score (Caliendo and Kopeinig, 2005). It imposes a tolerance level on the maximum propensity score distance (caliper), so that bad matches are avoided and hence the matching quality rises. However, one problem in caliper matching is that it is difficult to know a priori what choice for the tolerance level is reasonable.

C. Kernel matching: kernel matching is another matching method whereby all treated units are matched with a weighted average of all controls with weights which are inversely proportional to the distance between the propensity scores of treated and controls (Becker and Ichino, 2002)). Kernel weights the contribution of each comparison group member, therefore the more importance is attached to those comparators provide better match. It difference from the caliper methods is due those included are weighted according to their proximity with respect to the propensity score. The most common approach is to use the normal distribution (with a mean of zero) as a kernel, where the weight attached to a particular comparator is proportional to the frequency of the distribution for the difference in scores observed (Bryson *et al.*, 2002). However, they also have a drawback of the probability of using observations having bad match which leads to the importance of imposing the common support condition (Caliendo and Kopeinig, 2005).

III. Checking overlap condition and common support:

Imposing of common support ensures that any combination of characteristics observed in the treatment group can also be observed among control group (Bryson *et al.*, 2002). It is important step in PSM, since average treatment effect on treated and on population is only defined in the common support region. The common support region is the area within the minimum and maximum propensity scores of treated and comparison groups.

So, it helps to avoid comparing the incomparable groups. The fundamental criterion here is to delete all observations whose propensity scores are smaller than the minimum and greater than the maximum of treated and comparison groups.

Moreover, observations which lie outside this region are discarded from analysis (Caliendo and Kopeinig, 2008).

IV. Testing the matching quality (effect analysis):

Matching quality checked, if the matching procedure can able to balance the distribution of the all relevant in both treated and comparison groups. The basic approaches is to compare the situation before and after matching and check if there remain any differences after conditioning on the propensity score (Caliendo and Kopeinig, 2008). According to Rosenbaum and Rubin (1983), this is emphasized because to ensure whether the balancing condition is satisfied or not because it reduces the influence of confounding variables. There are different methods available to check the matching, the primary objective of all is to compare before and after matching and if there still exists any difference after conditioning on propensity score. Among different approaches the most commonly applied ones are described below.

Standardized bias (SB)

One suitable indicator to assess the distance in marginal distributions of the X variables is the standardized bias (SB) suggested by Rosenbaum and Rubin (1985). It helps to quantify the bias between intervention and control groups. This can be done for each variable prior and after matching.

T-test

As described by Rosenbaum and Rubin (1985), a two-sample t-test is applied to check if there is significant difference between the covariate means of both groups. However, before matching the difference is expected, but after matching the covariates must be balanced and there should be no significant difference between the two groups. When the statistical significance of the result is needed, the evaluator may select this test. Besides, this test has a drawback of showing clearly visible bias reduction before and after matching.

Joint significance and pseudo-R^2

According to Caliendo and Kopeinig, (2005), the Pseudo-R^2 demonstrates how well the regressors' X's explain the probability of participation. It is expected that after

matching there should be no systematic deference in the distribution of treatment and control group and hence the Pseudo-R^2 after matching fairly low (Caliendo and Kopeinig, 2005). Therefore, in this study the combination of above approaches are used to check the matching quality.

IV. ATT Estimation

ATT Estimation is the last and impact indicators steps of the program. Its empirical specification is explained as follows (Baker, 2000). In this case estimating the effect of household's participation in the PSNP on a given outcome (Y) is specified as

$$T_i = Y_i(D_i=1) - Y_i(D_i=0) \tag{7}$$

Where T_i is treatment effect (effect due to participation in PSNP), Y_i is the outcome on household i, D_i is whether household i has got the treatment or not (i.e., whether a household participated in the PSNP or not).

On the other hand, it is understood $Y_i(D_i=1)$ and $Y_i(D_i=0)$ cannot be observed for the same household at once. Moreover, estimating individual treatment effect T_i is impossible and one has to shift to estimate the average treatment effects of the population than the individual one. As Heckman (1997), the most commonly used average treatment effect estimation is an average Treatment Effect on the Treated (ATT) which is specified as:

$$T_{ATT} = E(T|D=1) = E[Y(1)|D=1] - E[Y(0)|D=1] \tag{8}$$

This helps to know, how much the households are benefited due to participation in the program as compared to those do not participated. As the counterfactual mean for those being treated, $E[Y(0)|D=1]$ is not observed, one has to choose a proper substitute for it in order to estimate ATT. One may think to use the mean outcome of the untreated individuals, $E[Y(0)|D=0]$ as a substitute to the counterfactual mean for those being treated, $E[Y(0)D=1]$. However, this is not a good idea especially in non-experimental studies, since; it is likely that components which determine the treatment decision also determine the outcome variable of interest.

In this particular case, variables that determine household's participation in the PSNP could also affect household's asset building and investment in SWC activities. Hence, the outcomes of individuals from treatment and control group would differ even in the absence of treatment leading to a self-selection bias.

By rearranging and subtracting $E\,[Y\,(0)|D=0]$ from both sides of equation 8, ATT can be specified as:

$$E\,[Y\,(1)|D=1]-E[Y\,(0)|D=0]=T_{ATT}+E[Y\,(0)|D=1]-E[Y\,(0)|D=0] \qquad (9)$$

From the above equation, both terms in the left hand side are observables and ATT can be identified, if and only if $E[Y\,(0)\;D=1]-E[Y(0)D=0]=0$. i.e when there is no self-selection bias. This condition can be ensured only in a randomized experiments (i.e., when there is no self selection bias). In non-experimental studies one has to introduce some identifying assumptions to solve the selection problem. The following are two strong assumptions to solve the selection problem.

Assumption1. Conditional Independence Assumption (CIA):

The Conditional Independence Assumption is given as:

$$Y0\;Y1 \perp D|X, \qquad (10)$$

Where

$\perp$ indicates independence

X -is a set of observable characteristics

Y_0 -non-participants and

Y_1 –participants

Given a set of observable covariates (X) which are not affected by treatment (in this case, participation in the PSNP); potential outcomes (level of asset building and investment in SWC activities) are independent of treatment assignment (independent of how the households were selected in PSNP).

This assumption implies that the selection is only based on observable characteristics (X) and variables that influence treatment assignment (participation in PSNP) and

potential outcomes (asset building and investment in SWC practices) are at the same time observed (Bryson *et al.*, 2002; Caliendo and Kopeinig, 2005). Therefore, after adjusting for observable differences, the mean of the potential outcome is similar for $D=1$ and $D=0$.

So, $E(Y_0|D=1, X)=E(Y_0|D=0, X)$.

Assumption 2: Assumption of Common support

According to Bryson *et al.*, (2002), imposing a common support condition ensures that any combination of characteristics observed in the treatment group can also be observed among the control group. As one of the implementation steps of PSM, more explanation will be given latter.

Given the above assumptions, the PSM estimator of ATT can be written as:

$$T_{ATT} = E[Y_1 - Y_0|D=0, P(X)] = E[Y_1|D=1, P(X)] - E(Y_0|D=0, P(X)] \quad (11)$$

Where $P(X)$ is the propensity score computed on the covariates X. The above equation shows that the PSM estimator is the mean difference in outcomes over the common support, appropriately weighted by the propensity score distribution of participants.

Sensitivity Analysis

An assumption of matching method is based on the conditional independence (CIA), which states that the evaluator should observe all variables that are at the same time influencing the participation decision and outcome variables. This assumption is principally non-testable because the data are uninformative about the distribution of the untreated outcome for treated groups and *vice versa* (Becker and Caliendo, 2007). Moreover, the estimation of treatment effects with matching estimators is based on the unconfoundedness or selection on observables assumption. However, if there are unobserved variables which affect assignment into treatment and the outcome variable simultaneously, a hidden bias might arise which invalidate the CIA and it results in biased estimates of ATTs (Rosenbaum, 2002). Since matching estimators are not robust against hidden biases, it is important to test the robustness of results to

departures from the identifying assumption. However, it is impossible to estimate the magnitude of selection bias with non-experimental data. Therefore, this problem can be addressed by sensitivity analysis.

3.7. Variables Choice, Measurement and Description

In the estimation of the propensity score, we are not interested in the effects of covariates on the propensity score because the purpose of our work is to assess the impact PSNP on outcome variables. However, the choice of covariates to be included in propensity score estimation is an issue. In this particular case, variables that determine households' to participate in the program could also affect the outcome variable (asset building and investment on SWC activities). There are no general rules for which variables to include in the model (Anderson *et al.*, 2009). However, the evaluator is guided by economic theory and empirical studies to know which observables (explanatory variables) affect both participation and the outcomes of interest (Bryson *et al.*, 2002).

3.7.1. Measurement and Indicators of the Outcome Variables

Asset building indicators of the outcome variables: includes those change brought in livestock asset and non-livestock assets (households asset, consumer durable asset and productive goods). It measured in tropical livestock unit (TLU) and amount in number which from the years 2006 to 2012, respectively.

Soil and water conservations activities as outcome variables: includes measures like; soil bunds, stone bunds, check dams, cut-off drains, and if any other. Of these practices which are widely practiced and expected as outcomes of PSNP in the study area are taken in this study. These outcome variables measured in m/ ha and they are continuous in type.

3.7.2 Explanatory Variables Related to Asset Building and SWC Activities

Base on theory, empirical studies and eligibility criteria to participate in PSNP the indentified explanatory variables are personal characteristics, socio-economic, institutional and biophysical factors. These factors affect participation in PSNP and outcome variable (asset building and SWC activities) described below in (Table2).

Table 2. Identified Variable for PSM model in relation to asset building & SWC activities

Type of variable	Description of variable	Category
Explained	Participation on PSNP (1=yes,2=No)	Dummy
Explanatory		
EDUHH	Education level of HH head in school years	continuous
AGEHH	Age of household head in year	Continuous
SEXHH	Sex of household head (1=Male,2=Female)	Dummy
TOTHHSIZ	Total household size in number	Continuous
LABORFRC	Family size of HH members age 15-64yr in number	Continuous
LANDHG	Land holding of the household in hectors	continuous
PLTNUM	plot number of the household	continuous
LIVSTCK	Number of livestock in TLU	continuous
HHMMED	Household members education (1=yes,2=No)	dummy
OFFARIC	Off farm income in ETB	continuous
FOODINSC	Households faced problem of food insecurity (1=yes,2=No)	dummy
CREDACC	Access of credit when need arise (1=yes,2=No)	dummy
VISTEXT	Extension agents visit in number of days/month	continuous
DSFHMS*	Average distance of farm from homestead in Hour	continuous
SLOPE*	Steep and very steep slope of plot in percent	continuous

Source: Own Description
*Means, these variables are additionally considered in estimating SWC activities outcome

4. RESULT AND DISCUSSION

In this part, description of all necessary variables, and results of Propensity Score Matching (PSM) model estimation for the outcome variables of the study was described sequentially in detail.

4.1. Description of Sample Respondent Characteristics

4.1.1. Demographic and Socio-Economic Characteristics of Respondents

The section shows the general relationship between the PSNP beneficiaries and non-beneficiaries before matching. Table 3 presents the descriptive results of continuous variables considered as pre-intervention characteristics of both beneficiaries and non-beneficiaries of PSNP. Accordingly, the program beneficiaries and non- beneficiaries were found to be significantly different with respect to household heads education level, mean of cultivated land holding, plot number[3], livestock in TLU, and relative distance of the farm to their houses . In contrast to beneficiaries, non- beneficiaries have larger size of cultivated land holding, plot number, their farm was found relatively at far distance from the house, and high number of livestock in TLU. However, in relation to the household age in year, number of family size, and availability of labor force, there was no statistical difference between the two groups. The difference between the two groups was statistically significant at 1% probability levels.

[3] Plot number in this study refers to the number of farm land plot that is owned by individuals' households. So that, having more than two or three plot number can be conserved as an indication of large land holding

Table 3. Descriptive result for socio-economic and demographic characteristics of the Sample households

Variable	PSNP beneficiaries		Non- PSNP		Mean Diff.	T- value	P-value
	Mean	**SD**	**Mean**	**SD**	**Mean**		
Age of HH head	43.63	8.09	44.92	8.56	-1.28	-1.03	0.15
House family size	6.96	2.16	6.8	2.61	0.16	0.46	0.67
HH head edu.	2.36	1.45	2.9	1.47	-0.53	-2.46***	0.007
Labor force	3.63	2.09	3.96	2.99	-0.32	-0.83	0.20
Land holding	0.48	0.31	0.94	0.49	0.46	-7.75***	0.000
Plot number	1.34	0.52	2.06	0.95	-0.72	-6.34***	0.000
Av .distance farm	1.39	0. 84	1.71	0.85	-0.31	-2.50***	0.006
TUL	1.92	1.03	2.60	0.81	-0.68	-4.89***	0.000

Sources: own survey, 2013
Where *** means significant at 1% probability level

Table 4 shows the sex of household head and education level household members of the study farmers. The study sample respondents were composed of both male and female household heads. In both groups, the majority households were headed by male while only few were female headed. With regard to education level of household members again in both groups most of the sample households were found under literate category (Table, 4).But, the proportion of literate house hold members was higher (86.67%) for non- beneficiaries than the beneficiaries (78.02%), respectively. When we compare the two groups in statistical term, there was significant difference between the groups in relation to household head sex of the sample respondents. However, in terms of the household's member's education they do not have significant difference among groups. The difference was observed at 1 % probability level (Table, 4).

Table 4. Descriptive result of sample households for dummy variables

Variable		PSNP Beneficiaries		Non -PSNP		
Sex of HH head		Freq	%	Freq	%	X^2
	Male	66	72.53	76	84.44	3.80***
	Female	25	27.47	14	15.56	
Total		**91**	**100**	**90**	**100**	
Education HH members						
	Illiterate	16	21.98	12	13.33	1.42
	literate	75	78.02	78	86.67	
Total		**91**	**100**	**90**	**100**	

Source: Own survey, 2013
Where *** means significant at 1% probability level

4.1.2. Respondents Land characteristics

Table 5 indicates the land characteristics based on the important features as responded by the households in the study area. These characteristics of land include slope, soil depth, and soil fertility status that are important factors influencing SWC practices. Moreover, the description of this features were provided on (Appendix 1).

Accordingly, the majority of land feature is flat slope for both beneficiaries and non-beneficiaries followed by steep slope. Besides, the sum of steep and very steep slope proportion of land was account similar percentage for beneficiaries (41.65%) and non-beneficiaries (41.15%), which is almost equal with that of flat slope land feature for both groups.

When the land is compared on the soil depth category again both groups have high percentage of medium depth status. Moreover, under the soil fertility category the majority of both groups have medium status, followed by low fertility. However, even if the majority of the groups are found under the same category of the features, the result shows there was slight difference in that percentage.

Table 5. Land/ plot characteristics of the sample households in study area

Variable	PSNP Beneficiaries		Non- PSNP	
Slope	**Freq.**	**%**	**Freq.**	**%**
Flat	38	41.76	36	40
Medium	15	16.48	17	18.89
Steep	24	26.37	25	27.78
Vey steep	14	15.38	12	13.33
Total	**91**	**100**	**90**	**100**
Soil Depth				
Shallow	30	32.97	36	40
Medium	43	47.25	40	44.44
Deep	18	19.78	14	15.56
Total	91	100	90	100
Soil Fertility				
Low	29	31.87	37	41.11
Medium	43	47.25	40	44.44
Fertile	19	20.88	10	11.11
Total	**91**	**100**	**90**	100

Source: Own survey, 2013

4.1.3. Access to Extension and Training/Advice Services

Access to development agents and taking training/advice from development agents is important institutional factor which have an implication on both asset building and SWC activities. Accordingly, only few respondents 4.5% (3.22%) were not visited by DA from beneficiaries and non- beneficiaries of the program, respectively. Concerning training /advice for soil and water conservation activities, majority 90.1% (92.22%) of beneficiaries and non- beneficiaries were obtained it (Table, 6).

Table 6. Contact by development agent, and training /advices of sample HHs in 2012

Variable		PSNP Beneficiaries		Non- PSNP	
Visited DA		**Freq.**	**%**	**Freq.**	**%**
	yes	86	94.5	88	97.78
	No	5	4.5	2	3.22
Total		**91**	**100**	**90**	**100**
Training /Advice					
	Yes	82	90.1	83	92.22
	No	9	9.9	7	7.78
Total		**91**	**100**	**90**	**100**

Sources: Own survey, 2013

Moreover, comparison of the visit by extension agents, and training / advice in number of days per month during 2012 cropping year was presented in Table 7. Based on the result of the study, there was no statistical significant difference between the groups in number of days per month by taking training / advice on SWC activities and visits by DAs. This implies that, participation in the program does not significantly affect the contact by DAs and opportunity for training and advice on SWC activities.

Table 7. Mean number of day per month visited by development age, and obtained training/advices of sample households in 2012

Variable	PSNP beneficiaries		Non- PSNP		Mean difference	T- values
	Mean	**SD**	**Mean**	**SD**	**MD**	
Visit by DA	4.12	3.79	4.22	3.87	-0.101	-0.17
Training / advice	3.16	2.85	4.70	3.17	-0.009	0.02

Source: Own survey, 2012

4.1.4 Access to Credit Services

Access to credit services is another important factor which has also an implication on both asset building and SWC activities. Table 8, indicates the access to credit facility and the purpose for collection of the credit. With regard to credit access, about 82.32% and 23.33% of the sample respondents reported that they received credit from

beneficiaries and non- beneficiaries, respectively. This shows that majority of PSNP beneficiaries have been using credit as compared to non- beneficiaries.

With regards to the purpose of credit usage, the majorities (65.79%) of the respondents from beneficiaries were used for livestock purchase, while majority (33.33%) non- beneficiaries were used for fertilizer purchase, and for fertilizer and improved seed purchase, respectively.

Table 8. Credit access and purpose used among sample households in 2012

Variable		PSNP beneficiaries		Non- PSNP	
Access to credit		**Freq.**	**%**	**Freq.**	**%**
	yes	76	82.32	21	23.33
	No	15	17.68	69	76.67
Total		**91**	**100**	**90**	**100**
Purpose used for					
	Fertilizer purchase	8	10.53	7	33.33
	Improved seed purchase	4	5.26	5	23.82
	Livestock purchase	50	65.79	1	4.76
	Fertilizer and seed	3	3.95	7	33.33
	Fertilizer, seed & Livestock	5	6.58	-	-
	Seed and livestock	3	3.95	-	-
	Others(education & health fee)	3	3.95	1	4.76
Total		**76**	**100**	**21**	**100**

Source: Own survey, 2013

4.1.5. Source and Amount of Income for Sample Households

In the study area sample respondents engaged different activities/sources to generate their livelihood income. These activities includes farm crop sale, livestock's and livestock products sales, and engagement in non- farm activities. The major crop includes wheat, *teff* and *enset* and livestock includes cow, oxen, sheep and beehives. The major non- farm activities made are daily labor work, petty trade, and hand craft. Moreover, one major source of income for both beneficiaries and non- beneficiaries PSNP was *chat*.

Accordingly, Table 9 portrays the 20012/13 mean annual income obtained from sale of crop, livestock and its products, and non- farm activities in ETB. The result indicates that there was a statistically significant difference between the groups at mean annual income from crops sales at 1% level and *chat* sale at 5% level, respectively. In contrast to the beneficiaries, non- beneficiaries were earned higher mean annual income from both crop and *chat* sales. This is due the fact that the non-beneficiaries have more (on average 0.94 ha) cultivated land holding than beneficiaries (on average 0.45 ha), and hence, the land holding is one of the determining factor of the yield. However, the mean annual income generated from the livestock and its product, and from non- farm income sources do not have Significant differences between the beneficiaries and non- beneficiaries of the PSNP. Besides, the beneficiaries have one more additional income sources than non-beneficiaries, which is income from participation in public work. Therefore, this may help to minimize the income deference between the beneficiaries and non-beneficiaries through increasing beneficiaries income.

Table 9. Sources and amount of mean annual income for sample households at 2012 in ETB

Variable (Income source)	**PSNP beneficiaries**		**Non- PSNP**		**Mean**	**T- value**
	Mean	**SD**	**Mean**	**SD**	**Dif**	
Crop sale	489.01	678.96	1510	1679.02	-1020.98	-5.37***
Income from TLU	858.18	1847.29	577.77	1584.03	280.40	1.095
Non- farm activities	1052.52	2107.35	1326.84	3181.93	-274.31	-0.684
Income from *chat*	1358.12	1119.50	3063.41	2274.39	-1705.29	-2.85**
Income from PSNP	1656.26	373.08	-	-	-	-

Source: Own survey

Where, *** and ** means significant at 1% and 5% probability level

4.1.6. Change in the household asset building and S WC activities

The outcome variables of the program, particular to this study, are amount /level of asset holding and level of soil and water conservation activities by the sampled households. Therefore, before undertaking the matching steps, the existing relationship between asset holding and SWC activities of the two groups as an outcome variable was described below.

4.1.6.1. Sampled House Hold Asset Holding

Different types of households asset building is one of the outcome variable expected from PSNP implementation. In line with this, in this study assets were categorized as livestock and non- livestock asset.

The major livestock assets reared by the study households were cow, oxen, sheep, goat, donkey and poultry. These livestock asset levels for the two groups were compared before and after PSNP operationalization by tropical livestock unit (TLU).

Table 10 indicates the total livestock among the two groups and the change between 2012 and 2006 (the time of full implementation of PSNP in study area). The result shows that there was significant difference among the beneficiaries and non-beneficiaries during 2012 and the years of commencement of the program. The difference was at 1% probability level. However, with regard to the change in TLU during 2012 and 2006 (years of commencement) there was no statistically significant change within a group. This implies that the PSNP does not have significant contribution in the beneficiaries' livestock asset building, which is prior to the application of PSM. Moreover, from the result, one can observe that the number of livestock through time was increasing and decreasing for beneficiaries and non-beneficiaries, respectively, though it was not as such significant.

Furthermore, the amount of other assets (other than livestock assets) in number was also presented in the same Table (10). This asset includes both production and household durable assets. Under production assets the major once are ploughing tools, spade, excavating tools, chopping axe, sickle and beehives which were considered so

long as production tools are concerned. The household's durable assets owned by the respondents includes; own house, bed, radio, fuel wood minimizing stove, and mobile telephone for both groups. Based on the result there was statistically significant difference among the beneficiaries and non- beneficiaries in terms of the number of household production and durable assets before commencing of the program. Moreover, as the survey result indicates, a statistically significant difference was observed by now among two groups focusing "the ownership of household production and durable assets".

However, the result shows there was no statistically significant difference or change within group before and after intervention in the number of non- livestock asset ownership. Despite this, the mean numbers of these assets ownership were increasing in a smaller rate through time for both beneficiaries and non- beneficiaries of PSNP. This may be, because of the provision of production tools by the project for beneficiaries, and possession of mobile telephone due the expansion of the mobile technology to the place where, both beneficiaries and non- beneficiaries are dwelling. The difference was significant at 1% probability level.

Table 10.Total livestock and non- livestock assets for sample households in number

Asset holding (variable)	PSNP beneficiaries		Non- PSNP		Mean Diff/ce	T-value	P-value
Livestock asset	**Mean**	**SD**	**Mean**	**SD**	**Mean**		
Livestock in TLU by now	2.04	1.16	2.47	0.95	-0.43	3.74***	0.003
Livestock in TLU at 2006	1.92	1.03	2.60	0.81	-0.68	-4.89***	0.000
Difference in TLU	0.12	1.35	-0.13	0.97	0.242	1.38	0.912
Other Asset in Number							
All other assets in 2012	9.03	2.71	10.07	3.11	-1.39	-3.31***	0.0005
All others assets at 2006	8.68	2.66	9.54	3.75	-5.51	-3.81***	0.0001
Difference in number	1.49	2.73	1.04	2.75	0. 94	1.10	0.864

Source: Own survey, 2013

Where *** means significant level at 1% probability level

4.1.6.2. Soil and Water Conservation activities

Before, directly going to outcome comparison between the two groups it is better to have description of issues related with SWC activities in the study area. Accordingly, Table 11 indicates the respondents who faced soil erosion problem, indicators of the problem as responded by sample households, individuals who applied and not applied SWC activities and reason for not using the SWC practices.

The result shows that almost similar percentages of respondents from the two groups were faced soil erosion problem. This was about 41.8% from beneficiaries and 41.1 % from non- beneficiaries, respectively. The most reported indictor of the erosion problem for the two groups was "decrease in soil depth".

Concerning the application of the soil and water conservation activities, nearly similar percentages of 38.5% (37.8%) of the respondents from the beneficiaries and non-beneficiaries of PSNP were used, respectively. And about 61.5% from beneficiaries and 62.2 % non- beneficiaries were no employed any type of SWC activities. From this, about 94.6% and 91.1 % of the sampled respondents have not used any type of soil and water conservation activities in their farm land, due to their farm land does not require application of soil and water conservation.

Moreover, only few respondents from the two groups, who faced the erosion problem, were not used SWC practices on the farm land. This was because of lack of interest and knowledge, which accounts rate of 1.79% (3.57%) and of 3.57 % (5.36%) from beneficiaries and non- beneficiaries, respectively (Table, 11).

Table 11. SWC activities & related Issues of the sample hhs in the study area

Variable	PSNP Beneficiaries		Non- PSNP		Total	
Soil erosion problem	**Freq.**	**%**	**Freq.**	**%**	**Freq.**	**%**
Yes	38	41.8	37	41.11	75	41.44
No	53	58.2	53	58.89	106	58.56
Total	**91**	**100**	**90**	**100**	**181**	**100**
Indictors Soil erosion						
1.Decrease production (A)	3	7.89	4	10.8	7	9.33
2.Visible rills/gully (B)	7	18.4	4	10.8	11	14.7
3.Decrease soil depth (C)	14	36.8	20	54.1	34	45.3
4. Soil color change (D)	2	5.26	-	-	2	2.67
5. A and B	1	2.63	-	-	1	1.33
6. A and C	5	13.2	3	8.11	8	10.7
7. A,B,C and D	6	15.8	6	16.2	12	16
Total	**38**	**100**	**37**	**100**	**75**	**100**
SWC measures employed						
Yes	35	38.5	34	37.8	69	38.12
No	56	61.75	56	62.2	112	61.88
Total	**91**	**100**	**90**	**100**	**181**	**100**
Reason for not exercising SWC activities						
Absence of interest	1	1.79	2	3.57	3	2.679
Lack of knowledge	2	3.57	3	5.36	5	4.464
Land doesn't need SWC	53	94.6	51	91.1	104	92.86
Total	**56**	**100**	**56**	**100**	**112**	**100**

Source: Own survey, 2013

Table 12 portrays the level /amount of soil and water conservation activities (which were practiced in the study area) in meter per hectare. The two groups have statistically insignificant difference with regard to SWC activities namely soil bund (m/ha), check dam (m/ha), waterway (m/ha) and cut off drain (m/ha). Comprehensively, the aggregate result also shows no significant difference among beneficiaries and non- beneficiaries of the program. Besides, condition that matters more for practicing SWC activities in the study area was exposure of the land to erosion, rather than being beneficiaries or non- beneficiaries of PSNP (this idea in compliance with the information disclosed in Table 11)

Table 12. Level of SWC activities constructed by sample households in meter per ha

SWC activities (m/ha)	**Total**		**PSNP Beneficiaries**		**Non- PSNP**		**Mean Diff**	**T-value**
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	
Soil bund	21.17	47.79	22.66	45.21	19.67	50.45	2.98	0.418
Check dam	1.98	7.54	2.58	8.04	1.388	6.99	1.19	1.06
Water way	3.033	13.59	3.28	11.85	2.77	15.21	0.507	0.250
Cut off drain	1.94	7.89	1.48	6.76	2.41	8.90	1.61	-0.78
Total SWC	28.02	50.31	29.76	48.74	26.25	52.07	3.51	0.46

Source: Own survey, 2013

4.2. Econometric Model Result

Under this section, the result of Propensity Score Matching was discussed in detail. To estimate the average treatment effect on the treated (ATT) on intended outcome variables, first a Logit model result was estimated in order to get the propensity scores. Next a matching estimator that best fit to the data was selected. Thirdly, based on those scores estimated and matching estimator selected, matching between beneficiaries and non- beneficiaries was done to find out the impact of the project on the mean values of the outcome variables. Therefore, this part indicates all the required procedures applied to calculate the average treatment effect on the treated, which helps us to identify the impact of the PSNP program in the study area.

4.2.1 Propensity Score Matching Estimation

Ahead of executing the logistic regression model to estimate propensity scores, it is necessary to test important cross-sectional data problems by using econometric assumption, whether it is holding valid or not.

Accordingly, existence of severe multicollinearity problem between continuous and discrete explanatory variables was checked by using techniques like Variance inflation factor (VIF) and contingence coefficient (C). Thus, the VIF (Xi) result shows that the data had no serious problem of multicollinearity (Appendix 3). This is because, for all continuous explanatory variables, the values of VIF were by far less than 10. Therefore, all the explanatory variables were included in the model. Moreover, the contingence coefficient (C) result indicates again, there was no serious problem of multicollinearity (Appendix 4), since all the values are below 1.

Additionally, hetroscedasticity test was done using Breusch-Pagan /Cook-Weisberg test for hetroscedasticity and the P-value was 0.7081 which is insignificant implying the absence of the problem of hetroscedasticity.

Propensity score estimation of the Logit model results was indicated in Table 13. The result shows that the pseudo-R^2 value is 0.39. Moreover, a low R^2 value shows that the allocation of the program has been reasonably random (Pradhan and Rawlings,

2002). In a simple word, a low R^2 value means that beneficiaries households do not have much different characteristics over all and as such finding a good match between program beneficiaries and non- beneficiaries households becomes easier. Besides, the pseudo- R^2 shows how well the covariates explain the participation probability. According to Caliendo and Kopeinig, (2005), there should be no systematic differences in the distribution of covariates between both groups after matching and hence, the pseudo- R^2 should be fairly low.

The maximum likelihood estimates of the logistic regression model shows that, total household, plot number, food in security problem, and livestock holding, are important factors in influencing access to participation in PSNP in the study area (Table 13).

About thirteen variables were hypothesized to explain factors affecting participation in PSNP. The propensity score estimation model result indicated that, program participation were found to be statistically significant with four variables, while the remaining were less significant in explaining the variations in the dependent variable. These significant variables include total household size at 10% level, plot number at 5% level, households facing food insecurity problem at 1 % level, and livestock holding by TLU at 10% level.

Moreover, the marginal effect was conducted after logit estimation and indicted in column 4 and symbolized as dy/dx (ME) in Table 13. It reveals that as the number of family's increases by one unit (number), the probability of participation in PSNP increases by 4.58%, this is plausible since a family with high number may face food shortage than small size family's, and hence get a chance to participate in PSNP, which is a program that targets food insecure households. As plot number of a household increases by one number, the probability of participation in PSNP decreases by 25.23% , and this is due to fact that having large number of farm plot may show high size of land holding, which also hinder from participation on PSNP.
The result also reveals that, when the level of livestock holding increases by one TLU, the probability of participation in PSNP decreases by 10.23%. This means those individuals who have high number of TLU cannot have a room to participate in

PSNP. As households do not face a frequently food insecurity problem, the probability for participation in PSNP decreases by 56.05%.

Table 13. Logit model result for participation on PSNP to estimate of propensity score

Covariates	Coefficients	Std. Err.	dy/dx (ME)	Z- value	P-value
HHSEX	0.3190	0.5421	0.07906	0.59	0.556
AGEHHHEAD	0.0405	0.0290	0.0100	1.40	0.162
HH HEADEDU	-0.2140	0.1750	-0.0530	-1.22	0.222
HHMMEDU	0.3105	0.6731	0.0758	0.46	0.645
TOTALHHSIZE	0.1852	0.1091	0.0458	1.70*	0.090
LABOURFRCE	-0.1633	0.1129	0.0458	-1.45	0.148
LANDHLD	-0.8718	0.6949	-0.2160	-1.25	0.210
PLOTNM	-1.018	0.4177	-0.2523	-2.44**	0.015
VISTDA	0.0229	0.0562	0.0056	0.41	0.684
FOODINSC	-2.262	0.5336	-0.5605	-4.24***	0.000
TUL	-0.4128	0.2168	-0.1023	-1.90*	0.057
AVDISTFRM	0.0184	0.0145	0.0045	1.26	0.207
STEPVRSTEPLD	0.6854	0.49975	0.1696	1.37	0.170
CONSTANT	3.1003	1.794		1.73	0.084
Pseudo R2 =	0.3918	Log likelihood = -76.300113			
LR chi2(13) =	98.31	Prob > chi2 = 0 .0000			

Source: Model estimation result, 2013
Where ***, ** and * means level of significance at 1%, 5% and 10% respectively

4.2.2. Matching PSNP Beneficiaries and Non- Beneficiaries Households

As explained in previously, main tasks should be accomplished before one commences the matching task itself. In the first place, predicted values of program participation (propensity scores) should be estimated for all households in the program and outside the program. Next, a common support condition should be imposed on the propensity score distributions. Thirdly, dropping observations whose predicted propensity scores fall outside the range of the common support region will follow. At last, ATT estimation (impact of program) computed on outcome variable.

Table 14 indicates the estimated propensity scores of program beneficiaries and non – beneficiaries. Accordingly, the result shows estimated propensity scores vary between 0.0323737 and 0.95371 (mean = 0. 732) for intervention households and between 0.0033059and 0. 8804737 (mean = 0. 270) for non-intervention households.

Table 14. Estimated propensity score Distribution

Respondents	Observ.	Mean	Std. Dev	Minimum	Maximum
Total households	181	0.502	0. 341	0.0033059	0. 95371
Intervention group	91	0. 732	0. 226	0. 0323737	0. 95371
Control group	90	0. 270	0. 273	0. 0033059	0. 8804737

Source: Model result, 2013

The common support region would then lie between [0.03237373, 0.95371]. In other words, households whose estimated propensity score is less than the minimum and greater than the maximum are not considered for the matching purpose. Hence, 14 control households were dropped due to this restriction. Fortunately, all beneficiaries' households have lied within common support region. This shows that the study did not keep out PSNP beneficiary households from the sample in computing the impact estimator. Therefore, Appendix (5) shows that the region of common support is [0.032373, 0.95371], and 14 observations that was dropped.

Following this, the common support region has been examined by plotting a histogram of the propensity score. The common support is the region where the propensity score has a positive density for both treatment and control units. Figures 3 have given the frequency distribution of the propensity scores for the treatment and control groups of PSNP. The Histogram tells that there is a substantial region of overlap, and which implies a severe common support problem does not exist. Since the main purpose is not on the probability estimations (logistic estimations), but in the application matching of households, which is encouraging to see that a large fraction of households from both groups (treatment and control) gets an estimated probability in the range of 0.032373 to 0.95371 (Table14).

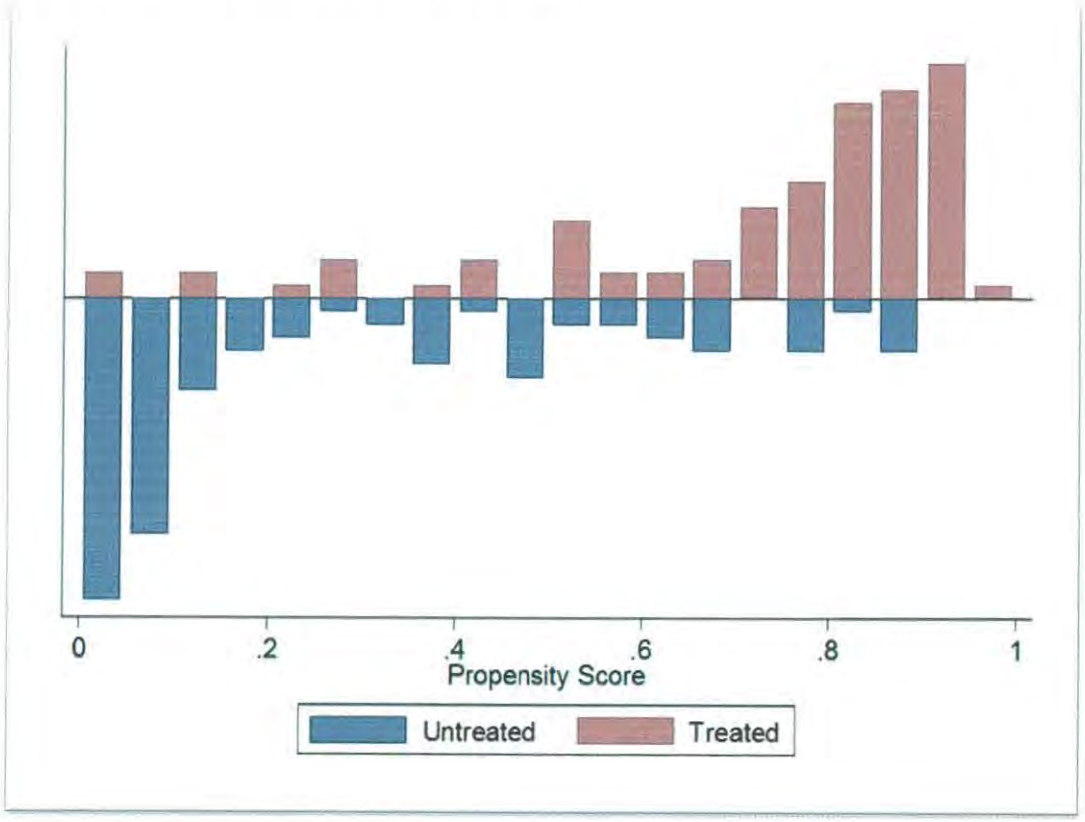


Figure 3. Histogram of the propensity scores estimation distribution for the treatment and control groups of PSNP.

Table 15 shows the inferior bound, the number of treated and the number of controlled observations for each block. Moreover, the result indicated that the balancing property of the PSM has been satisfied; this means that households with the same propensity scores have the same distributions of all covariates for all five blocks.

Table 15. Test of balancing property of the propensity score

Inferior block of Propensity score	Treated	Control	Total
0.0323737	4	38	42
0.2	5	11	16
0.4	11	11	22
0.6	21	11	32
0.8	50	5	55
Total	**91**	**76**	**167**

Source: Model estimation result, 2013

4.2.3. Choice of Matching Algorithm/ Estimator

Alternative methods matching estimators/algorithms were applied in matching the participants and non-participants households in the common support region. However, the final choice of a matching estimator was guided by different criteria like equal mean test that referred to as the balancing test, pseudo-R^2 and matched sample size (Dehejia and Wahba, 2002). Explicitly, a matching estimator which balances all explanatory variables (i.e., results in insignificant mean differences between the two groups), bears low pseudo-R^2 value and results in large matched sample size is preferred.

Table 16 shows the estimated results of tests of matching quality based on the above mentioned performance criteria. When the result was observed, it has been found that kernel matching with a band width of 0.25 is the best estimator for the data at hand. As such, the estimation results and discussion was the direct outcomes of the kernel matching algorithm.

Kernel matching associates the outcome of the treated household with the matched outcome that is given by a kernel-weighted average of all control groups improvement

in household's asset building and SWC activities. Since, the weighted averages, which matches a treated groups to all control groups weighted in proportion to the closeness between the treated group and the control group are used to construct the counterfactual outcome, and kernel matching has an advantage of lower variance because more information is used (Yibeltal, 2008).

Table 16. Performance of different matching estimator

Matching Estimator	**Criteria**		
	Balance test[4]	Pseudo R^2	Matched sample size
Nearest neighbor matching			
Without replacement	13	0.491	119
With replacement	13	0.391	141
Stratification	13	0.391	157
Caliper			
0.01	12	0.241	146
0.25	10	0.123	160
0.50	10	0.123	154
Kernel matching			
Band width 0.01	12	0.127	128
Band width 0.25	13	0.047	167
Band width 0.50	12	0.104	167

Source: Model estimation result, 2013

[4] Balancing test represents number of explanatory variables with no statistically significant mean differences between the matched groups of treatment and control households

4.2.4. Balance Test for propensity score and covariates

The next mission after choosing the best performing matching estimator is to check the balancing of propensity score and covariate using various steps by applying the selected matching algorithm. The main purpose of the propensity score estimation is not to obtain a precise prediction of selection into treatment, but rather to balance the distributions of relevant variables in both groups. The balancing powers of the estimations are ascertained by considering different test methods such as the reduction in the mean standardized bias between the matched and unmatched households, equality of means using t-test and chi-square test for joint significance for the variables used.

Accordingly, the output of the Table 17 shows two rows for each variable—"unmatched and matched", that is before matching and after matching mean for each variable, "%bias," % reduction in bias, and t-test for the treatment group and the mean for the control group.

The mean standardized bias before matching were shown in the Table 17 under column five, and after matching output were also shown on the same Table under column six which reports the total bias reduction obtained by the matching procedure. Moreover, in this matching model, the standardized difference of covariates before matching was in the range of 1.17% and 115.1% in absolute value. After matching, the remaining standardized difference for almost all covariates lies between 0.5 % and 21.5%. In all cases, it is manifest that sample differences in the unmatched data significantly exceeded those in the samples of matched cases. The process of matching thus creates a high degree of covariate balance between the treatment and control samples that are ready to use in the estimation procedure.

Moreover, t-values obtained in Tables 17 shows that before matching six covariates from the total of thirteen exhibited statistically significant differences, where us all of the covariates were balanced after matching. The tests of standardized differences were used here to illustrate the reduction in bias that can be attributed to matching on $p(X)$. This test was first described in Rosenbaum and Rubin (1985) and checks the balance between the treatment group and the comparison group.

Table 17. Balance Test for propensity score and covariates

Variables	Sample	Mean			% reduction	t-test	
		Treated	Control	% bias	|bias|	T	p>|t|
HHSEX	Unmatched	1.27	1.15	29.1		1.96*	0 .052
	Matched	1.26	1.26	0.5	98.3	0.03	0.980
AGEHHHEAD	Unmatched	43.63	44.92	-15.4		-1.04	0.301
	Matched	43.14	43.93	-9.5	38.1	-0.54	0.591
HH HEADEDU	Unmatched	2.36	2.9	-36.6		-2.46**	0.015
	Matched	2.79	2.68	7.8	78.8	0.43	0.671
HHMMEDU	Unmatched	0.82	0.86	-11.7		-0.79	0.432
	Matched	0.84	0.86	-7.0	40.2	-0.41	0.685
TOTALHHSIZ	Unmatched	6.91	6.8	4.6		0.31	0.756
	Matched	6.56	6.04	21.5	365.8	1.27	0.207
LABOURFRCE	Unmatched	3.61	3.88	-10.6		-0.72	0.475
	Matched	3.75	3.53	8.2	22.9	0.48	0.630
LANDHLD	Unmatched	0.476	0.947	-115.1		-7.75***	0.000
	Matched	0.552	0.601	-12.1	89.5	-0.83	0.409
PLOTNM	Unmatched	1.34	2.06	-94.2		-6.35***	0.000
	Matched	1.39	1.48	-12.5	86.8	-0.89	0.376
VISTDA	Unmatched	4.12	4.22	-2.6		-0.18	0.859
	Matched	4.09	3.91	4.6	73.9	0.26	0.793
FOODINSC	Unmatched	1.08	1.66	1.17		-9.97***	0.000
	Matched	1.12	1.17	-12.7	91.4	-0.79	0.434
TUL	Unmatched	1.92	2.60	-72.8		-4.89	0.000
	Matched	2.13	2.19	-6.8	90.6	-0.36	0.717
AVDISTFRM	Unmatched	13.02	18.11	-28.7		-1.93*	0.055
	Matched	13.43	15.68	-12.7	55.8	-0.73	0.470
STEPVRSTPL	Unmatched	0.285	0.255	6.8		0.45	0.650
	Matched	0.218	0.261	-9.6	42.2	-0.56	0.574

Source: Model estimation result, 2013
Where *,** and *** means significant at 1%, 5% and 10% level

Additionally, after matching the low pseudo-R^2 (0. 046) and the insignificant likelihood ratio tests, it supports the hypothesis that both groups have the same distribution in covariates X after matching (Table 18). These results clearly show that

the matching procedure is able to balance the characteristics in the treated and the matched comparison groups. Therefore, we used these results to evaluate the effect of PSNP participation between groups of households having similar observed characteristics. This allowed us to compare observed outcomes for participants with those of a comparison groups, sharing a common support. All of the above tests suggest that the matching algorithm, which has been chosen, is relatively best estimator for the data we have at hand. Thus, we can proceed to estimate ATT for households.

Table 18. Chi-square test for the joint significance of variables

Sample	Pseudo R^2	LR chi^2	p>chi^2
Unmatched	0.3918	98.31	0.0000
Matched	0.046	8.25	0.827

Source: model estimation result, 2013

4.2.5. Estimation of Average Treatment Effect on Treated for the impact of PSNP on household's asset building and of SWC activities.

The whole procedure that has been conducted in the above was aimed to come up with the project impact on the outcome variables (level of asset building and practicing of SWC activities of households). The evaluation was done for the impact on beneficiary households, after the pre-intervention differences were controlled. Therefore, the following sections will provide us the detail on each outcome in a brief.

4.2.5.1 Estimation of Average Treatment Effect on Treated for Asset holding

As explained in the earlier part, households assets were categorized as livestock and non- livestock assets for this study. Following this, Table 19 indicates the ATT estimation result of these assets, and it presents T-value as an indication of impact of the PSNP on household assets building. Moreover, the estimation result was attempted to observe on different matching estimation methods. However, the nearest neighbor matching, the stratification and radius methods were dropped because they hold limitation like low match size, high pseudo R^2 and low balance test between the two groups as it was indicated in (Table, 16). Therefore, the emphasized was given to

kernel estimation method, and this is consistent by former users like Yibeltal, (2008). Therefore, the focus of the ATT for this study was kernel matching estimator with band width 0.25.

The result on the Table 19 shows that, on average, participation in PSNP did not bring statistically significant change on household's livestock asset holding. This finding is consistent with the Andersson *et al.* (2009); Gilligan *et al.* (2008); Tadelle, (2011) findings. They also have found insignificant impact of PSNP on asset holdings. This may be happened due to the focus of transfer use only on temporary consumptions or relief aid by beneficiaries themselves and the resources limitation.

With regard to transfer use by beneficiaries only on temporary consumptions or relief aid, as of to the interview carried with PSNP coordination office, though, the PSNP is good, most of the beneficiaries who received resources from the program are found to have feeling of relief aid dependency sense in utilization of resources. This means, due to the relief aid dependency feeling they spend the money they received for temporary consumptions and non-useful services (like drinking alcohol). Therefore, we may think that, this may be one of the problems accounted by beneficiary households, which in effect lead to the insignificant impact of the program.

On the other hand, the resources limitation has triggered the local level government, to transfer resources in a diluted form, which in turn contributes weakly for the expected achievements of asset building. This means that, targeted households with 'X' number of total eligible household members received in-proportionate amount of resources, which couldn't be able to cover the minimum needs of the HH members. As the result, the HH heads and members will fail to contribute significantly on the asset building activities in particular and program impact in general.

Though, the impact of the program is found to be insignificant, we could not deny that the estimated ATT shows an increment of TLU by 0.118 for the beneficiaries of PSNP and positive level of the difference (0.185 TLU) as it can be seen in the Table (Table 19).

When we come to other asset category, which includes household production and durable assets, it was found that the difference of Average Treatment Effect on Treated (ATT) was negative and statistically insignificant. This also indicates participation in PSNP thorough time, did not lead to protection of household assets. This might be because the households are using the transfer from PSNP only for temporary in-house consumption rather than to increase the amount of their productive and durable assets. This result was also found as consistent with findings of the above mentioned authors (Andersson *et al.*, 2009; Gilligan *et al.*, 2008; Tadelle, 2011).

Table 19. ATT estimation results of the Impact of PSNP on livestock and non-livestock asset holdings

Outcome variables	Beneficiaries	Non- beneficiaries	Differences	Std. Err.[5]	T-value
Livestock asset change in TLU	0.118	-0.066	0.185	0.249	0.74
Other assets change in number	1.494	1.942	-0.448	0.648	-0.69

Source: Model estimation result, 2013

Moreover, an additional reason that can be raised for the insignificant outcome, which was opposed to the expected result, may be due to the weak post transfer monitoring, program appraisals and follow-up of limitation of the program, and beneficiary household's status through time after implementation of the program by the respective level of execution structure (command) (PSNP coordination office interview, 2013).

Additionally, graduation from PSNP was considered as one of indication for increase level of assets. This in turn, can also be used reference of significant impact of the Program. However, when we look the reality, graduated household from the program beneficiaries for each sample kebeles were very few and insignificant in number as compared to the number of those household heads, who have got benefited (Table, 20). Therefore, this also may be taken as supportive evidence for lacking the achievement of expected outcome by the program.

[5] Boot strapped standard error is obtained after 50 replication

Table 20.Total beneficiary HH head and graduated HH head number from PSNP up to 2012

Kebeles	Beneficiaries HH head number	Graduated HH head number up 2012
Ambicho Gode	94	4
Lembuda	136	6
Lisana Kusa	173	5
L/Kode Duna	215	9
T/Ambicho	86	6
Total	704	30

Source: LDAO report, 2012

4.2.5.2. Estimation of Average Treatment Effect on Treated for SWC activities

As it was already justified in the first case, the emphasis here also was given to kernel estimation methods to look in the impact of PSNP on SWC activities. Moreover, from the survey result of 2013 by the study households mostly used conservation activities are soil bund, check dam, water way and cut off drain, based on the requirement of their farm land characteristics.

Table 21 indicates the result of estimation of average treatment effect on treated **(ATT)** of the individual households SWC activities. Accordingly, when we look at each activity separately, we have found that the PSNP implementation resulted in insignificant outcome for each SWC activities (soil bund, water way, cut off drain and heck dam) by beneficiaries. On top this, it is also necessary to check for aggregated individual households SWC activities outcome to arrive at final decision. The last raw of the Table 21 reveals this aggregate of the SWC activities, and it also indicates that there was no supportive evidence, which shows participation in PSNP had significant value individual households. This means that the participation on PSNP did not bring significant change in application of the total SWC measures by individual households. Therefore, this leads to conclude that PSNP has not contributed for significant change on households investing SWC practices in the study area. Tadelle, (2011) had also found insignificant impact of PSNP on sustainable land management practices by taking soil and water conservations as an indicator. Thus, the reasons for this case may be due to fact that those households, who are participated in the program, were

most often time involved in community activities rather than in private and self rehabilitation activities.

Even though, the impact of the on SWC activities found to be insignificant, the ATT estimation difference is still positive. This means that the PSNP has also a minimal contribution on individual households SWC activities.

Table 21: ATT Estimation results for the Impact of PSNP on households SWC activities

Outcome variables	Beneficiaries	Non-beneficiaries	Differences	Std. Err.[6]	T-value
Soil bund (m/ha)	22.417	18.772	3.644	11.646	0.31
Check dam (m/ha)	2.582	0.138	2.444	1.699	1.44
Water way (m/ha)	3.322	0.327	2.994	3.470	0.86
Cut off drain (m/ha)	1.483	4.563	-3.079	2.009	-1.53
Total SWC(m/ha)	29.76	23.78	5.985	12.119	0.49

Source: Model estimation result, 2013

[6] Bootstrapped standard error is obtained after 50 replication

5. SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1. Summary

This study was conducted to examine the impact of PSN on individual household's asset building and investment of soil and water conservations activities in Lemo Distinct, Hadiyya Zone, Southern Ethiopia. To come up with the final result, propensity score matching (PSM) methods was applied. In randomized experiment, the impact of a program can be evaluated simply by estimating the mean difference between the participants and controlling groups. However, for quasi-experimental design, the simple "***with-and-without***" comparison of "***means***" for the treated and control groups would make the biased estimates; because the program placement creates a selection effect. Therefore, the mentioned method, which is widely applied to evaluate non-experimental social programs, was used to handle this problem in this study. Moreover, PSM is used to create a comparable pair of treatment-control households in a non-randomly placed program with the absence of baseline data and for estimating the counterfactual effect.

The cross sectional data were collected from a total of 181 households, which encompass almost equal proportion of both beneficiaries and non-beneficiaries of the PSNP. All necessary steps of propensity score matching were applied. Accordingly, the investigation shows that participation in the program was significantly influenced by the total household size, amount livestock holding, households whether faced the problem of food security or not, and amount of plot number which is an indication of land holding of the households. The propensity score estimation for matching has resulted all (91) households from beneficiaries as good match to 76 household to non-beneficiaries by controlling confounding factors. As a result, only 167 sample households were identified to be considered in the estimation process. This was after discarding 14 households whose propensity score value is out of the common support region. Different types of matching quality/balance tests were applied to check the balance of the distributions of relevant variables in both groups after matching. This comparison resulted in the insignificant difference after-matching, as we compare it with that of the before- matching situation.

5.2. Conclusions

The anchor idea of the study was to answer the question, "What could happen if the program was not in a place?". To answer it and come up with the final result, propensity score matching (PSM) methods was applied.

The findings of this research based on the estimation result average treatment effect on treated (ATT) indicates that the implementation of PSNP had not fetched significant impact on asset building and improvement on the investment of SWC activities at individual household's level. In conclusion, major reasons like: resource limitation, the beneficiary households focus only on temporary consumptions or relief aid dependency, lack of strong and continuous monitoring, and allocation of larger share of the time of beneficiaries for the communal works rather than on private have contributed for the insignificant impact of the program.

5.3. Recommendations

Though, strong impact was expected from PSNP implementation, the empirical result of this study shows that program had not significantly changed the levels of the asset building and SWC activities of individual household's. Therefore, based on this finding, the following policy recommendations were provided to concerned parties:

- ✓ Focus ought to be given to address the behavioral shortcomings of beneficiaries, so that they may become wise at the utilization of resources received.
- ✓ Continuous monitoring and following-up devise better be deployed, so as to reduce the in-proportionate transfer of resources, resulted from the deficit of resources and resultant diluted form of distribution amongst the beneficiaries, and to make timely evaluation on each beneficiaries change in status.
- ✓ For training and advice, maximum effort needs to be exerted to evict the feeling of dependency on relief aid of or temporary consumption, which is deep-rooted in the heart of beneficiaries.

- ✓ Take account of the scheme of practicing soil and water conservation activities on private land rather than practicing only on communal lands.

On top of this, it is much advisable to conduct intensive researches in this area and review the already conducted researches at all level with that to get a new and strategic way to positively touch the lives of untouched. This means, we need to work on identification and scrutinization of special ways to address the needs of the most marginalized, and bring a significant scenario of resilience together with a creditable multidimensional change.

Finally, re-thinking or re-evaluating the program objectives is inevitable at national, regional, and other operational levels, so as to bring an anticipated change in the lives of beneficiaries and actualize targeted objectives of the program.

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APPENDICES

Appendix 1: Description of the range of slope (%) and soil depth in cm

Description	
Slope	Slope range (%)
Flat	Below 5
Medium	5-10
steep	11-15
Very steep	Above 15
soil depth	Soil depth range in (cm)
Shallow	25-50
medium	50-90
Deep	90-150

Source: Taffa, 2011

Appendix 2. Conversion factors used to estimate Tropical Livestock Unit (TLU)

Livestock types	**TLU equivalent**
Cow and oxen	1.00
Horse/mules	1.10
Donkeys	0.70
Heifers/bulls	0.75
Calves	0.25
Sheep/goats	0.13
Chicken	0.013

Source: Strock *et al.*, 1991

Appendix 3 .Variance inflation factor for continuous explanatory variables for logit model

Variables	VIF	1/VIF
Number of days visit by DA	1.08	0.187
Plot number	2.06	0.484
Labor force	1.78	0.561
Land holding	1.86	0.537
Total household size	1.62	0.615
Age of household head	1.38	0.722
Average farm distance	1.38	0.725
Education of HH head	1.29	0.776
TLU	1.23	0.810
Steep and very steep land	1.08	0.927
Mean VIF	**1.48**	

Source: Model estimation result, 2013

Appendix 4: Contingency coefficients for discrete explanatory variables of logit model

Variables	Value of C
HHSEX	0.01
HHMMEDU	0.625
FOODSECUPR	0.032

$$C = \sqrt{\frac{x^2}{N+x^2}}$$

Where C= coefficient of contingency, x^2= Chi- square of random variable and

N= total sample size

Appendix 5. Description of the estimated propensity score in region of common support

Estimated propensity score				
Percentiles		Smallest		
1%	.0328277	.0323737		
5%	.0478433	.0328277		
10%	.0603395	.0380013	Observation	167
25%	.1945041	.0380137	Sum of Wgt.	167
50%	.6327674		Mean	.5433833
		Largest	Std. Dev.	.3235002
75%	.8397131	.9441582		
90%	.9116604	.9455483	Variance	.1046524
95%	.9273884	.9467102	Skewness	-.3638632
99%	.9467102	.95371	Kurtosis	1.578348

Source: model estimation result, 2013

Note: the common support option has been selected the region of common support is [.03237373, .95371001]

Appendix 6. Household Survey Questionnaires

My name is Dessalegn Anshiso. I am MA student at Addis Ababa University, in the Center for Environment and Development studies. Currently I am doing a research to investigate the ***Impact of Productive Safety Net Program on Asset Building and Soil and Water Conservation Activities: A Case of Lemmo District, Hadiya Zone of Southern Ethiopia:*** The responses you give are valuable and will be held in utmost confidentiality and will be used only for the analysis of this research. Thank you in advance for your cooperation!!

Interview information

Name of interviewer_____ signature_____
Date of interview_____ month _____ year _____
Name of supervisor _____signature _____ date _____

A. General information on household characteristics (Pre- and post intervention)

1	Name of household head	_____	
2	Household code number		
3	Kebele		
4	Sex of household	1) Male 2) Female	
5	Household marital status	1) Single 2) Married 3) Widowed 4) Divorced	
6	Religion	1) Protestant 2) Orthodox 3) Muslim 4) Others (Specify)___	
7	Age of household head	_____ year	
8	Education level of household head	_____ year of school	
9	Education level of house hold members of age 15- 64 years	0) Illiterate (not able to read & write) 1) literate (able to read and write)	

10. Describe the Family size, age and sex composition and of household member?

Age group year	Male	Female	Total
1. <10			
2. 10-14			
3. 15-64			
4. >64			
5. Total			

B. Household Land holding and Crop production system

11	Primary occupations of the respondent HH	1) Farmer 2) Government employee 3) trader 4) other specify_____	
12	Do you have your own farm land?	1) Yes 2) No	

15	How could you get access to the farm land you are using currently?	1)Through rentin 2)Through share cropping 3) Inherited from the parents 4) Allocated by the Kebele 5) other specify	

14	What is the total size of your land holding (home garden + farm) in **ha**?	1) Less than 0.50 2) from 0.5 to1 3) from 1.1 to 1.5 4) from 1.6 to 2 5) greater than 2	
15	What is the total size of cultivated farm land you have in hectare?	1.Your own cultivated land _____ ha	
		2. Rented in /shared in cropping ___ha	
		3.Rented out / shared out_____ha	
		4.Total _____ ha	
16	How many parcel of farm land do you cultivate?	1) One 2) two 3) three 4) four & above	
17	What is the average distance of your cultivation field from your residence?	1)Less than ten minutes 2)10-30min 3) 31-60min 4) more than 60 min	
18	How do you perceive the distance of your cultivated land from your residence?	1) Near 2) far 3) very far	
19	How do you see the size of your agricultural land over 7 years time?	1) decreasing 2) No change 3) increasing	

21. What were the crops and vegetation grown in 2011/2012 cropping season?

A. Crop types	Yield in quintal	Amount sold in Kg	Birr per Kg
1.Enset			
2. Maize			
3. Wheat			
4. Teff			
5. Sorghum			
6. Barely			
7.Other specify			
B. vegetation			
1.potato			
2. cabbage			
3. carrot			
4. beetroot			
5.Tomato			
6. onion			
8.others specify			

20	How do you see the characteristics of you land by the following features?		
	1.Slope	1) flat 2) medium 3)steep 4) very steep	
	2.Soil depth	1) shallow 2) medium 3) deep	
	3.Fertility status	1) low 2) medium 3) fertile)	
21	How do you see the productivity of your farmland over last 7 seven years?	1)Decreasing 2)The same 3)Increasing 4) I do not know	

22	If the productivity of your farmland is decreasing what is the reason?	1) Frequent cultivation of land without fallowing 2) Soil erosion 3) absence of crop rotation 4) others (specify) _____	

C. Labor availability and Land Tenure Security

23	Do you have enough labor to perform farm work?	1) Yes 2) No	
24	Which family members participate in farm activities?	1) Men 2) women 3) children 4) all 5) Men and women	
25	Do you think that you have the right to inherit your land to your children?	1) Yes 2) No	
26	If no, Why?	_____	

D. Access to Extension Services and Credit Facilities

27	How often were you **visited by development agents** (DAs) last year	_____day/month	
28	Do you get extension advices and trainings on soil and water conservation practices last year?	1) Yes 2) No	
29	If Yes, how many times? ___ in month last year?	_____in month	
30	Did you take credit for the last seven years?	1) Yes 2) No	
31	If Yes, what was the purpose of the credit?	1) Fertilizer credit 2) Improved seed credit 3) Livestock credit 4) Money to buy farm tools 5) Other (specify)____	
32	Have you got credit for soil bund construction in the past years?	1) Yes 2) No	
33	If No, why?	1) No credit access 2) Not profitable 3) High interest rate 4) No need of money to construct bund 5) Other (specify) ___	

E. List of Household Asset Holding

How many of the following assets do you have (your own?)

Type of asset	34.No. owned by now	35.No. owned before 7 years	36.Difference & If there is difference answer (Q39) & (Q40)	37. Reason for increase overtime? 1) We bought this asset 2) we got from family/ others freely 3) Livestock reproduced 4) Due to PSNP 5) Other (specify)____	38. Reason for decrease? we forced to sold it 1) to buy food 2) for health expense 3) for education expense 4) To exchange the asset for food 5) Livestock died 6) other (specify)___
A. Livestock					
1.Cow					
2.Ox					
3.Goat					
4. sheep					
5.Horse					
6. Donkey					
7. poultry					
8. others (specify)					
B. Productive asset					
1. Plough equipments					
2. Water pump					
3. Beehives,					
4. Others (specify)					
C. HH durable goods					
1. Telephone (Mobile)					
2. Radio					
3. House					
4.Bed					
5. Bicycle					
6. Motor bicycle					
7. Stove					
8. others (Specify)					

G. Households Income Source

What is your household source of income of 2011/12?

Type of activity	39.Mark on your selection (×)	40. Average monthly income (Br.)	41.Total annual income (Br.)
A. Agriculture			
Crop production			
Sale of cattle			
Sale of sheep			
Sale of goat			
Fattening			
Sale of animal products			
Poultry rearing/selling			
Bee keeping			
Other specify------			
B. Non-farm & Off-farm activities			
Daily labor work			
Trading of livestock			
Firewood wood sale			
Petty trade			
hand craft			
Renting of asset(land, ox etc)			
Other specify----			

H. Farmers' practices towards soil & water conservation activities and perception of SWC technologies benefits

42	Do you think soil erosion is a problem for you?	1) Yes 2) No	
43	If Yes, Which indicators lead you to believe that soil erosion exists?	1) Decrease production 2) Visible rills/gully formation 3) Decrease soil depth 4) Soil colour changes 5) Others_____	
44	Have you ever used any type SWC practices on your farmland?	1) Yes 2) No	
45	If you say no for (Q44) what is/ are the reason/s?	1) Absence of interest 2) lack of knowledge 3) my land not need SWC practices 4) Others (specify)	
46	If yes which types of SWC measures do you use?	1) Soil bund & Fanya juu terrace 2) check dam 3) water way 4) cut off drain 5) stone faced soil bunds 6) Drainage ditches	

		7) Afforestation 8) manure 9) other specify _____	

47	What is the amount/size of soil and water conservation structures currently existed on your plot in meters?	1) Soil bund _____ m	
		2) check dam_____ m	
		3) water way_____ m	
		4) cut off drain_____ m	
		5) stone faced soil bunds___m	
		6) Drainage ditches _____m	
		7) Afforested area _____m	
48	How do you construct SWC structures?	1) In groups with family labor 3) mass mobilization 4) hired labor 5) other (specify) _____	
49	Why do you construct SWC structures on your farmland?	1) Imposed to do so 2) To get FFW or cash for work aid 3) because of its benefits voluntarily 4) other (specify)_____	
50	Have you maintain SWC structures on your plot?	1) Yes 2) No	
51	If you are maintaining how frequent do you maintain SWC structures?	1) Every year 2) within two year 3) when damage happens 4) When there is imposition	
52	If you are not maintaining SWC structures on your farm plot, what is the reason?	1) Work is very tedious 2) high maintenances cost 3) in adequate labor 4) Neighbours are not willing to maintain 5) Structures were built without my willingness 6) others_____	
53	Do you think that using soil and water conservation technologies benefits you?	1) Yes 2) No	
54	What types of other land management practices do you apply to enhance the fertility status of land and increase production?	1) Compost 2) Tree planting 3) Fertilizer 4) Crop rotation 5) Others (Specify)	

H. Status of household Food security and copping strategies

55	Does your household face any food shortage during the last 7 years?	1) Yes 2) No	
56	If your answer is yes, What are	1) Rented out land to buy food 2) Sold	

	the strategies used by your household to survive from food shortage problem?	livestock to buy food 3) sold other assets to buy food 4) Sold firewood or charcoal 5) Sent children to stay with relatives 6) Sent children to work 7) Others (specify)	

57	During last 7 years, do you gate any form of food or cash transfer from government Safety Net programme?	1) Yes 2) No. (*If **yes, answer question Q57 to Q71, otherwise go to Q 72)**	

(For PSNP Beneficiates Households only)

I. Question related with PSNP and Its outcome on Household asset building

58	Who selected which household would receive the transfer from PSNP?	1)The DA 2)Kebele administration 3) The community Woreda Agr. Office 5) Woreda administration 6) Other (specify)	
59	How do you feel about selection process?	1) It was fair 2) It was not fair	
60	Why do you think your household was selected to participate in new government safety net programme (PSNP)?	1) We have limited land size 2) We don't have or have a few livestock 3) We have no family support or remittance from relatives 4) We received food aid/ emergency cash transfer before selection 5) Other reasons (specify)	
61	Do you know the objective of PSNP?	1) Yes 2) No	
62	Before PSNP have you participated in food for work program (FWP)?	1.)Yes 2)No	
63	If Yes, Is there any difference between FWP and PSNP?	1)Yes 2) No	
64	If yes, Please describe:		
65	Have you participated in other food security programme?	1) Yes 2)No	
66	If yes, what type of transfer you received?	1) Dairy 2) sheep/got rearing 3) livestock fattening 4) Beehives 5) Food item 6) others (specify)	

67. What is the amount of transfer that you receive in the form of food or cash from PSNP?

Type of Transfer	2006	2007	2008	2009	2010	2011	2012
Food (wheat) kg							
Cash in Birr							