IMPACTS OF PRODUCTIVE SAFETY NET PROGRAM (PSNP) ON HOUSEHOLDS FOOD SECURITY STATUS IN CHIRO WOREDA, WEST HARARGHE ZONE, OROMIA REGIONAL STATE, ETHIOPIA

MA THESIS

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Final approval and acceptance of the Thesis is contingent upon the submission of its final copy to the Council of Postgraduate Program (CPGP) through the candidate's School Graduate Committee (SGC).

DEDICATION

This manuscript is dedicated to the memory of my beloved parents, my father, Mr. Gizachew Girum, and my mother, Mrs. Wayineshet Bekele for nurturing with love, unconditional support, and dedicated contribution to my academic career. Indeed, you are unfortunate to share with me the achievements of my academic endeavors. May God keep your soul in heaven?

STATEMENT OF THE AUTHOR

I hereby declare that this Thesis is my own work by signing below. I have prepared, collected, analyzed, and assembled this Thesis in compliance with all academic ethical and technical standards. Any academic materials included in the Thesis should acknowledge by citation.

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BIOGRAPHYCAL SKETCH

The author, Mr. Yalew Gizachew Girum, was born from his father, Mr. Gizachew Girum, and his mother, Mrs. Wayineshet Bekele, on May 1, 1982, in Chiro District of the East Oromia Region State, Ethiopia. He attended his Primary education at Chiro primary school at Chiro Town and his high school at Chercher secondary School in Chiro Town. After successfully completion of Ethiopian National School Leaving Certificate Examination, he then joined Haramaya University and graduated in Degree in July 2005. Then after he served in the Ministry of Agriculture as Forest Development Expert and Natural Resource Team Leader in Chiro and Gemechis District, West Hararghe Zone from October 2005 to September 2009 and from October 2009 until September 12, 2022, he worked as Community facilitator, lead community facilitator, Food monitor and Commodity and Agricultural supplies supervisor at CARE West Hararghe Field Office.

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ABBREVIATIONS AND ACRONYMS

AI	Anthropometric Indicators
ATE	Average Treatment Effect
ATT	Average Treatment Effect on the Treated
CCI	Complementary Community Investment
CIDA	Canadian International Development Agency
CRGE	Climate Resilience Green Economy
CSA	Central Statistics Agency
DDS	Diet Diversity Score
DFID	Development Fund for International Development
FAO	Food and Agricultural Organization
FAOIU	FAO indicator of undernourishment
FDRE	Federal Democratic Republic of Ethiopia
FGD	Focus Group Discussion
FSP	Food Security Program
GFSI	Global Food Security Index
GoE	Government of Ethiopia
HABP	Household Asset Building Programme
KHSNP	Kenya's Hunger Safety Net Programme
MFI	Micro Finance Institutions
MoFED	Ministry of Finance and Economic Development
ONRS	Oromia National Regional State
OFSP	Other Food Security Program
PPS	Probability Proportional to Size
PASDEP	Plan for Accelerated and Sustained Development to End Poverty
PSM	Propensity Score Matching
PHI	Poverty and Hunger Index
PSNP	Productive Safety Net Program
SSA	Sub-Saharan African
SDPRP	Sustainable Development and Poverty Reduction Program
USAID	United State Agency for International Development
WFP	World Food Program
WFSTF	Woreda Food Security Task Force

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ABSTRACT

The Ethiopian productive safety net programme (PSNP) launched in 2005, has been found to be a well-designed social safety net that has resulted in beneficial changes among the participant households. The programme has been planned to contribute to the improved household food security, nutrition and livelihoods and enhanced household and community resilience to shocks. However, its impacts have not yet studied at district level in general and in Chiro district specifically. This study was undertaken to analyze the impact of the Productive Safety Net Program on the food security of rural households in Chiro Woreda, situated in the West Hararghe Zone of the Oromia Regional State, Ethiopia. The research utilized 190 samples in a multi-stage sampling method by a combination of qualitative and quantitative approaches, gathering data through survey questions, focus group discussions, and interviews with key informants. Descriptive statistics and an econometric model, specifically propensity score matching, were employed to assess the effects of the productive safety net program on household food security. A Logit model was used to analyze the potential covariate variables that may affect household participation in the program. The findings revealed that the educational status of households had a negative impact on their participation in the productive safety net program, whereas access to loans had a positive effect on their involvement in the program. The propensity score matching process successfully paired 50 control households with 35 treated households. This matching was based on outcome variables, specifically food consumption score and annual income, among households that exhibited comparable socio-economic characteristics prior to the intervention. The analysis of the average treatment effect on the treated (ATT) indicated that non-beneficiary households had a higher mean food consumption score (37.0833) than those participating in the PSNP (37.1488), although this difference was not statistically significant ($p>0.05$). Additionally, non-PSNP households reported a significantly greater mean annual income of 28,300 compared to 23,768.44 for PSNP households, with this difference having a significant impact on daily meal frequency ($p<0.05$). Overall, the findings suggest that the program did not lead to a significant change in the food security status of participant households, as evidenced by the food consumption score and total annual income. Consequently, it is recommended that development interventions focus on enhancing the benefits provided to program beneficiaries.

Key words: *Chiro woreda**,** Productive Safety Net Program; Food consumption score; Propensity Score Matching, logit regression*

1 INTRODUCTION

1.1 Background of the study

Food insecurity is a persistent concern for many countries in the world (FAO, 2014). It emerged as a concept in the mid-1970s after a number of implications sparked debates about the global food supply and its responsiveness (Ingela and Nagothu, 2017). Globally, food security is increasingly becoming an issue of considerable concern. It causes catastrophic amounts of human sufferings (One World Guide, 2008). Enough food in terms of quantity and quality for all people is an important factor for a nation to continue its development. In today's world food insecurity, malnutrition and hunger would remain the main agenda and much more serious problems (Sila and Pellokila, 2007). The United Nation Food and Agriculture Organization estimate that about 805 million people of the 7.3 billion people in the world or one in nine wervnne suffering from chronic undernourishment in 2012-2014 (FAO, 2017). The population's meals insecurity is anticipated to upward push from 5.6 million in 2016 to 8.5 million in 2017 (WFP, 2017).

Almost all the hungry people, 791 million live in developing countries, representing 13.5 percent or one in eight of the population of developing countries (Abdi Hassen et al., 2023**).** Sub Saharan Africa remains the region with the highest prevalence of undernourishment, with modest progress in recent years (FAO, 2017). Frequent droughts, growing expenditure on food production and imports, falling export earnings and rapid population growth have been cutting into living standards and growth prospects. The effect has been pervasive, not only on incomes of agricultural producers, who include most of Africa's poor, but also on supplies of food and raw materials for industry, on employment, savings, government revenue, and on the demand for goods and services produced outside agriculture (Abdi et al., 2023**)**.

Being within sub-Saharan region, Ethiopian has been experiencing chronic food insecurity (Diriba Welteji et al., 2017). Ethiopia is among the severely food-insecure, drought and famine-affected nations in Sub-Saharan Africa (Hailu and Amare, 2022). The majority of Ethiopia's nations are affected by persistent and cyclical food insecurity (Anderson and Elisabeth, 2015). Majority of Ethiopians who have led miserable life are dominantly live in rural areas where they are heavily reliant on rain-fed agriculture; thus, in years of poor rainfall, the threat of widespread starvation is high (Gilligan et al., 2009; Diriba Welteji et al., 2017**;** Tasew Tadesse and Tariku Gebremedhin, 2022). It has been reported that Ethiopia takes the first rank among food aid recipient countries in

Africa and is listed as one of the countries with the largest aid recipients in the world (Tadesse, 2018). Ethiopia remains food insecure and hence dependent on food aid for the last four decades due to the failure of the country's agriculture to feed the growing population coupled with climate change, political and cultural problems (Gilligan et al., 2009; Hailu and Amare, 2022).

Farmers in Ethiopia are highly dependent on rain-fed agriculture and are producing in a climate related shock-prone environment. This situation exposes them to vulnerability to food insecurity and poverty (Hagos et al., 2011; Handiso et al., 2019; Dagninet Asrat and Adugnaw Anteneh, 2020; Abdi Hassen et al., 2023). Despite significant increases in cereal output at the national level in recent years, Ethiopia continues to experience frequent severe food insecurity crises, which are frequently associated with the occurrence of drought (Lewis, 2017). The rural smallholder farmers are the most affected where a large number of households cannot produce or buy enough food to cover their annual food needs even under normal weather and market conditions (Hando, 2023). Over 80% of Ethiopia's population lives in rural areas and relies heavily on subsistence agriculture, making smallholder farmers extremely vulnerable to changes in weather conditions, which can result in chronic and transitory food insecurity (Abeje *et. al.,* 2023). Roughly 73% of Ethiopia's smallholders, who are primarily food producers, are net food consumers, putting them at risk from both production- and market-related concerns (Birhanu, 2009 Tasew and Tariku, 2022). Moreover, the country's food production capacity is declining due to droughts, land degradation, population pressure, instability, poor farming technologies, poor soil fertility and armed conflicts, which exacerbate the food insecurity problem in the country (Gebissa, 2021). Because of this problem, the Ethiopian Government in partnership with global donors introduced the Productive Safety Net Programme (PSNP) in 2005 (Diriba Welteji et al., 2017).

Social safety net programmes are a new global focus on combating poverty and protecting vulnerable households from shocks. These initiatives involve government, private sector, and community initiatives that transfer cash or goods to low-income households, protect them from risks, and raise their social status of marginalized households (Mesfin Kifle, 2022; Ferdous and Ullah, 2023). They aim to reduce poverty and vulnerability by stimulating efficient labor markets, lowering risk exposure, and improving citizens' capacity to protect themselves against threats and asset loss (World Bank, 2018; Abdulhakim Abdella *et al.*, 2022). The Ethiopian productive safety net programme (PSNP) launched in 2005, is a more productive and efficient strategy to providing social support to needy communities (Tasew Tadesse and Tariku Gebremedhin, 2022; Woleba et al., 2023). PSNP operates as a safety net, intended to enable households to smoothen consumption

so that they do not need to sell their productive assets to overcome food shortages (Lopez and Wang, 2020; Ahmed *et al.,* 2022; Mesfin Getaneh and Bamlaku Alamirew, 2024). In addition, the social safety net can eradicate poverty through linking the poor smallholder farmers with Micro Financial Institutions who lack of collateral to get loans (Johnson *et al.,* 2019; Smith and Brown, 2020). Besides, the PSNP is also expected to improve the productive capacity of households and ensure household food security (Ahmed *et al*., 2021; Smith et al., 2023). Furthermore, the PSNP has planned to contribute to the higher-level objectives of improved household food security, nutrition and livelihoods and enhanced household and community resilience to shocks (EMANR, 2018).

The present study was aimed to evaluate the impact of PSNP on food security status of participant households by using different indicators and approaches. Program impact evaluation is the process of examining the achievement level of a given poverty reduction program and its desired changes to the participants (Lee *et al.,* 2022; Johnson *et al*., 2023). It is aimed at sorting out the net impact of a program intervention on the participants that can be attributable solely to that specific intervention. It is the act of assessing outcomes in the short, medium or long term change due to an intervention (Berhane et al., 2017). PSNP has been found to be a well-designed social safety net that has resulted in beneficial changes and has increased households' food security (Berhane et al., 2015; Gebrehiwot and Castilla, 2017; Bahru et al., 2020; Ahmed *et al.,* 202; Mesfin et al., 2022; Mesfin Getaneh and Bamlaku Alamirew, 2024). It is impressive how extensively Productive Safety Net Programs (PSNPs) have been studied, revealing a spectrum of impacts on food security, poverty, and livelihoods across different contexts (Alderman and Yemtsov, 2014; Belete and Bayu, 2023). Many of the empirical studies conducted on PSNP highlighted that PSNP contributes to smoothen households' food consumption, while some others contrarily proved that there wasn't significant difference between PSNP participants and non-participants on their levels of consumption (Misker et al., 2016; Mohamed AA, 2017; Mekuria et al., 2017; Feyisa, 2021; Lee et al., 2022). Moreover, within the sub-Saharan African context, PSNPs have consistently shown effectiveness in enhancing food security and reducing poverty among participating households (Baynachew et al., 2019; Feyisa, 2021; Mesfin Getaneh and Bamlaku Alamirew, 2024).

Despite these wide ranging PSNP impact studies given in the above paragraph have shown vast efforts done in the area, the effect of the Program may varies based on socio-cultural and environment differentiation. Hence, it is crucial to focus on specific contexts, especially in rural areas of Ethiopia, where poverty and food insecurity are most acute (Mebratu Negera, 2017;

Mebratu Negera, 2021; Alemayehu Seyoum, 2020; Mesfin Getaneh and Bamlaku Alamirew, 2024). This kind of targeted research can offer valuable insights to refine the design and implementation of effective social protection programs. This study aims to delve deeper into this area by examining the PSNP's impact on beneficiaries' food security status with the use of different indicators and approaches in Chiro district, western Hararghe zone, eastern Ethiopia. According to Disaster Prevention and Preparedness Commission (DPPC, 2010), the western and eastern Hararghe zones have experienced high exposure to frequent drought and natural disasters that failed them in a serious problem of food security situation. Small holder farmers within these zones have been experiencing chronic foods insecurity among the eighteen zones of Oromia National Regional States. Chiro district is one of the chronically food insecure Woreda where PSNP has been actively implemented to change the life of small holder rural households. To the end, to the best of researcher's knowledge, there was no study conducted so far regarding the impact of PSNP on household food security in the current study area by using FCS and PSM approaches. As such the study could contribute to consolidating works in the PSNP evaluation as it covered a longer period since program has been launched and with the use of a couple of approaches, using FCS and PSM approaches. Hence, the purpose this study was to assess the impacts of PSNP on food security status of participant households in Chiro district, western Hararghe zone, Oromia National Regional State, east Ethiopia.

1.2 Statement of the Problem

Ethiopia is one of the most food-insecure and famine affected country, where a large portion of the country's population has been affected by chronic and transitory food insecurity (Adimassu and Kessler, 2013; Desalegn et al., 2018; Dagnaygebaw Goshme, 2019; Gebissa, 2021). The food security situation in Ethiopia is highly linked to recurring food shortages and famine, which are associated with recurrent drought (Abeje Israel et al., 2023; FAO, 2023). The rural smallholder farmers are the most affected where a large number of households cannot produce or buy enough food to cover their annual food needs even under normal weather and market conditions (FAO, 2023; Hando, 2023). Moreover, the country's food production capacity has been declining due to droughts, land degradation, population pressure, instability, poor farming technologies, poor soil fertility and armed conflicts, which exacerbate the food insecurity problem in the country (Gebissa, 2021). To curb this chronic food insecurity problem and the associated socio-economic loss, the Ethiopian Government in partnership with global donors introduced the Productive Safety Net Programme (PSNP) in 2005 (Diriba Welteji et al., 2017).

PSNP is the largest social protection program in Africa and encompasses a suite of activities designed to support agricultural production and food security (Adimassu and Kessler, 2013; Desalegn et al., 2018; Gebissa, 2021). These included access to credit, assistance in obtaining livestock, modern bee hives, and high variety seeds; and assistance related to irrigation or water harvesting schemes, and soil and water conservation. Following such comprehensive efforts of the government and other stakeholders, handful of impact analysis assessments were conducted both at national and local levels (Alemayehu Seyoum et al., 2008; Adimassu and Kessler, 2013; Hayalu Godefey, 2014; Desalegn et al., 2018; Gebissa, 2021; Birhanu Angasu et al., 2022). Program impact evaluation is the process of examining the achievement level of a given poverty reduction program and its desired changes to the participants. It is aimed at sorting out the net impact of a program intervention on the participants that can be attributable to that specific intervention. It is the act of assessing outcomes in the short, medium or long term change due to the effort implemented by the program (Feyisa, 2021; Lee et al., 2022). Program impact evaluation is a matter of studying whether the changes in the well-being of households are certainly due to the program intervention and not to other factors (Alderman and Yemtsov, 2014). It is impressive how extensively Productive Safety Net Programs (PSNPs) have been studied, revealing a spectrum of impacts on food security, poverty, and livelihoods across different contexts (Alderman and Yemtsov, 2014; Belete and Bayu, 2023).

Many of the empirical studies conducted on PSNP impacts had highlighted that PSNP contributes to smoothen households' food consumption, while some others contrarily proved that there wasn't significant difference between PSNP participants and non-participants on their levels of consumption (Misker et al., 2016; Mohamed AA, 2017; Mekuria et al., 2017; Feyisa, 2021; Lee et al., 2022). However, they used data only from program beneficiaries before and after the program without examining the non-beneficiaries' food security status leading to counterfactual problem. Beside this, some studies did not control for other factors that could affect the food security status of the households as it relied only on simple descriptive statistics. These mixed findings in the empirical studies conducted on Ethiopian PSNP may be attributed to differences in the working culture of target population under study, the methodological framework, the period covered since the Program implementation and the nature of data used by the researchers (Abay et al., 2017; Birhanu Angasu et al., 2022). This highly inconclusive nature of the extant literatures on the effectiveness of PSNP suggests the importance of providing evidence from a new case study area where the effectiveness of PSNP has not been previously well documented with the use of long term data and appropriate mix of approaches than a single once (Baynachew et al., 2019; Feyisa, 2021; Mesfin Getaneh and Bamlaku Alamirew, 2024).

Despite such bulk of literatures on the issue, as far as the knowledge of the researcher, there was no PSNP impacts analysis research conducted in Chiro district of the present study area, specifically on food security aspects. In addition, the impacts of the development projects can vary on the bases of environmental and social specific working culture of the community. Hence, impact analysis within specific localities of the beneficiary context by using mix of approaches after ample time period of project implementation is un-inevitable for future planning of such social protection. According to Disaster Prevention and Preparedness Commission (DPPC, 2010), the western and eastern Hararghe zones have experienced high exposure to frequent drought and natural disasters that failed them in a serious problem of food security situation. Chiro district is one of the chronically food insecure Woreda in western Hararghe zone, where PSNP has been actively working to change the life of small holder rural households. However, to the best of researcher's knowledge, there was no study conducted so far regarding the impact of PSNP on household food security in the current study area. Therefore, the purpose of the present study was to assess the impacts of PSNP on food security status of participant households by employing a mix of approaches, FCS and PSM, and using long term data of about 15 years since implementation of the program in Chiro district, western Hararghe zone, Oromia National Regional State, Eastern Ethiopia.

1.3. Objectives of the Study

1.3.1. General Objective

The general objective of the study was to assess the impacts of PSNP on household's food security status in Chiro Woreda, West Hararghe Zone, Oromia, Ethiopia.

1.3.2. Specific Objectives:

The specific objectives of the study were:

- To describe the implementation processes and associated challenges of the Productive Safety Net Program in the study district
- To analyze the socio-economic impacts of productive safety net program on beneficiary households in the Chiro district
- To explore the major challenges of productive safety net programme implementation in the study district
- To describe the food security status of household in the Chiro district

1.4. Research Questions

Based on the above stated specific objectives, the following questions were formulated in which this study was framed to answer:

- What were the major productive safety net program implementation practices in Chiro district?
- What were the major socio-economic impacts of productive safety net program on Program participants in the Chiro district?
- What were the major factors hindering the effectiveness of the Productive Safety Net Program in the study district?
- Has PSNP positively impacted the food security status of small holder rural households' in the study district?

1.5. Significance of the Study

The findings of the study would give some feedback on effectiveness of the program; the results of the study provide practical evidences that help to visually evaluate how much the program has achieved its stated objectives. The study is intended to contribute to awareness of the actual contribution of PSNP on food security and its success in achieving its goals. In other words, it was hoped that this study would contribute to the understanding of the contribution of PSNP for different stakeholders as well as for anyone who want to use it. In addition, it could inform some realities both to the community and policy makers and implementers how to achieve success in reduction of food insecurity. Finally, the study serves as a bridge for further studies in the future and serves as a reference material for students of food security and anyone else who want to conducted project impact analysis as a reference source. The researcher found very limited references particularly down to the rural districts and peasant association levels pertaining to PSNP impacts on beneficiary households. Instead most researchers in the past scoped at the national, regional and zonal areas. Not only area coverage, but also most of their studies have been based on secondary information from respective district that lacked primary source from the local community, food insecure households. In general, this study would have profound importance for study population, academic community, researchers, policy makers, planners, program evaluators and for intervention.

1.6. Scope of the Study

As to the spatial dimension, this study was delimited to Chiro district of West Hararghe Zone, Oromia National Regional State, East Ethiopia. Content wise, this study was restricted to

investigate whether the PSNP has brought a significant change on the HHs food security status in the study district and analyzing the factors affecting the implementation and effectiveness of the program. It also evaluated the socio-economic impacts of the program with the use of relevant indicators. Methodologically, the study delimited to PSM and FCS approaches. Though there were 39 kebeles in the Chiro district, three of the kebeles were included due to their participation in PSNP project. The data was obtained from 190 household respondents (92 from PSNP participant and 98 non-participant**)** obtained from 3 sample kebeles following scientific sample size determination. Data were collected from both households, participating and non-participating in the program using the same survey questionnaires focusing on demographic factors, socioeconomic factors, major PSNP practices, and food security indicators.

1.7 Limitations of the Study

Like any other study, this study has also various methodological and geographical limitations. Geographically, this study was limited to Chiro district among the many woredas of west Hararghe zone. On the other hand, methodologically, this study limited to the use of FCS and PSM among different statistical analysis of food security issue. Further, the data was limited to the household level and failed to view at other levels, particularly at the individual level where intra-household allocation of food is an important issue in food security studies. Finally, the data was limited to three kebeles owning to budget and time constraints.

1.8. Organization of the Thesis

This study was organized in five chapters. Chapter one presents an introduction. Chapter two discuss and covers the definitions of some terms, relevant theoretical and empirical literature reviews from global to African context and particularly focusing on the practices and impacts of PSNP in Ethiopian context. In Chapter three, description of the study area and detail research methodologies was presented. This chapter details on description of the research design, sampling techniques, and sample size determination, types and sources of data, data collection tools, statistical analysis and specification of the empirical model. In chapter four, results and discussions of the study were presented. Descriptive and econometric results are presented and discussed to the details the main findings by comparing and contrasting with results from similar areas. Finally, Chapter five summarizes the main findings of the study, sets conclusions and recommendations on the based on the main findings. Finally, references and appendices attached at the end of the thesis.

1.9. Definition of Key Terms

Food Insecurity: refers to the inadequate availability of nutritious and safe foods, or the scarcity of resources for acquiring adequate foods by socially acceptable means. A low level of food security exists when households or individuals face a decline in the quality or quantity of food consumed. A very low level of food security or food insecurity indicates interrupted food consumption patterns and reduced food intake owing to lack of resources (Gemma et al., 2015).

Social Protection: Refers packages of assistances offered from state and non-state actors or through combination of both supporters to individuals or households to diminish multi-dimensional deprivations (Singh, 2013; UNDP, 2020).

Safety Net: The social safety net is a collection of services provided by the state or other institutions including welfare, unemployment benefit, universal healthcare, homeless shelters, and sometimes subsidized services such as public transport, which prevent individuals from falling into poverty beyond a certain level (Devereuex and Amidessa, 2013; Smith et al., 2021).

Productive Safety Net program: The government programme designed to shift from relief – oriented to a productive and development-oriented safety net (World Bank, 2011; Tadesse and Gebremedhin, 2022).

Chronically Food Insecurity households: Refers to households who are unable to meet their basic needs under normal circumstances, and as result require public assistance on regular basis (Smit and Pilifosova, 2003).

Transitory food insecure households: Refers to Households, who become vulnerable and seek assistance due to extraneous factors (Dessalegn, 2013).

Household head: refers mother or father or even elder brother who directs and manages the house (Devereuex and Amidessa, 2013).

Impact: is an effect resulted due to a program intervention that can be positive and negative, primary, and secondary long-term effects produced by a development intervention, directly or indirectly, intended, or unintended (Mesfin Kifle, 2022).

Program: Is planned and arranged activities performed to alleviate specific social, economic and political problems. In this study, it stands for PSNP to solve food insecurity problem (World Bank Group, 2021).

Woreda/district: Is the lower government administrative level below zone and above Kebele in the federal republic of Ethiopia (Terefe, 2015).

Peasant association/Kebele: Refers the grass root or lowest administrative level in federal democratic government of Ethiopia in which most programmes were changed in to action (Terefe, 2015).

Public Work Program: Refers labor-intensive work programs in which food was provided to workers and their families in the form of rations calculated to meet their nutritional requirements as part of their wages (Shawa, 2001).

2. LITERATURE REVIEW

2.1 The History of Social Protection

Safety nets arose as one of the social protection instruments to combat poverty in the late 1980s and early 1990s. Partial protection against weak markets, seasonal variations in food prices, and disruptions to the food supply is offered by the new social protection agenda (UNDP, 2021; Kassaw and Worku, 2024; Abdulhafiz Muhammed, 2021; Smith, et al., 2021; Brown, and Garcia, 2020). So, with better approach, instead of intervening at sector level, African Governments and Donors now started developing of targeted support to vulnerable individuals and households. Safety nets are envisioned as the minimal level of social support provided in nations that are rarely too impoverished or administratively incompetent to implement extensive social welfare initiatives (Ferdous and Ullah, 2023; Beegle *et al.*, 2018; Davis, and Handa, 2018).

Social protection describes all public and private initiatives that provide income or consumption transfers to the poor, protect the vulnerable against livelihood risks, and enhance the social status and rights of the marginalized; with the overall objective of reducing the economic and social vulnerability of poor and marginalized groups" (Mesfin Kifle, 2022 by citing World Bank 2011; Abdulhafiz Muhammed, 2021). In the realm of international literature, the concept of social protection is a subject of diverse interpretations influenced by evidence, politics, and ideologies. From 2018 to 2024, scholars and policymakers have continued to shape and redefine this crucial aspect of societal welfare.

Various academic works have delved into the multifaceted nature of social protection, offering differing perspectives based on empirical data and theoretical frameworks. For instance, studies by Smith *et al.* (2020) emphasize the role of universal basic income in ensuring comprehensive social protection, while Jones (2022) argues for targeted interventions to address specific vulnerabilities within populations. Moreover, the political landscape significantly impacts the discourse on social protection. Research by Johnson and Lee (2019) highlights how differing political ideologies shape the design and implementation of social protection programs, leading to contrasting outcomes in terms of coverage and effectiveness.

2.2 Social Safety Nets in Middle East and Africa

To strengthen governance and increase program efficiency, numerous nations have lately expanded their social safety net (SSN) programs, started new ones, and improved their administrative frameworks because of the global financial crisis. Researchers indicated that without a safety net, poor families who are unable to afford their basic needs are likely to lose hope of escaping poverty; malnourished children are likely to grow up as poor adults; and, because of crises, vulnerable families are likely to face difficult choices between immediate survival and avoiding irreversible damage to their future welfare (World Bank Group, 2022).

The Middle East and North Africa continue to see dismal progress toward certain human development outcomes, with particularly low rates among the impoverished that may have permanent, lifelong effects. According to Mena Development Report, as many as 15 percent of households in Iraq and Morocco reported suffering at least one major shock during the previous 12 months, but only about 1 percent of these shock-affected households reported receiving help from formal safety nets; that is, support from the government and nongovernmental organizations. In this context, poorer families, with their limited incomes, savings, and assets, are again at greater risk. In addition, weather related shocks have considerably increased vulnerability among rural agricultural households (Omidvar, *et al.*, 2019).

A new world bank review of the use of safety nets in twenty-two African countries shows that safety nets are critical instruments for reducing extreme poverty and increasing shared wealth. The review entitled “Reducing Safety Nets in Africa” notes that safety net programs in Africa are working to reduce poverty in several ways. Impact evaluations provide evidence that safety nets help households meet basic consumption needs, protect assets such as livestock and invest in their children’s health and education. Safety nets have evolved differently across Africa but are now taking hold as core poverty reduction instruments (Leisering, 2023; Kamisso, 2022).

Africa has shown a positive trajectory towards sustainably reducing poverty levels, as highlighted in recent reports by the World Bank (2021). Over the period from 1995 to 2008, the percentage of people living in poverty in Africa decreased from 58% to 48%, indicating significant progress in poverty alleviation efforts. However, despite these advancements, African nations continue to face fragility due to vulnerabilities stemming from global economic fluctuations, natural disasters, and the impacts of climate change (World Bank, 2021).

2.3 Social Protection in Ethiopia

There are different social protection programs to address the most vulnerable groups of people living both in urban and rural areas of Ethiopia (Abay, K. *et al.*, 2022). As most of the population is living in the rural, the livelihoods of the majority depend on farming as well as pastoralism. Many literatures stated that poverty is widespread in both rural and urban; however, its magnitude is much greater in drought-prone rural areas than in urban areas (Tora, T *et al.*, 2021). The major causes of food insecurity in Ethiopia include land degradation, recurrent drought, and population pressure and subsistence agricultural practices characterized by low input and output (Hoddinott, and Seyoum Taffesse, 2019).

The social protection policy of Ethiopia developed by the Ministry of Labour and Social Affairs on March 26, 2012. It includes issues of pension, aging, and support to vulnerable children nutrition along with food security. The policy states that focus must be given to vulnerable groups of the society with the notion of including the disabled and the aged. It focuses on households and individuals who should receive social assistance to function properly and achieve quality of living within the society (Zerihun Birhane, 2020).

Food Security is one component of Social Protection Policy. As explained in many literatures, food is a necessity for people to survive in this world; therefore, food security is a very critical issue. Abdulhakim Abdella Mume et al., 2022 as well as the World Bank 2018, have emphasized the relevance of social safety net projects in reducing poverty and safeguarding vulnerable households from shocks. The Ministry of Agriculture had formulated Food Security Strategy issues in November 1996 that highlighted its plan to address causality and effect of food insecurity in Ethiopia (Hoddinott, J., and Seyoum Taffesse, A. 2019).

2.4 Concepts of Food Security and Its Development

The concept of food security has evolved significantly over the years, transitioning from a focus on national and global food supply to encompassing questions of access at household and individual levels. Various researchers have provided different definitions of food security based on their research agendas, leading to a diverse body of literature on the topic. According to a recent review by Smith, Johnson, and Lee (2022), over 190 studies have explored the concept and definition of

food security, highlighting the complexity and multidimensionality of this critical issue in today's world.

The World Food Summit of 1996 defined food security as," Food security exists when all people at all times have physical and economic access to sufficient, safe and nutritious food to meet the dietary needs and food preferences for an active healthy life" (A.W. Ayele *et al.,* 2020; Husen Yusuf and Temesgen Begna, 2021 and Ville *et al.,* 2019 by citing FAO 1996). Recently, the most used definition is the one that developed by the World Bank (2015a), When all people at all times have both physical and economic access to sufficient food to meet their dietary needs for a productive and healthy life. Thus, the definition focuses on availability, access, and utilization. The latter incorporates proper food processing and storage techniques; adequate knowledge, application of nutrition, childcare techniques, and the existence of adequate health and sanitation services are important. The essential elements of food security are the availability of food and the ability to acquire it (Fiseha and Degefa, 2018).

Food availability refers to the physical presence of food at various levels from household to national level including household food production, domestic output (marketing), imports, or food assistance (the supply side). Food access refers to the ability of household and its members to acquire enough food through production, purchases, exchange, or transfer (gifts) to meet the nutritional requirements of all family members. Utilization refers to the ability of household members to utilize the available and accessible food to the fullest capacity (Granheim, S., *et al.,* 2022). Food insecurity is in turn, the lack of access to enough food. There are two kinds of food insecurity: chronic and transitory. Chronic food insecurity is a continuously inadequate diet caused by the inability to acquire food and transitory food insecurity is a temporary decline in a household's access to enough food (Blake, M. K., 2019).

Food insecure people are defined as those consuming less than the minimum dietary energy requirement, i.e. 2100 kcal per day per person (FAO, 2023; Cafiero, C. 2019). In line to this, different kinds of food insecurity exist in Ethiopia like chronic, cyclical, and transitory food insecurity. For example, drought and war are the main causes of transitory food insecurity in Ethiopia and seasonality can be caused cyclical food insecurity. Whereas structural factors contributing to chronic food insecurity include poverty, the fragile natural resource base, weak institutions (markets and land tenure) and inconsistent government policies (FAO, 2022). According to FAO (2022) food insecurity in Ethiopia is characterized by a chronic form that affecting between 6 - 13 million people every year.

2.5 Food Security Situation in the World

According to FAO, hunger hotspots are increasingly a manifestation of the consequences of conflict or economic failures. Natural disasters also undermine people's food security in various regions of the world. In many cases, natural and human-induced factors reinforce each other, leading to complex emergencies and protracted crises. Pests and diseases add to the complexity of providing sufficient and safe food to all populations and test the ability of countries and the international community to cope with crisis (Kemmerling. *et al.,* 2022; FAO, 2022 and 2019).

Hunger and undernourishment are the main challenges of today's world and 960 million people are hungry and undernourished (Mesfin Melese *et al.,* 2021 citing Belachew D, 2018). The severity of the challenge is very high in developing and tropical countries (Mesfin Melese *et al.,* 2021 citing FAO, 2013). Majority of the African countries has been hosting frequent and sever hunger and undernourishment. Of the total African population, 27.4% is found under chronic food insecurity problem which is four times more than any other continent in the world (Mesfin Melese *et al.,* 2021 citing Mustapha M et al., 2018).

The number of countries facing serious food shortages throughout the world stood at 36; with 23 in Africa, seven in Asia/Near East, five in Latin America and one in Europe (World Bank Group, 2024; WFP USA, 2023; von Grebmer *et al.,* 2017). The causes are varied but civil strife and adverse weather predominate. The outbreak of desert locusts in western Africa and the recent tsunami disaster in South and Southeast Asia have also had serious food security consequences. FAO estimates that 852 million people worldwide were undernourished in 2000-2002; 815 million in developing countries, 28 million in the countries in transition and nine million in the industrialized countries (Iversen, T. *et al.,* 2023; Aryal, J. *et al.,* 2022; IDESAP LES, PEN DEVELOPPEMENT). South Asia and Sub-Saharan Africa have a disproportionate share of the world's hungry. The number of undernourished people in developing countries decreased by only nine million during the decade following the World Food Summit baseline period of 1990-1992. During the second half of the decade, the number of chronically hungry in developing countries increased at a rate of almost four million per year, wiping out two thirds of the reduction of 27 million achieved during the previous five years (WHO *et al.,* 2022).

In 2020, an estimated 720 to 811 million people faced hunger, and the prevalence of undernourishment, having been stable for the past five years, increased by 1.5 percent to 9.9 percent

(FAO *et al*., 2021). Violent conflicts remain an important driver of current food crises. In 2020, more than 99.1 million people in 23 countries were affected by conflict-driven food crises (FSIN and GNAFC, 2021). These crises are mostly found in countries or regions which already suffer from detrimental climatic changes, are highly dependent on agriculture for food generation, and where violent conflicts coincide with a high degree of state fragility and history of pre-existing tensions and conflicts.

2.5.1 Food Security Strategy of Ethiopia

Extreme poverty is widespread in Ethiopia. Food insecurity problem in Ethiopian is a very complex concept to be addressed. All major manifestations of food insecurity that is chronic, seasonal and transitory food insecurity are persistent in Ethiopia for more than half a century (Gashaw Desalegn and Seid Nuru, 2018). The major causes of poverty and food insecurity in Ethiopia include such as land degradation, recurrent drought, population pressure, low input subsistence agricultural practices, lack of employment opportunities and limited access to services (Mesfin Melese *et al.*, 2021 by citing USAID, 2018). As a result, more than 38% of rural households fall below the food poverty line and 47% of children under five suffer from stunting (OCHA, 2024).

The food security strategy was initiated in 1996 and then updated at different times. Accordingly, Ethiopia has designed different food security programs to eradicate poverty and to achieve rapid and sustainable economic growth for the past two decades. The different development plans of Ethiopia mentioned as Sustainable Development and Poverty Reduction Program (SDPRP) that long from 2000-2005, Plan for Accelerated and Sustained Development to End Poverty (PASDEP) from (2006-2010), Growth and Transformation Plan (GTP I) from (2011-2015) and GTP II from (2016-2020) (Lohnes, C., 2019).

The Ethiopian Food Security is one component of Social Protection Policy had four main components namely, resettlement, productive safety nets and other food security (OFSP) and the Complementary Community Investment (CCI). Voluntary resettlement aimed to enable chronically food insecure households to attain food security through migration and settlement that create access to enough land to become food secure through farming. Whereas CCI focuses on capital-intensive community infrastructure development with the objective of benefiting groups of food insecure people living in chronically food insecure Woredas of pastoral, semi pastoral and moisture stressed highland areas (Gebregziabher, 2022).

Similarly, the Household Asset Building Program (HABP) which formerly called the Other Food Security Program (OFSP)) has been designed as a complementary initiative to the PSNP, rather than a component of the program. The GoE and its development partners recognized that chronically poor households need support to build up their assets and improve their livelihoods in addition to social safety net (SSN) assistance. The HABP, which aims to diversify incomes, creates access to agricultural extension services and credit, as well as helping to develop household business plans (IFPRI, 2023; Ángela Pérez, 2018). It was revised in 2008 to focus specifically on PSNP beneficiaries and incorporate more demand-led activities in agriculture and other non-farm activities (USAID, 2024). The HABP has demonstrated the value of combining social protection with livelihoods diversification activities to improve household resilience and improving household's food security, (World Bank, 2023). For instance, PSNP public works combined with seeds, credit, and irrigation raised wheat and maize yields by about 200 kilograms per hectare (IFPRI, 2020).

2.5.2 Ethiopian Productive Safety Net Program

Prior to 2005, the needs of both acute and chronically food insecure people were met through emergency appeals, even though the shortfalls faced by the latter group are structural in nature and not necessarily related to short-term events such as drought (WFP, 2019; GoE, 2018). While the emergency assistance succeeded in saving many lives by meeting the short-term food consumption needs of the chronically food insecure, it was unpredictable for both planners and households, often arriving late relative to the need (IFPRI, 2021; MOA, 2020**)**. The delayed and uncertain aid did little to address the underlying causes of food insecurity, had minimal impact on protecting livelihoods, preventing environmental degradation, generating community assets, or preserving household assets. As a result, household-level food insecurity remained both widespread and chronic in Ethiopia (World Bank, 2022; EDRI, 2020).

In 2005, the Government of Ethiopia with the support from Development Partners, designed and implemented Productive Safety Net Program (PSNP) as well as complementary programming to strengthen local livelihoods (Dejene and Cochrane, 2022; Amede, 2020; Kassa, 2018). Launched in 2005, the program has grown from 4.5 million to around 7.6 million beneficiaries in 2012, or eight percent of Ethiopia's population; there are plans to reach 8.3 million people by 2015. The PSNP is managed by the GoE and is largely donor-funded, with the government's contribution mainly in the

form of civil servant costs. In line to this, ten development partners have committed approximately about US$ 2.3 billion for implementation third phase of PSNP that extends from 2011-2015 (MOA, 2020; Hailu and Amare ZY, 2022).

The PSNP 4 operates from 2016-2020 and is characterized by scaling up systematically to before programme implementation begins. The scaling up of the programme will build on the residual caseload of existing areas and new Woredas experiencing the greatest vulnerability in the existing programme regions. Eventually the PSNP 4 cover all regions except Gambella and Benishangul Gumuz and become a national programme. The estimated maximum annual programme caseload during PSNP4 was 10 million clients, consisting of 8.3 million chronic food insecure clients and additional 1.7 million to include the transitory clients if need exists (Berhane, G. *et al.* (2020-2023); Messay Mulugeta *et al.,* 2019).

PSNP5 has evolved through several phases, and the program will witness the significant expansion and some important improvements in its design and implementation over the years. Building on the lessons learned from PSNP4 (2015–2020) and the historical evolution of the program, PSNP5 will continue to focus on building resilience of the extreme poor and vulnerable people. The cornerstone of PSNP5's strategy is a strong emphasis on system building, modernization, and transparent accountable structures (Berhane, G. *et al.,* 2022; World Bank, 2020).

2.6 Food and Nutrition Security Indicators

There are numerous indicators of food and nutrition security, globally, nationally, at household and individual level. Each indicator reflects a specific aspect of food and nutrition security indicators (FNS) and thus will only be relevant for certain situations. FAO *et al.,* (2022) mentioned that the FNS concept is elusive which explains a single indicator cannot summarize the complexity of FNS. Thus, a set of indicators must be built to capture all the dimensions of FNS. The food security indicators that can be discussed in this study are very relevant such as FAO Indicator of Undernourishment (FAOIU), Global Food Security Index (GFSI), Poverty and Hunger Index (PHI), Anthropometric indicators (AI) and Diet Diversity Score (DDS) (Iversen, *et al.,* 2023; Kini, 2022; Gantina *et al.,* 2020).

2.6.1 The FAO Indicator of Undernourishment (FAOIU)

FAO (2022) provides an indicator of undernourishment for most of the countries and considers mean dietary energy supply as a proxy for food energy consumption. The FAO (2021) indicator comprises three parameters namely the mean quantity of calories available for human consumption, the inequality in access to those calories among the population, and the mean minimum amount of calories required by the population (J Kini, 2022; FAO and WHO, 2022; Smith *et al.*, 2022; FAO and WHO, 2019).

2.6.2 The Global Food Security Index (GFSI)

The GFSI is published by the Economist Intelligence Unit and attempts to measure the risks of food insecurity, particularly following the food uprisings of 2008 and 2011. GFSI provides ranking of food security for 105 countries including high- and low-income countries. The index is based on a consistent framework that assesses food security across the three dimensions: affordability, availability, and utilization. The calorie intake can even in the time of crisis, remain unchanged or even increases (GFSI 2023; EIU, 2022). However, the problem is that the households shift their consumption to cheaper calorie sources (FAO, 2020). The direct consequence is severe decrease in micronutrient intake which leading to children and maternal nutrient deficiency (Kini, 2022; Kummu *et al.*, 2022; EIU, 2021).

2.6.3 The Poverty and Hunger Index (PHI)

This is a multidimensional indicator of poverty and hunger which is linked with the MDGs indicators. The PHI is developed as one of the instruments in monitoring the achievement of MDGs. The proportion of the population living on less than a dollar per day, the poverty gap, the share of the poorest quintile in national income or consumption, the prevalence of children underweights, and the proportion of undernourished population calculated by the FAO are among the indicators used (Minjauw, *et al.*, 2024; Kini, 2022; World Bank Group, 2021; Von Grebmer *et al.*, 2020; Alkire *et al.*, 2019).

2.6.4 Anthropometric Indicators (AI)

The anthropometric indicators such as stunting (low height-for-age), underweight (low weight-for-age), and wasting (low weight-for-height) measure nutritional outcomes at the individual level. The

nutritional outcome is influenced by aspects beyond the availability and accessibility to food that means the prerequisites for nutrition security such as the interactions between food losses, intra-household food distribution, individual health and activity levels, and environmental quality. Unlike generic indices, anthropometric indicators directly measure the point of policy interest as they reflect under nutrition and how it might affect health and well-being pointed out the advantage of anthropometric indicators that they directly reflect the imbalances between energy intakes and expenditures (Arimond, and Ruel, 2020).

2.6.5 Diet Diversity Scores (DDS)

Dietary diversity represents the number of different foods or food groups consumed over a given reference period. There are many diet diversity scores in the literature, with different purpose (measuring individual diet quality versus household food access, for example with different number and definition of food groups, unit of analysis (individual or household), reference periods, etc (WHO *et al.,* 2020; Galasso *et al.,* 2020; Mallard *et al.,* 2018; Arimond *et al.,* 2017; Jones, 2017; Habte and Krawinkel, 2016).

2.7 Impact Evaluation Methods

To know the effect of a program on a participant, the researcher must compare the observed outcomes with the outcomes that would have been resulted if individuals are not participated in the program. However, as stated earlier, two outcomes cannot be observed for the same individual. In other words, only the factual outcome can be observed. Thus, the fundamental problem in any social program evaluation is the missing data problem (Banerjee *et al.,* 2017).

Estimating the impact of a program requires separating its effect from intervening factors which may be correlated with the outcomes, but not caused by the project. There are two groups namely, control and treatment. The control group is a group of individuals or households who do not receive the intervention, but have similar characteristics as those receiving the intervention, the treatment groups. Identifying these groups correctly is a key to identifying what would have occurred in the absence of the intervention. In theory, evaluators could follow three main methods in establishing control and treatment groups: randomization/pure experimental design; non-experimental design and quasi-experimental design. In practice, the choice of a particular approach depends, among other things, on data availability, cost, and ethics to experiment. In what follows, brief descriptions

of the main impact evaluation methods mentioned above (Athey and Imbens, 2017; Duflo *et al.,* 2019; Carson *et al.,* 2022).

2.7.1 Experimental (Randomized) Methods:

In a randomized experiment, the treatment and control samples are randomly drawn from the same population. In other words, in a randomized experiment, individuals are randomly placed into two groups, namely, those that receive the program or intervention and those that do not. This allows the researcher to determine program impact by comparing means of outcome variable for the two groups (Carson *et al.,* 2022; Duflo *et al.,* 2019). The main advantage of a randomized experiment is its ability to avoid the problem of selection bias, which arises when participation in the program by individuals is related to their unobservable or unmeasured characteristics. However, the researcher will not apply this method because the participants were not targeted through randomization but deliberately based on their wealth and household food security status (Koning *et al.,* 2019).

2.7.2 Quasi-Experimental (Non-Experimental) Method

According to Greene *et al.* (2021), non-experimental approaches to impact evaluation can be broadly categorized into before-and-after estimators and cross-sectional estimators. The **before-and-after estimator** compares the outcome variable of interest for a group of individuals after participating in a program with the outcome of the same variable for the same group or a broadly equivalent group before participating in the program. The difference between the two outcomes is then considered the estimated average treatment effect on the treated.

Cross-sectional estimators use non-participants to derive the counterfactual for participants, making them quasi-experimental methods. Since the treatment and comparison groups are typically selected after the intervention using non-random methods, statistical controls are necessary to address differences between the groups. Additionally, sophisticated matching techniques should be used to construct a comparison group that closely resembles the treatment group (Gilligan *et al.,* 2023).

2.7.3 Quasi-Experimental Method

Quasi-experimental design involves the matching of program participants with a comparable group of individuals who do not participate in the program. This simulates randomization but need not take place prior to the intervention (Kerr *et al.,* 2023). A quasi-experimental method is the only alternative when neither a baseline survey nor randomizations are not feasible options. The quasi-experimental method consists of constructed (matched) control where individuals to whom the intervention is applied would be matched with an "equivalent" group from whom the intervention is withheld. The study will use this method as there is no base line data and as the program placement is not random (Jalan and Ravallion, 2023).

Quasi-experimental design has advantages in that it can draw on existing data sources; it is quicker and cheaper to implement; and it can be performed after a program has been implemented if sufficient data exist. However, it has some limitations, too. First, the reliability of the results is often reduced, as the methodology is less robust statistically. Second, the methods can be statistically complex. Finally, there is a problem of selection bias that yields inaccurate results (Baker, 2023). These limitations impose methodological challenge in non-experimental evaluation methods and hence affect the reliability of results when generating a comparison groups (Thomas, L., 2024). To avoid or reduce these problems, different econometric approaches have been developed of which some are discussed as follows:

2.7.4 Double Difference or Difference-In-Differences (DID) Methods:

This method enables the evaluators 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. The identified participants who do not actually participate in the project form the counterfactual. Besides, the 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 both treatment and comparison group at the end of the program relative to the difference in indicators at the commencement (Heckman and Vytlacil, 2018).

2.7.5 Propensity Score Matching (PSM)

Propensity Score Matching (PSM) aims to find a comparison group similar to the treatment group except for their exclusion from the program. This method is beneficial for evaluators facing time

constraints and lacking baseline data but utilizing a single cross-sectional dataset (Rosenbaum and Rubin, 2018). However, defining "similarity" poses a challenge in practice, as matching may involve multiple characteristics without clear guidelines on the level of similarity required (Bernard *et al.,* 2020).

The method of PSM balances the observed covariates between a participant and a control (comparison) group based on the similarity of their predicted probabilities of receiving the treatment (propensity scores) and can justifiably claim to be the observational analog of a randomized experiment (Rosenbaum and Rubin, 2018).

The PSM summarizes the pretreatment characteristics of each subject into a single index variable and then uses the propensity score (PS) to match similar individuals. By doing this, it solves the difficulties of matching the treated and the control subjects when there is a multidimensional vector of characteristics. It forms the probability of assignment to treatment conditional on pretreatment variables (Rosenbaum and Rubin, 2018). The reliability of matching estimates is based on several factors. First, participants and control groups should have the same distribution of observed and unobserved characteristics. Second, the same questionnaire is administered to both groups. Third, treated and control groups should be selected from the same economic environment. Otherwise, the difference in mean impact of the two groups is a biased estimate of the mean impact of the program (Jalan and Ravallion, 2018).

Like other methods, the PSM also has its own limitations. First, PSM is non-parametric. Hence, any functional form assumptions regarding the average differences in the outcome are not made. Second, the PSM method cannot address the bias created by unobservable characteristics that might affect the outcomes (Ravallion, 2018). Third, PSM requires large amounts of data to maximize efficiency (Bernard et al., 2018). Finally, one cannot be entirely sure that he/she has included all relevant covariates in the first stage of the matching model and effectively satisfied the conditional independence assumption. Despite these limitations, PSM is the best method for impact evaluators with time constraints and working in the absence of baseline data in that it can be applied with a single cross-section data. Hence, this study will employ the PSM to assess the impact of the PSNP program on household food security for beneficiaries and non-beneficiaries.

2.8 Empirical Review of Literatures

2.8.1 Review of Determinants of PSNP Participation

Factors that affect household food security in various developing countries especially in Africa have been documented in some literatures and these factors or determinants are most often them not location-specific (i.e. different study areas were found to have variant attributes as food security determinants with some attributes recurring. For instance, some more recent studies (within the last 5-10 years) that have looked at determinants of household food security in developing countries, especially Africa, with some recurring factors included.

The study that conducted in Nigeria by 2020 using a logistic regression model found that household size, income level, crop production, livestock ownership, and access to credit had positive impacts on food security, while dependency ratio negatively impacted it (Omonona, B. T. *et al*., 2020). Again a 2019 study conducted in Tanzania using a probit model found that education level of household head, farm size, livestock ownership, non-farm income, and access to extension services increased food security, while large family size and distance to market decreased it (Mwakaje, A. G., 2019). A 2021 study in Malawi found that farm size, income diversification, livestock ownership, and access to extension services increased food security, while large family size, low education levels, and distance to markets decreased it (Mwale, M and Baulch, B, 2021).

A 2018 study in Ethiopia found that household size, livestock ownership, income diversification, off-farm income, credit access, and distance to market were positively associated with food security, while dependency ratio was negatively associated (Teklewold, H. *et al.*, 2018). Similarly some more recent studies from 2020 -2023 that looked at specific factors affecting household food security were conducted in Jigjiga Woreda of Ethiopia are summarized as follows: -

A study from 2020 found that use of fertilizer, total household income, access to veterinary services and extension services had a positive impact on food security, while the agro-ecology stratum had a negative impact. Improved seed use and adult equivalent had negative effects on calorie intake, while land size and livestock numbers positively affected calorie intake (Gebregziabher, *et al.*, 2020). A 2021 study using a logistic regression model found that farm size, livestock ownership, off-farm income, credit access, and distance to water sources increased food security, while dependency ratio and distance to markets decreased it. Fertilizer and improved seed use had no significant impacts (Tadesse, and Shiferaw, 2021).

Again A 2022 study examining factors influencing calorie intake specifically found that land size, livestock ownership, and use of extension services positively influenced calorie availability, while family size and distance to markets reduced it. Fertilizer and improved seed use showed no significant effects (Melese, *et al.,* 2022). Lastly, a study conducted by Gebregziabher, *et al.* (2023) using a probit model confirmed that total income, livestock ownership, access to credit and extension services increased food security levels, while dependency ratio and distance to markets decreased it. Fertilizer and improved seed use were not found to be significant factors.

Here is a study from 2022 that uses propensity score matching and logistic regression to analyze determinants of participation in Ethiopia's Productive Safety Net Program (PSNP) (Tsegaye, D. et al., 2022). This study used logistic regression to estimate propensity scores and match PSNP participant and non-participant households based on observed characteristics. Variables in the logistic regression included demographic characteristics, asset ownership, land size, livestock holdings, credit access, distance to market, etc. After matching, there were no statistically significant differences in covariates between the two groups, indicating balanced matching. The pseudo R2 was low. The matching procedure identified the key determinants of PSNP participation as land size, livestock holdings, education, dependency ratio, credit access, and distance to market. A difference-in-differences approach was then used to estimate program impact on food security outcomes like calorie availability. This study provides a good recent example (2022) of using propensity score matching via logistic regression to identify determinants of participation in Ethiopia's major social safety net program and estimate its impact while controlling for selection bias.

2.8.2 Food Security Indicators and Measurements

The estimation of household food security levels can be done in several ways. But there isn't a single strategy that is agreed by everyone as a benchmark for assessing food security. High food costs, high rates of malnutrition, high rates of maternal death, high levels of vulnerability, and high rates of poverty can all be used to characterize the level of household food insecurity worldwide. Vulnerability, for those concerned with food security, is the probability of an acute decline in food access or consumption due to hazards in the physical or social environment. Typical hazards include weather disturbances, such as drought or man-made disturbances, such as civil war or extreme price fluctuations (De Haen, and Hemrich, 2018; Barrett, and Constas, 2020;). Indicators are constructed from a set of observations or measurements of food security related conditions,

which are classified according to a given set of criteria. A sound indicator needs to be relevant, low cost, time sensitive and adaptable across locations (FAO *et al.,* 2020).

According to FAO (2022 and 2013) citing Franken Berger (1992), the different types of indicators are classified into two broad categories: process and outcome indicators. The process indicators provide an estimate of food supply and food access situation, whereas an outcome indicator serves as proxies for food consumption. FAO *et al*. (2022) describes that the frequently available and utilized indicators which potentially measure food security as: nutritional status, actual food consumption at the household level by a 24-hour recall, coping strategies index, as well as proxy indicators such as calorie intake, household income, productive assets, food shortage, under 5 nutritional status, dietary diversity, and household food insecurity access scale. Although these indicators reasonably capture and designate a small portion of the problem, they do not provide a comprehensive picture (Martin-Prével *et al.,* 2020). There are four measures of household and individual food security: individual intakes, household caloric acquisition, dietary diversity, and coping indices (Wiesmann *et al.,* 2020).

2.8.3 Empirical Review of Ethiopian Food Security

A wide range of empirical studies are available in the areas of food security. However, few of the previous study in Ethiopia have been applied propensity score matching method (PSM) for social program evaluation. More recent Ethiopian studies from the past 5 years have increasingly applied PSM and other matching methods to rigorously evaluate various programs' impacts on household food security outcomes. For instance, Gebrehiwot *et al.* (2022) conduct study on the impact of agricultural extension package program on smallholder farmers' food security and extension services increased crop productivity, income, and food security from 2018-2020; Abera *et al.* (2020) assess the impact of productive safety net program on household food security and find that Ethiopia's PSNP increased food consumption and reduced food insecurity compared to non-participants and Mekonnen *et al.* (2018) also Studied various technologies' impact on food insecurity founds a significant positive effects by applying a propensity score matching technique. Thus, the study found that the program has increased participating households' calorie intake by 30% (i.e., 698 calories) compared to that of non-participants.

Daily caloric intake per adult equivalent that calculates all food items consumed by the households in the past 24 hours and then divided to all household members adult equivalent. The medically

recommended levels of calories per adult equivalent that used to determine the calorie demand for each household (2200 kcal per day) (FAO and FHI 360, 2018; EPHI, 2022 and 2020; FAO, 2020 and WHO, 2021). WHO (2021); CSA and ICF (2021) and FAO (2020) expressed that the minimum energy demand of 2200 Kcal per day per person enables an adult to lead a healthy and moderately active life. The result of the study by Taffesse, A. *et al.* (2018) showed that the mean daily caloric intake per adult equivalent for PSNP participants and non-participants households was 2620 Kcal and 1884 Kcal respectively. The study conducted by Abera, M. *et al.* (2020) results also showed that a statistically significant difference of 736 kcal/day between PSNP participants and non-participants at $p<0.01$ level.

Similarly, the program helped the households in the study areas to fulfil their consumption needs in different ways like increasing the number of dining times and the amount of meal at each dining time. Considering the overall livelihood effect of PSNP, the majority (44.4%) of respondents stated that the livelihood situations of the household are a little bit better (Tassew, W. and O'Donnell, O., 2021; Zerhun, 2020). In another case, the study which was done by Abera, B. *et al.* (2020 and 2019) and on the asset accumulation showed that there were statistically significant differences between PSNP participants and non-participants which favored positive impact on livelihoods. Likewise, the study conducted by Berhane, G.et al.(2018) in Adami Tulu Jido kombolcha of Ethiopia also found statistically significant differences in assets like livestock favoring PSNP participants and confirmed that the impact of productive safety net programs on asset accumulation found to be positive.

2.8.4 Empirical review of impacts of PSNP

According to Khandker, S.R. and Samad, H.A. (2018) impact evaluation is the act of studying whether the changes in well-being are indeed due to the intervention and not to other factors. Additionally, Abera, B. *et al.* (2019) and Berhane, G. *et al.* (2018) evaluated the impacts of the Ethiopian Productive Safety Net Program (PSNP) on rural households' holdings of livestock found increased livestock holdings among PSNP participants using panel data, applied both regression analysis and propensity score matching. The study found by Abdulhafiz Muhammed (2021) and Abera, M. *et al.* (2021) no indication that participation in PSNP induces 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.

Similarly, for previous Aman (2013) findings on TLU changes; Abera B. *et al.* (2019) analyzed panel data from 2011-2015 and found statistically significant increases in average TLU holdings for PSNP participant households compared to non-participants. This confirms the positive livestock accumulation impact observed by Abera M. *et al.* (2021) also reported increased livestock holdings among PSNP participants using national panel data from 2011-2018. They found the program led to higher livestock accumulation compared to non-participants. For greater increment in TLU for beneficiaries: Berhane G. et al. (2018) analyzed national panel data and observed statistically larger increases in average livestock ownership (measured in tropical livestock units) for PSNP participant households compared to non-participants. Again Tassew and O'Donnell (2021) found the public works component of PSNP, which reaches more households, had a larger positive impact on livestock accumulation than direct support. For decreasing difference in TLU between groups; Abera B. *et al.* (2020) replicated earlier studies finding reduced livestock ownership differences between participants and non-participants in one district, showing PSNP helped reduce the asset gap over time. In General, the updated studies provide broader evidence from national panel data confirming PSNP contributed to greater livestock gains for beneficiaries, helping narrow the asset gap compared to non-beneficiaries.

The comparison between beneficiary and non-beneficiary households revealed a significant increase in asset values for PSNP participants, with Abera *et al.* (2019) and Berhane *et al.* (2018) confirming these findings through their analyses of panel data. Additionally, Tassew and O'Donnell (2021) highlighted the higher accumulation of assets, such as livestock, among PSNP households. Zerihun (2020) emphasized a substantial difference in mean annual income, favoring PSNP beneficiaries, further supported by Abera *et al.* (2021) and Tassew and O'Donnell (2021) showcasing increased household income and consumption expenditures for PSNP participants based on national panel data. These updated studies consistently demonstrate the positive impact of PSNP on asset and income gains for beneficiary households compared to non-beneficiaries across various time periods and large-scale national datasets.

2.9 Conceptual Framework

As presented in the Figure1 below, the researcher developed the conceptual framework of study by modifying from Welteji *et al.* (2017). Different factors such as households' demographic, socio-economic, institutional, and environmental factors will determine the household's participation for PSNP and food security status. To reverse the food insecurity situation of households, GoE of Ethiopia with joint support of development partners implemented PSNP for the last 15 years. The

PSNP can support household food security during the hunger period for its beneficiaries. Additionally, the program helps the food-insecure households to withstand with stresses and shocks, accumulate asset for HHs that eventually make the households food self-sufficient. The PSNP transfers food, cash or both based on the actual need and season for its permanent direct support and public works core beneficiaries. The program also provides credit and technical support to households based on tailored business plans to stabilize their incomes. Besides, the PSNP has a multiplier development effects through the participation of able-bodied individuals in different development activities like soil and water resources rehabilitation and developing of the community infrastructures such as rural road, schools, and clinics (FAO, IFAD, and WFP, 2018). In addition to the regular transfer provision, PSNP can also be expanded to respond to any possibility of climate related shocks like drought, flooding, erosion and pest infestation through its contingency resources.

In doing so, researchers apply a propensity score matching approach that aims to compare only households with shared support and exclude other households from the analysis. Unlike econometric regression techniques, PSM does not rely on parametric assumptions to compare observations and identify project effects. According to World Bank (2024) and FAO of UN (2022), it makes an effort to calculate the average treatment effect on treatment/ATT. Therefore, the researchers decided to measure the FCS, the diet score, and the food security status of the households participating in the program by comparing them with those of non-participating people.

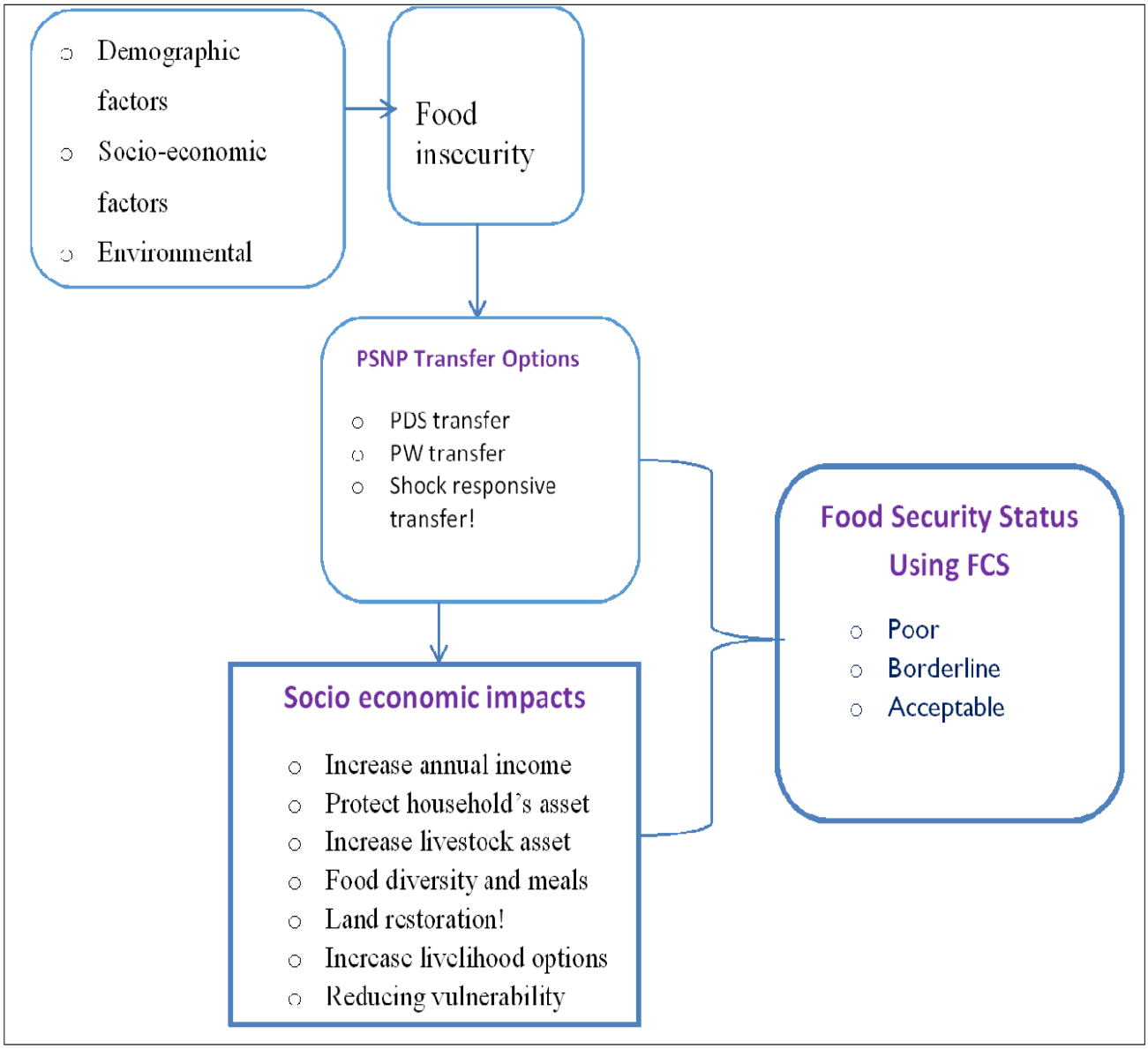

Figure 1 Conceptual framework adapted from (Diriba, 2017).

3 METHOujmDOLOGY

3.1. Description of the Study Area

3.1.1 Location and size

Chiro district is one of the 15 Woredas of West Hararghe Zone of Oromia Regional State and is found 325 km from Addis Ababa. Chiro is the capital town for both Chiro district and West Hararghe Zone. Chiro woreda is located between $8^0$55'47" N - $9^0$13'10"N latitude and $40^0$36'45"E - $41^0$00'36" E longitude (Fig.2). The district is bordered in the south by Gemechis woreda, in the west by Guba Koricha woreda, in the northwest by Miesso woreda, in the north by Doba woreda, in the

northeast by Tulo woreda, and in the east Galetti River separates it from Mesela woreda and the East Hararghe Zone. The total area of the woreda is about 68,314.73 Ha(Chiro Woreda Land Administration Office, 2024).

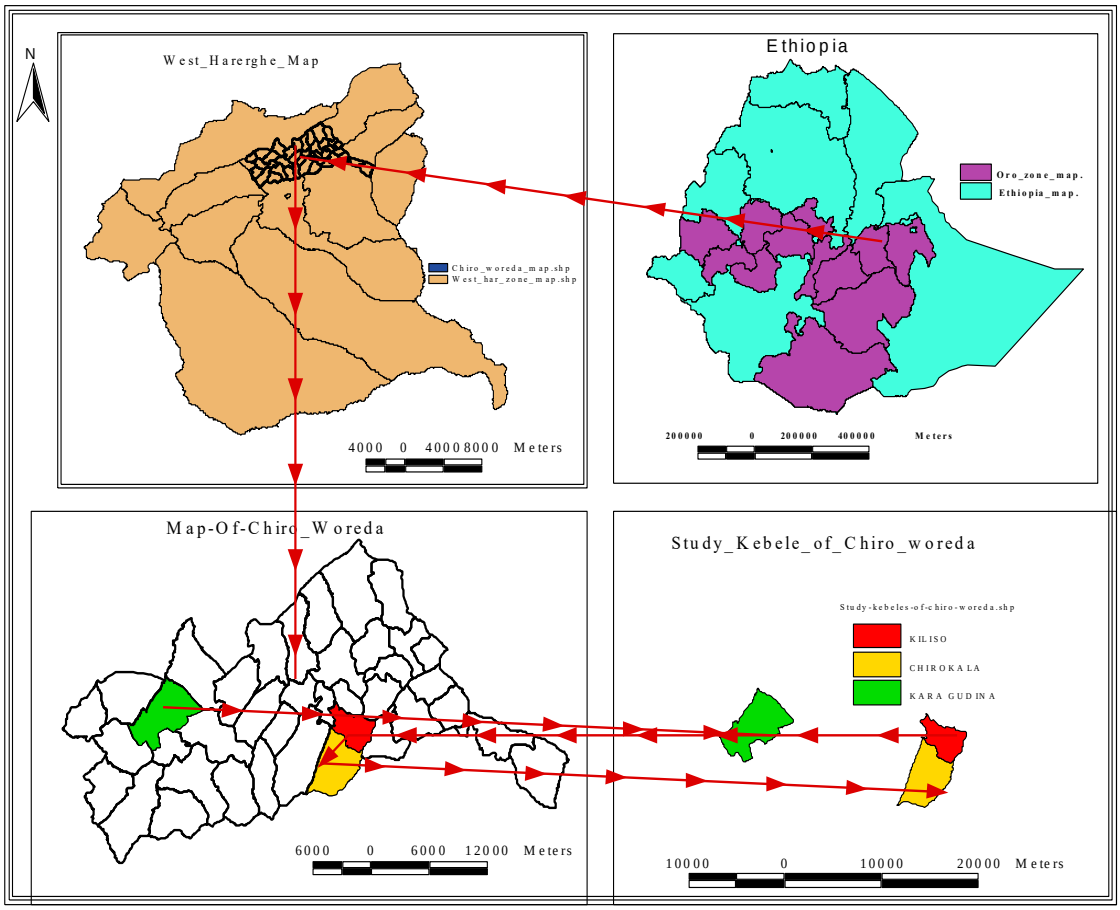

Figure 2 Map of the study area. (Source: GIS based own construction, 2024)

Based on the 2019 census conducted by the Central Statistical Agency of Ethiopia (CSA), the total population of Chiro woreda is estimated to be around 189,510 in 2018, of which male accounts for 97,029 (51.2%) and female 92,481 (48.8%). The district has 39 administrative kebeles. The percentage of dependent people for less than 15 years of age accounts for 49.6% and greater than 64 years accounts for 3.3%. Currently, the population density is approximately 259 people per one km^2. Most of the district population is Muslim in religion (83.68%), Christianity is (15.4%), and the remaining (0.92%) is protestant (CSA, 2016).

3.1.2 Topography and Soil

Chiro district is characterized by undulating topography, steeply mountainous with low vegetation cover, and sparsely vegetated landscapes. The altitude of the district is between 1500 – 2500 m

above sea level. About 45% of the woreda land is plain and 55% is a steep slope. The woreda is highly vulnerable to soil erosion hazards. The woreda soil condition is characterized by sandy soil (25.5%, clay soil (32%) and loamy soil (42.5). The soil types vary with topography. Mostly black soils are observed in the highland and midland whereas one can see the red soil in the lowland (Chiro Woreda Agriculture and NR Office, 2020).

3.1.3 Climate

The climate of the woreda is characterized by rainfall variability and unpredictability with high temperature and the woreda classified into three agro-climatic zones. These are lowland (Kola), mid-land (Woyina Dega) and highland (Dega). Topographically Dega is the highland and temperate rainy climate comprises four kebeles accounts for 10% of the woreda. Woyina Dega is the midland and characterized by tropical rainy climate, consisting of 13 kebeles (34%) and Kola is lowland with tropical arid climate consisting of 22 kebeles (56%). The annual minimum and maximum temperature of the woreda lies between 27.5°C to 38.5°C. The annual rainfall across lowlands and highlands ranges from 600 mm to 1,000 mm respectively (Woreda Agricultural and Natural Resource Office, 2020).

3.1.4 Land Use Pattern

Chiro woreda is characterized by undulating topography, mountainous with low vegetation coverage, and sparsely scattered. The land cover of the woreda is highly depleted. The remnants of natural forests are found only in areas where access is impossible, and the terrain is rugged and steeply. The distribution of the woreda includes forestland (8104.313) Ha, terrain mountains (15731.42) Ha, arable land (31659.01) Ha grazing land (482) Ha and communal land like woodland, bush, and shrubs (14,986.09) Ha (Chiro woreda Agriculture and Natural Resource Office, 2020). The average land holding size of the farmers in the woreda is explained: 19% of farmers owns 0.25 Ha or less than, about 45.4% of farmers owns from 0.26 - 0.5 Ha, 28% owns from 0.51 - 1 Ha and 5.8% owns from 1 - 1.5 Ha (Oromia National Regional State Climate Resilience Green Economy, 2011).

3.1.5 Vegetation and Wildlife

Chiro woreda is characterized by undulating topography, mountainous with low vegetation coverage that is sparsely scattered. Natural forests are found mainly around inaccessible mountain

areas and steep topography. Common tree species that exist in the woreda include: Juniperus procera, Cordia Africana, Podocarpus falcatus, Olea Africana, Cupressus lusitanica, Eucalyptus species and Croton macrostachyus. The number and diversity of wildlife species in the study area is very low due to scant vegetation for sheltering and feeding availability. Only a few wild animals like hyena, fox and monkeys dwell the area (Chiro woreda Agriculture office, 2019).

3.1.6 Livelihoods System and Socio-Economic Condition

The livelihood of most of the people is established mainly on smallholding subsistence farming system. The main source of income for farmers is from rain fed crop production with small supplement of livestock production mainly cattle and shoats. The woreda is categorized into two main livelihoods zones: Sorghum, Maize, and Chat (SMC) and wheat, barley, and potato (ONRS, 2019). The rain fed crop production enables only one harvest once in year with likely of high-risk failures due to erratic and unreliable rainfall. In this regard, the woreda is known for its food insecurity and vulnerability to different shocks. Drought, pest infestation, soil erosion, flooding, animal forage scarcity, and lack of income diversity are the main threats to food security and sustainability for the people in the woreda. That means, chronic and transitory food insecurity of the woreda is driven by the complex interplay of economic, natural, health, and social factors. The main cereal crop growing in the woreda are maize, wheat, sorghum, barley, and haricot bean. Chat and haricot bean are mainly produced for market sale as cash crop while maize and sorghum for home consumption.

Safety nets are a component of social protection aimed at combating poverty and the risks of poverty. Social Safety Net is a program that provides predictable and reliable support in the form of food, cash, or vouchers to people at risk of poverty, poverty, food insecurity, or other forms of deprivation (WFP, 2017). According to the World Bank (2023), safety net programs, in the form of in-kind benefits, or in cash or vouchers, can be provided by the public sector (government, donors, NGOs) or private parties (individual or group charities, informal budget agreements).

3.1.7 Food Security of the Study area

Food security has been a major challenge in the study area for decades, primarily due to factors such as abject poverty, recurrent drought, floods, and soil erosion. To address this chronic issue, the government has implemented the Productive Safety Net Program (PSNP), targeting 29,668 vulnerable individuals across 39 kebeles. Of these, 23,152 participated in public work initiatives,

while 3516 received direct support. Additionally, the woreda targeted 25,652 individuals for unconditional emergency food aid (Chiro Woreda Agriculture and Natural Resource Office, 2022). These programs aim to mitigate food insecurity and poverty by providing support to vulnerable populations.

3.2 Research Design and Approach

During the present study, the researcher was applied a Quasi-Experimental survey design. It is an experimental design aim to measure the change(s) resulting from a development intervention like the impacts of PSNP implemented to intervene the food insecurity status of the households in the present study area, Chiro district. This is done by comparing the situation of a target population that received the development intervention with the situation of a similar group that did not and hence, the difference can then be attributed to the intervention. A target population can be comprised of any unit of analysis, such as people, households, communities or organizations. For the present study a target population was those that are beneficiary of PSNP in Chiro district of West Hararghe zone in general and of sampled kebeles in particular. Quasi-experimental survey design was used to collect quantitative data from PSNP beneficiaries or treatment group and non-beneficiaries or control group by focusing on their demographic, economic and institutional services. The qualitative data was also collected from stakeholders and narrated. To triangulate the information obtained from respondents, key informants' interview and focused group discussion were applied.

3.2.1 Data types and sources

This study was employed both primary and secondary data sources. Primary data was collected from sample beneficiaries and non-beneficiaries, key informants' interview was conducted at woreda level from three different office such as Woreda Agriculture and NR Office, Disaster Risk Management Office, and Woreda Labor and Social affair Office and focus group discussion was conducted. In general, collect the required primary data that guide discussion with the concerned bodies to obtain in-depth information about different issues related with the study objectives. Secondary data will be collected from concerned line offices like Woreda Agriculture and NR Office, Disaster Risk Management Office, and Woreda Labor and Social affair Office. Besides, these data will be collected from published and unpublished official statistics, articles, internet, reports, and other data available at libraries. Enumerators were trained on the subject matter of the questionnaires for facilitation of the data collection. Pre-test of the questionnaire was conducted before actual data collection is started through households identified for the purpose. The researcher

was used both primary and secondary data sources to evaluate the impacts of productive safety net programs on household food security.

3.2.2 Primary Data Sources

The researcher was used different data collection instruments such as household survey, key informant interview, focus group discussions and field observation to collect primary data from the sources. The first category of questionnaire will be the calorie intake from different food items for the last 24 hours. The second household questionnaire was included household demographics such as age, sex, labor capacity, parental status, and family size. Additionally, the questionnaire includes also socio-economic variables such as farmland, access to crop, educational status, food gap months and livelihood asset. Moreover, it included different institutional factors such as credit access, extension service, food security related training and marketing service and environmental factors like drought, flood, pest, and disease.

3.2.3 Secondary Data Sources

The researcher used secondary data sources such as both published and unpublished official statistics, articles, internet, approved reports from NGO agency, woreda and zonal government officials. These gave additional information to primary data to give accurate and quality supplementary information for research under investigation.

3.2.4 Sampling technique and Sample Size

To select the sample for this study, the researcher applied multi-stage sampling technique. At the first stage, Chiro woreda was taken from many districts in West Hararghe zone owning to the presence of PSNP intervention where the researcher was also a part of implementing bodies and well known with processes and challenges of its implementation. In the second stage, three Kebeles were selected from thirty-nine Kebeles of the Chiro woreda based on their participation in the PSNP programme. In the third stage, within three selected Kebeles, households were stratified into two strata (participant and non-participant of Productive Safety Net Programme), which is considered as sampling frame of the study. Finally, representative households were selected from three rural kebeles by using systematic random sampling technique considering size of residents in each kebele as a unit of analysis.

The total and target population of the woreda were 189,510 and 19,989, respectively. At the end, the researcher selected the lists of households for the study from three study kebeles based on their probability proportional to the size of the population by using systematic random sampling techniques. This study was used a simplified formula of Yamane (Yamane, 1967) as cited in (Yilma, 2005) to determine the required sample size with the confidence level of 95% and precision level of 5% as given in the following formula:

Equation 1

$$n = \frac{N}{1 + N\,(e^2)} = \frac{363}{1 + 363\,(0.05^2)} = \frac{363}{1 + 363\,(0.0025)} = \frac{363}{1.9075} = 190$$

Where n is the sample size, N is the population size and e is the level of precision. According to this formula, the sample size of the present survey was determined to be 190 households and was distributed in proportion to their actual population size to PSNP- participant (92 HHs) and the rest 98 to non-participant of the PSNP. Therefore, the survey was administered to 190 HHs sampled from PSNP beneficiary and non-beneficiary group (Table 1).

Table 1 . Total households' size and sample households' size in study kebeles

SN	Kebeles	Total PSNP HHs	Total non-PSNP HHs	Sample PSNP HHs	Sample Non-PSNP HHs	Total Sample HHs
1	Chiro Kela	58	70	38	36	74
2	Kiliso	41	59	32	36	68
3	Kara Gudina	60	75	22	26	48
Total		159	204	92	98	190

3.2.5 Data collection methods

Relevant data from primary and secondary sources were produced by the study. Data was gathered from sample respondents via questionnaires as the primary source. The questionnaire was designed to generate the data that could help to measure the objectives of this study. Before the collection of actual data, the questionnaire was pretested. In addition to questionnaire, Key Informants (KIs) interviews was used to the interview framework to gather the necessary primary data through direct discussions with the relevant parties to get in-depth information about various issues linked to the study objectives and used to triangulate the data from questionnaires. Regarding secondary sources,

data was collected from review of different documents including research works, books, office documents, journal articles written by different scholars on the related issues.

Questionnaires: Before the collection of actual data, the prepared questionnaire was pretested on a small sample of 15 household respondents that were not part of the main study but who were socioeconomically and demographically similar to those in the actual study population. The selection criteria included household characteristics like family size, socioeconomic status, and engagement in relevant livelihood activities. This diverse selection allowed us to assess the clarity and relevance of the questions across different household types. During the pretest, feedback was gathered through both verbal discussions and follow-up questionnaires. Respondents were encouraged to identify any unclear questions, suggest additional topics, or point out questions they found irrelevant. Based on this feedback, some adjustments like simplifying complex questions (to enhance clarity), rephrasing certain questions (to better align with local terminology and practices) and adding a few open-ended questions (to allow respondents to express opinions that weren't covered by closed-ended options) were made. These modifications were made to enhance the clarity, relevance, and flow of the questions, as well as the time required to complete the survey and thereby to ensure that the final questionnaire was comprehensible, culturally acceptable, and effective in gathering the intended data. After these all, training was given to enumerators by discussing every question raised in questionnaire that helped us while employing to households to gather the data as intended by the researcher to measure indicators selected to evaluate the impacts of the PSNP on participant households compared to non-participant households of Chiro district, West Hararghe zone.

Data collection was carried out from the selected sample households in the study areas using trained data collectors under close supervision of researcher. The general form of the questions was structured, and the type of questions having both open-ended and closed-ended. The household survey focuses on household characteristics (family size, age, sex, education, and marital status), livelihood activities, farm and non-farm income and other socioeconomic factors. Livelihood options such as On-farm activities (Off-farm activities, Non-farm activities etc.), Off-farm activities (Trading of livestock shoat, ox, poultry, egg and camels, trade of food grain, chat trade, Rental of farmland, etc.) and Non-farm activities (Petty trade like oil, sugar, shopping, local beer, soft drinks, hair braiding, hand crafting, mining activities, etc.). Further, data on sources of income (Non-farm, Off-farm, On-farm, Remittances, etc.), Food Security status variables (Number of meals per day, dietary diversity) and annual income level were collected among the two groups of respondents.

Key Informant Interviews: The respondents of KIs interview were selected purposively based on the position and the relevance of their expertise in the field and knowledgeable about the PSNP. The selection of the key informants was based on both their professional roles within the relevant organizations and their demonstrated experience with the Productive Safety Net Program (PSNP). Apart from their positions, their length of service, involvement in the program, and previous contributions to relevant research and policy discussions were considered. Accordingly, an in-depth interview was held with 6 key informants (KI) from woreda Agricultural and Natural Resource Office, Disaster Risk Management and Labor and Social Affair Office as these institutions are directly involved in the implementation and monitoring of the PSNP.

The interviews followed a semi-structured format, allowing for a guided conversation while also permitting flexibility to explore topics in greater depth as they arose (Annex 2). This format fostered a rich exchange of insights and enabled me to draw on KIs' expertise, leading to nuanced understandings of the issues surrounding the PSNP. During the interviews, detailed notes were taken, and, with permission, the conversations were recorded to ensure accurate data capture and later analysis.

Focus Group Discussions: A focus group discussion was held with 6 groups having eight to ten members in each group based on their participation in the program i.e. the participants were purposively selected to ensure a balanced representation of PSNP beneficiaries and non-beneficiaries, as well as a mix of gender, age, and livelihood activities. The aim of employing FGD is to crosscheck and supplement the information gathered through other data collection techniques and to triangulate with the results of other data. This diversity of perspectives allowed me to gain a comprehensive understanding of the program's impacts, and the challenges faced by different segments of the community.

3.2.6 Methods of Data Analysis and Presentation

Data processing is critical part of the research operation including editing, coding, data entry, data cleaning and consistency checking, and all activities were undertaken by the researcher. After the data cleaned, information was coded, arranged into group variables, summarized, and tabulated for interpretation and analysis. The data is coded was entered in statistical software called Statistical Package for Social Sciences (SPSS) version 20 and STATA version 13 for analysis. Both descriptive and econometrics model of propensity score matching (PSM) was applied to analyze the

data. This study was also used some qualitative approaches to complement the quantitative analysis, such as Key informant interviews (Interviews with program officials, community leaders, or other stakeholders to gain in-depth understanding of the PSNP implementation and challenges) (Assefa, et al., 2021) and Focus group discussions (Discussions with beneficiary and non-beneficiary households to explore their perspectives on the PSNP and its impacts on food security) (Daba, et al.., 2020). Further, secondary data analysis and comparison was made using percentage for quantitative data to interpret problems associated with implementation of the PSNP project in Chiro district as stated in the first objective. This method used since it yields diverse perspectives and collective insights on the effects of PSNP on food security, allowing researchers to understand communal attitudes and shared experiences. Finally, to measure determinants of participation for PSNP among beneficiaries and non-beneficiaries (fourth objective), the researcher used binary logistic regression model.

3.2.7 Descriptive and inferential statistics

Descriptive statistics such as mean, standard deviation, and percentages were used to describe and interpret the results of socio-economic and demographic variables, institutional and environmental variables among beneficiaries and non-beneficiaries. T-test and chi-square tests were used to analyze the significance level of independent variables (t-test for independent continuous variables and chi-square for categorical independent variables). Further inferential statistics; chi square, was used to see the difference between PSNP participant and non-participant households across discrete explanatory variables of the study. During the present study the researcher used these inferential statistics to compare level of significance of the difference in socio-economic indicators between the sample households from PSNP participants and non-participants as stated in the second objective of this study.

3.2.8 Food Consumption Score (FCS)

Beside these, descriptive statistics was also used to compare the two groups of respondents (PSNP participant and non-participant) on the base of Food Consumption Score (FCS). The World Food Programme (WFP) developed the Food Consumption Score (FCS) index in 1996 according to the relative nutritional value of the food groups consumed (P´erez-Escamilla et al., 2017). To measure the food security level of the household that stated in the third objective of the study, the researcher was applied both per capita food consumption score and number of dining times. FCS weights household data on the variety and frequency of food groups

consumed over the course of the previous seven days (HDDS, INDDEX Project, 2019). The FCS captures the diet diversity and the frequency of foods. It was calculated by interviewing individuals to determine how many days in the previous seven days the household consumed any of the predefined food groups (FAO, 2020). To know the food consumption level of household members from all sources of 33 different food items in the last seven days prior to the interview was estimated and compared with fixed food consumption score as poor, borderline and acceptable. Also, the dietary food score /number of dining times for beneficiaries and non-beneficiaries was estimated from responses. In this study, FCS analysis was carried using number of meals/day and dietary diversity and the result was utilized to interpret the impacts of PSNP on HHs food security.Food groups include starches, pulses, vegetables, fruits, meat, dairy, fats, and sugar. When these groups are polled separately, the consumption frequencies of the various foods consumed by each group are added together, with a maximum value of 7 set for each group (Annex: I). Based on these weights, the formula is as follows: FCS = (starches ×2) + (pulses × 3) + vegetables + fruit + (meat × 4) + (dairy × 4) + (fats× 0.5) + (sugar × 0.5) (WFP, 2015). After calculating the food consumption score, The food consumption score of 35% was used as a reference point, along with the mean food consumption details provided in Annex 1 to group them in to Poor (0-21%), Borderline (21.5-35%) and Acceptable (> 35%) status in terms of food security status. Further, the impacts of PSNP on food security of the beneficiary household respondents was also done using propensity score matching (PSM) technique, which is a widely applied impact evaluation instrument in the absence of baseline survey data for impact evaluation.

3.2.9 Econometric model

The impact of PSNP on food security was measured if there may be any difference in households with the program and without the program. However, households participating in the program could not be simultaneously observed in two states, but it must be in the program or outside the program. Thus, this study was applied a propensity score matching (PSM) technique, which is a widely applied impact evaluation instrument in the absence of baseline survey data for impact evaluation. The PSM technique enables us to extract from the sample of non-participating households a set of matching households that look like the participating households in all relevant pre-intervention characteristics. In other words, PSM matches each participant household with a non-participant household that is (almost) the same likelihood of participating into the program.

Logit model: The researcher was applied the logit model as one of the econometric models to analyze the impacts of PSNP for different outcome variables. In this case, the dependent variable is participation in the program, which takes a value of 1 if the household participated in a program and 0 otherwise (Gujarati, 2004). Thus, mathematically the logit model is presented as follow:

$$p_i = \frac{e^{z_i}}{1+z_i} \quad 1 - p_i = \frac{1}{1+ez_i}$$ Where, pi is the probability of participation in PSNP

Whereas 1-pi= the probability of non-participation in the productive safety net program. Where: Pi is the probability of using PSNP and e represents the base of natural logarithm (2.718) and Z_i is the function of explanatory variables (x).

Average treatment on treated: In this study the researcher attempted to estimate the average impact of treatment on treated (ATT). In this case "treatment" implies participation in the productive safety net program, and impact was measured for the change in food security.

While control stands for non-treated households, treated used for PSNP households and compared. According to Imai, and Ratkovic, (2014), there are about five steps in applying the PSM. These are estimation of the propensity scores, choosing a matching algorism, checking on common support condition and testing the matching quality.

Estimation of the propensity scores: According to Caliendo and Kopeinig (2008), there are different matching criteria that can be used to assign participants to non-participants based on the propensity score by calculating a weight for each matched participant and non-participant. The most applied matching estimators are Nearest Neighbor Matching, Caliper and Radius Matching, Stratification and Interval Matching, Kernel and Local Linear Matching. Therefore, one of the matching algorithms among matching estimators was selected for high matching sample size, low psedoR2 value and high matching balance (Dehejia and Wahba, 2002) as cited in (Aman, 2013).

Region of Common Support condition: The common support region is the area which contains the minimum and maximum propensity scores of treatments and control group households, respectively. It requires deleting of all observations whose propensity scores is smaller than the minimum and larger than the maximum of treatment and control, respectively (Caliendo and Kopeinig, 2005).

Conditional Independence Assumption (CIA): This assumption implies that the selection is solely based on observable characteristics and variables that influence treatment assignment and potential outcomes are simultaneously observed (Caliendo and Kopeinig, 2005). This assumption implies that the selection is solely based on observable characteristics and variables that influence treatment assignment and potential outcomes are simultaneously observed (Caliendo and Kopeinig, 2005).

Binary logistic regression model: binary logistic regression model is useful for situations in which one want to predict the presence or absence of a characteristic or outcome based on values of a set of predictor variables. In this research, the binary logistic regression model was utilized to ascertain the determinants affecting household participation in the program. Thus, existence of severe multi-collinearity problem between continuous and discrete explanatory variables was checked by using techniques like Variance inflation factor (VIF) and Tolerance (T). Because this could help to omit the important variables that otherwise increased the bias in the resulting estimators (Heckman *et al.*, 1997) as cited in (Aman, 2013). Beside these, the F-statistics was applied to choose the explanatory variables that were statistically significant (p-value of 0.0348 obtained) and to identify a good fit of the binary logistic regression model to the data. Further, a systematic difference in the distribution of covariate variables between participants and non-participants was checked using a pseudo-R2 value. The pseudo-R2 value reflects the extent to which the model explains the food security variables. Following the matching process, it is expected that there will be no systematic differences in the distribution of covariates between the two groups, resulting in a relatively low pseudo-R^2 (Caliendo and Kopeinig, 2005). During this study, the the researcher incorporated eight socio-economic variables into the model analysis to identify the variables that significantly impact food security of the respondent households.

3.4.Definition of Variables

3.3.1 Dependent Variables:

The two main group's dependent variables that were used in this study were participation in the PSNP and non-participation. Thus, dummy 1 for participation and 0 otherwise. The determinants of participation were examined.

3.3.2 Independent variables

The independent variables that will be used in this study include demographic factors, socio-economic factors, institutional factors, and environmental factors.

1. **Family size:** is a continuous variable measure in adult equivalent which represents a group of people living in the same house, jointly sharing food, and comprising one family with a common head. According to Abduselam (2017), studies found that the family of PSNP beneficiaries is found to be higher than non-beneficiaries. This variable measure as continuous variable by taking the total number of household members. Therefore, those households with large number of people are more likely to be selected by the program.

2. **Sex of household head:** It is a dummy explanatory variable taking a value of 1 if the household head is male and 0 otherwise. Greenwell and Pius (2012) stated that gender in Africa is much more related to access to resources. In Africa context, most females are resource poor which may contribute female headed households to be in food insecurity status than male headed households. In this study, a male headed household is expected to be more food secured than their counter female headed households.

3. **Age of household:** It is a continuous explanatory variable referring to the age of the household head in years. Indris (2012) found out that age of a household head affected food insecurity positively. He argued that, as the age of a person gets older, the ability and strength of the person gets weaker so that there is more probability of that household to be food insecure (Ahmed, 2015). Thus, it is hypothesized that age of the household head and food security are negatively correlated.

4. **Education:** Education level could measure the household's human capital and therefore attainment of higher level of education is expected to provide higher levels of household welfare (Datt *et al*., 2000). So, education level is hypothesized to have negative relationship to participating in the PSNP.

5. **Credit Service:** It is a dummy variable, which takes the value of 1 if the household head had access to credit and 0 otherwise. Availability of credit eases the cash constraints and allows farmers to purchase inputs such as fertilizer, improved crop varieties, and irrigation facilities, which in turn enhance food production and ultimately increase household food energy intake

(Stephen and Samuel, 2013). In this study, it is expected to affect extent of households‟ food security positively.

6. **Extension service:** Getting agricultural information frequently and utilizing will create good condition for the decision to use new technologies to increase productivity of farm and livestock to assure food consumption, diversifying HH income and prevent depletion of household asset due to shocks. In addition, frequent study, as a pre-intervention variable, the higher the extension contact with development agent causes better understanding of food security condition and income status of household.

7. **Farmland size:** this variable represents the total cultivated land of a household in hectare. Bigsten and Abebe (2003) indicated that the size of cultivated land and household income are positively related, but cultivated land and participation to the PSNP is negatively related. As the cultivated land increases, provided other associated production factors remain normal, the likelihood that the holder gets more output is high. It is hypothesized that farmers who have larger cultivated land are more likely to be non-PSNP beneficiaries.

8. **Off-farm income:** agriculture isn't the primary or even the only source of income for rural households. The rural populace employs a variety of subsistence techniques. Therefore, it is anticipated that a household's asset and participation in off-farm revenue generating activities will be favorably correlated. Participation in off-farm/non-farm income-generating activities is therefore predicted to increase the likelihood of not becoming a PSNP beneficiary. The details of the impacts of participation in PSNP on household's food security have been shown by using indicator variables in Table 2 below.

Table 2. List of dependent and independent variables

S/N	Variables name	Type of measures	Expected sign
I	Dependent variables: participation in PSNP	Dummy: 1 for participation and 0 otherwise	+
II	**Independent variables**		
	Age of HH	Quantitative	+/-
	Sex of HH	Dummy (0 =Female, 1 =Male)	+/-
	Education of HH	Dummy (0=Illiterate, 1=Literate)	+
	Education level of HH	Quantitative	+/-

	Training on access	Dummy (0 = No, 1 =Yes)	+
	Dependency ratio	Quantitative	+/-
	Household size	Quantitative	+/-
	Farmland size in hectares	Quantitative	+/-
	Farm experience in years	Quantitative	+/-
	Access to extension services	Dummy (0 = No, 1 =Yes)	+
	Access to market	Dummy (0 = No, 1 =Yes)	+
	Access to credit	Dummy (0 = No, 1 =Yes)	+
	Access to saving	Dummy (0 = No, 1 =Yes)	+
	Asset ownership in ETB	Quantitative	+
	Livestock ownership (TLU)	Quantitative	+
	Food security gap in months	Quantitative	-
	Livelihood diversification activities		
	Number of income source	Quantitative	+/-
	Off farm in ETB	Quantitative	+/-
	On farm in ETB	Quantitative	+/-
	Non-farm in ETB	Quantitative	+/-
	Remittance in ETB	Quantitative	+/-
	Daily labor in ETB	Quantitative	+/-
	Wage/Self-employment in ETB	Quantitative	+/-
	Total Annual income in ETB	Quantitative	+/-
	Food security variables	Quantitative	+
	Household Dietary Diversity	Quantitative	+
	Food Consumption Score	Quantitative	+

4 RESULTS AND DISCUSSION

In this segment of the Thesis, the findings derived from various sample respondents utilizing tools such as questionnaires, interviews, focus group discussions, and key informant interviews are illustrated through Tables, Figures, and Charts. This section comprises five subsections. The initial subsection outlines the demographic characteristics of the household respondents. The second subsection addresses the primary implementation practices of the productive safety net program within the study area. The third subsection discusses the socio-economic impacts of the productive safety net program on beneficiary households in the Chiro district. The fourth subsection highlights the significant challenges that impede the effectiveness of the Productive Safety Net Program. The fifth subsection examines the food security status of households in the Chiro district relevant to this study. The concluding subsection summarizes the findings, presents conclusions, and offers recommendations based on the study's results.

4.1 Socio-demographic characteristics of respondent households

4.1.1 Demographic characters of sample respondents

Demographic information collected from the respondent households in the study area encompasses various aspects, including the age and gender of the respondents, their marital status, educational background, and family size. In this research, respondents were selected from both households participating in the Productive Safety Net Programme (hereafter referred to as PSNP) and those not participating (hereafter referred to as non-PSNP), with proportions of 51.58% and 48.42%, respectively.

4.1.1.1 Gender

The demographic analysis of gender revealed that out of a total of 192 household respondents, male-headed households constituted 57.8%, while female-headed households represented only 42.2% of the sample (Fig. 3). The gender distribution among the households in this study appears to be female skewed which is also in line with the findings of previous demographic studies (Chala et al., 2012; Omotayo, 2016). This suggests that a greater number of males are involved in agricultural activities, indicating that male-headed households were more prevalent among the respondents in the study area.

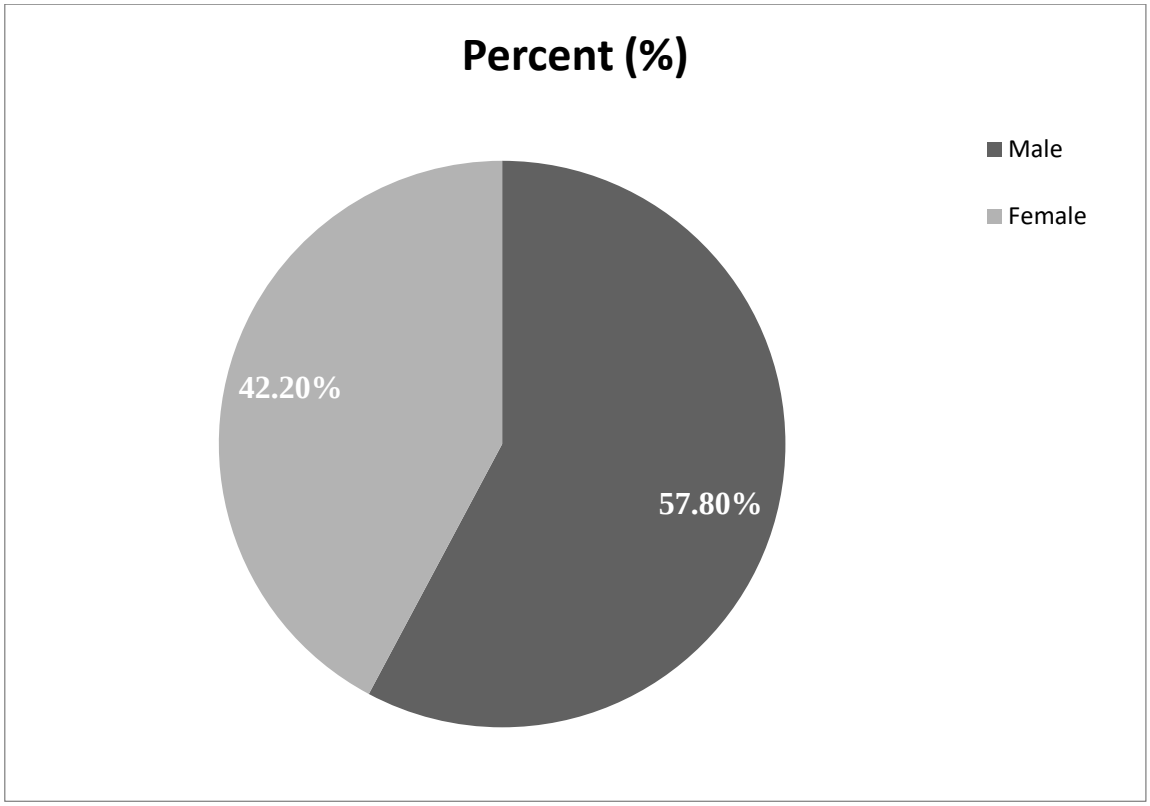

Figure 3 Sex distribution of respondent households from the study area

4.1.1.2 Marital Status

Analysis of data concerning marital status of respondents revealed that the married household heads is significantly higher in proportion of the total respondent household participants (74.4%) compared to widowed household heads (23.4%), divorced (1%) and single head households among the smallholder farming community of Chiro district of Western Hararghe zone (Table 2). The possession of higher married status of the smallholder farming community in the present study community is an indicator of the higher stability status of the farming community which might be associated to Gada socio-political cultural ruling system that fovours copoule stability. This result agrees with a report of Fekede Gemechu (2016) who obtained 75% of married status of head households from Hawi Gudina District East Hararghe zone of Oromia National Regional State, Ethiopia.

Table 3 Marital status of heads household respondents in the study area

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Married	143	23.9	74.4	74.5
	Divorced	2	.3	1.0	75.5
	Widowed	45	7.5	23.4	99.0
	Single	2	.3	1.0	100.0
	Total	192	32.0	100.0	
Missing	System	406	68.0		
Total		598	100.0		

4.1.1.3 Age

The data regarding the age of head household respondents in the current study area indicates a range from 20 to 70 years, with an average age of 41.6458±12.041 for all respondents (Table 3). The age of the household head is a significant characteristic that can influence the household's food security status.

4.1.1.4 Family Size

In terms of family size, the data from the Chiro district reveals that the number of family members among household respondents varies from 1 to 12, with an overall average of 5.4526±2.06389. While the size of household members may not directly indicate vulnerability or adaptive capacity regarding food security, a larger family size can enhance food security if a significant proportion of members are of working age and engage in various livelihood strategies, including both non-farm and on-farm activities (Berhanu et al., 2019; Brown and Garcia, 2020; Dejene and Cochrane, 2022). Conversely, a large family size, when coupled with a high dependency ratio, can lead to livelihood insecurity among farming households (Bezmer et al., 2002) (Table 3).

Table 4 Descriptive Statistics of socio-demographic status of households

	N	Minimum	Maximum	Mean	Std. Deviation
Age of head of HH	192	20.00	70.00	41.6458	12.04049
What is your household size?	190	1.00	12.00	5.4526	2.06389
No of family members 15 years – 64 years	192	1.00	9.00	3.0365	1.52937

No of family members <15 years	192	.00	6.00	2.4271	1.45972
School years of households	102	1.00	3.00	1.4314	.57178
No of family members > 64 years	192	.00	5.00	.2448	.73611
what is the size of farmland?	186	.06	.63	.2171	.11050
Valid N (listwise)	98				

Source: Own

4.1.1.5 Dependency Ratio

The dependency ratio is influenced by both family size and age distribution. In the study area, the percentage of dependents among household heads indicates that the combined proportion of children under 15 years and individuals over 65 years is 47.70%. In contrast, the percentage of those in the productive working age group, defined as individuals between 15 and 65 years, constitutes approximately 52.69% of the household size (see Fig. 4). This high percentage of dependent members suggests that nearly half of the family consists of dependents, which can significantly impact the food security status of the household heads. This finding aligns with the research conducted by Hayalu Godefey Safety Net Program in the Emba Alaje district community of Southern Tigray, northern (2014), which examined factors influencing household graduation from the Productive Ethiopia.

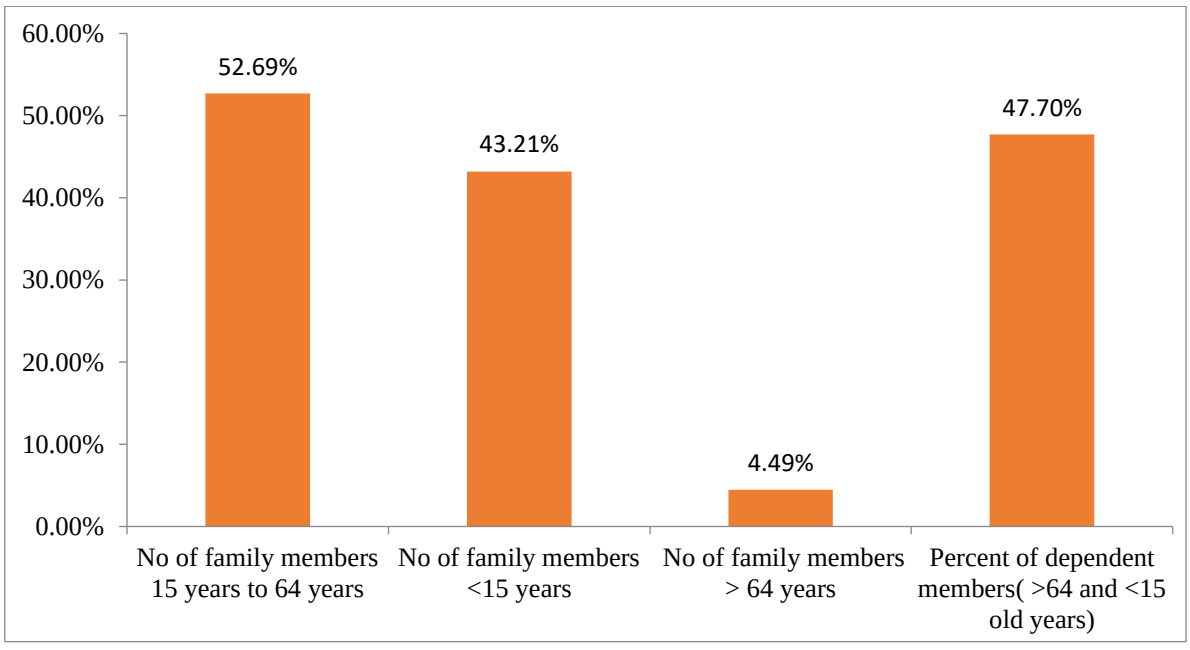

Figure 4 Proportion of dependent members of family per household

4.1.2 Socio-Economic characteristics of respondent households

4.1.2.1 Educational Background

Additionally, the average number of years of education attained by heads of households across the study is 1.4314±0.57178. It has been proposed that the food security status of households is positively correlated with the educational attainment of household heads. Education serves as a significant determinant among the variables influencing food security and is believed to have a beneficial impact (Gutu et al., 2012; Gebre and Rahut, 2021). When asked about their participation in training over the past five years, a majority of respondents (56.3%) affirmed that they had received training related to agricultural production. Additionally, empirical evidence indicates that rural households engaged in agricultural or non-agricultural training are more likely to enhance their farm production compared to those who have not participated in any training, as such training improves farmers' skills, knowledge, and experience in agricultural production (Adugna Lemi, 2005; Ayele and Senapathy, 2022). Furthermore, regarding market access within a radius of 5 kilometers, 89.6% of respondents confirmed the presence of a market in their vicinity (Table 4).

4.1.2.2 Farmland size

In the Chiro district, the total landholding size of respondents in this study ranges from 0.06 to 0.63 hectares, with an average of 0.2171±0.11050 hectares per household (Table 4). This figure is notably low when compared to the findings of Nesreddin (20014) and Mesfin (2018) from the west and east Hararghe zones of the Oromia National Regional State, Ethiopia (Nesreddin, 20014; Mesfin, 2018). Land is a critical factor in production and household food security, serving as an indicator of the wealth status within smallholder farming communities. Given the current low levels of technology adoption, increasing the area of land under cultivation remains the primary strategy to enhance resilience against food insecurity (Gebremedhin and Tadesse, 2021). The examination of data regarding the socio-economic attributes of the respondent households revealed that a significant majority, specifically 96.9%, possessed farmland, while a small minority of 3.1% indicated that they did not own any farmland (Table 4). This latter group confirmed during focus group discussions that they relied on daily labor for their livelihoods. Land serves as a critical factor in production and household food security, and it is also a key indicator of the wealth status within smallholder farming communities. Farmers with larger areas of cultivated land are generally more food-secure compared to those with smaller plots, as they have a greater potential for food production (Meseret 2012:16).

Table 5 Socio-economic status of respondent households in study area

Variables		Frequency (N)	Percent %)
Dou you have farming land?	Yes	186	96.9
	No.	6	3.1
Does anyone of household members participate in training in past 5 years?	Yes	108	56.3
	No.	84	43.8
Have you access to market center to purchase and sell food crops?	yes	172	89.6
	No.	20	10.4
Does anyone in your household members read or write?	yes	102	53.1
	No.	9o	46.9
What is the targeting method applied for your households in PSNP program?	Some members of HHs	51	55.4
	Full family targeting	41	44.6

4.2 Major Implementation Practices of Productive Safety Net Program

4.2.1 Food security task force description

The implementation of PSNP in the Chiro district of the present study area was launched in 2005. The programme consists of two components: Public Works (PW) and Direct Support (DS). In the PSNP context, Public Works refer to community-driven infrastructure projects funded and organized under the program, aimed at improving local agriculture, water access, and overall community resilience to food insecurity which are designed to create productive assets that benefit the community while providing economic incentives to households. Public works projects include Soil and Water Conservation, road construction and maintenance, and community infrastructure. These activities encourage labor participation from households, enabling them to earn food and cash payments for their work, directly impacting their food security by improving both income and food production capabilities (World Bank, 2020; IFPRI, 2021). Direct support in the PSNP context refers to unconditional cash or food transfers provided to vulnerable households to help them meet their immediate food needs and improve overall household food security. It is a crucial element of the PSNP, aimed at households that are unable to engage in public works due to age, illness, or disability. This support offers several benefits including immediate relief, stability and economic resilience. Through these transfers, the PSNP directly impacts food security by ensuring that vulnerable populations maintain access to food, thereby addressing hunger and nutritional deficits (FAO, 2022; EMA, 2019). The responsible body for the implementation of the programme is structured under the district's Office of the Agriculture and Rural Development.

A Food Security Task Force in relation to the PSNP is a collaborative entity comprising government officials, NGOs, and community leaders formed to coordinate strategies and monitor the impact of food security programs, including the PSNP on households. It plays a critical role in enhancing the effectiveness of the PSNP through Stakeholder Coordination, Monitoring and Evaluation and Policy Development (AU, 2023). The Food Security Task Forces (FSTF) at the woreda and Kebele level oversee the PSNP. Members or the task force are representatives from different offices of the Woreda Administration: Finance, Natural Resources Offices, Capacity Building, Agriculture and Rural Development, Women's Affairs and NGOs. Head or the Food Security Unit is the secretary of the task force. The task force prepares and consolidates the annual safety net budget plans and submits proposals to the Woreda Council for resource mobilizations. The Kebele Food Security Task Force (KFSTF) is responsible for planning and follow-up of the implementation of the PSNP activities at the Kebele level. The task force members are the Chairperson of the Kebele council, one member from the Kebele Council, one DA, three elected elders from the community. Hence, under this subsection, PSNP implementation practices and its socio-economic impacts on participant households had been presented. It encompasses types of transfer they are receiving, their interests or preferences over PSNP transfers, current saving status of respondents, improvements of PSNP on the living standards of households and overall socio-economic status of household beneficiaries compared to non-beneficiary households.

4.2.2 Mode of PSNP Support Transfer to Beneficiaries Households

The appropriate type of transfer, whether cash or food depends on local context and circumstances and can vary across different households' categories (Uffelen 2013). The data collected from smallholder farming households who participated in Productive Safety Net Programme concerning types of transfer by the project and its extent was presented here. Accordingly, among the respondent households most of the (77.2%) were received mixed transfer, food in kind and cash. However, only 12.8% and 10.0% of beneficiary households were receiving food only and cash only respectively (Fig.5). In line with this and in contrary to the current mode of transfer; the descriptive statistics showed that the mixed mode of transfer (cash and food transfer) have higher frequency from Sidama zone, Ethiopia (Desta Mussa, 2017). However, this finding is in contrary to the finding of Mulumebet Melaku (2010) from Jamma Woreda, South Wollo, Ethiopia, who reported higher preference to cash transfer. Beside the quantitative data result, as confirmed during focus group discussion, the beneficiary households highly preferred to mixed transfer than single type as the needs of both is required conditionally.

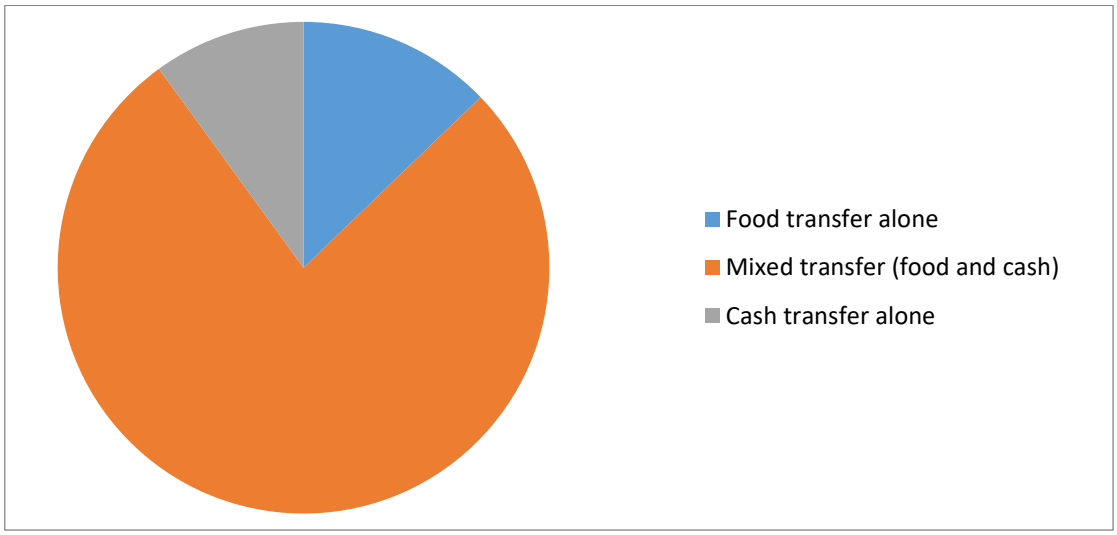

Figure 5 Mode of support transfer modality in study area

The additional information obtained from the questionnaire survey data further substantiated the understanding of the conditionality associated with the transfer modality. As illustrated in Table 6 below, when the community's needs indicated a demand for both food and cash transfers, all households (100.0%) received assistance through both modalities. In addition to cash and food transfers, 15.2% of beneficiary households also received other forms of support, such as agricultural inputs. Enhancing agricultural production is deemed crucial for ensuring food security. Farm households have been encouraged to adopt agricultural technologies, including fertilizers and high-yield seed varieties, to boost seasonal agro-production. Information regarding these technologies was regularly disseminated to all beneficiary households or their respective groups. Notably, although the proportion of users was relatively small (15.2%), those who utilized these inputs reported positive outcomes. However, a lack of interest in this sector was linked to the prohibitive costs of fertilizers and improved seed varieties, as highlighted by insights from focus group discussions. Additionally, it was confirmed that approximately 38.0% of participant households received training and capacity-building support (see Table 5).

The staff members of the NGOs who served as key informants indicated that regular capacity-building training sessions were conducted to assist beneficiaries of public works and direct support households. The participants acknowledged that their involvement in these training sessions had provided them with valuable information and enhanced their skills. Additionally, as noted during the focus group discussions and key informant interviews, the assistance provided included cash transfers for public work, free food aid, and food-for-work programs. According to the discussants,

the free cash transfer aid was directed towards households with individuals who were unable to participate in community services or public works. Household beneficiaries, both male and female heads of households, who were deemed able-bodied for public work activities received payment only when engaged in such activities. This approach, as explained by the district food security staff, aims to prevent a sense of dependency among beneficiaries. The public work activities encompass community asset-building initiatives, including soil and water conservation practices, rehabilitation of natural resources, and the enhancement of public services.

Table 6 Types of support provided to target households in the study area

What type of support do you receive from the PSNP?	Frequency (N)	Percent (%)
- Food assistance	92	100.0%
- Cash transfer	90	97.8%
- Agricultural inputs	14	15.2%
- Public works employment	14	15.2%
- Training and capacity building	35	38.0%

4.2.3 Conditions of Transfer System by the Programme

A fundamental tenet of the PSNP is the assurance that payments to clients engaged in Public Works and Direct Support are both timely and predictable. In alignment with these objectives, this study assessed that program participants recognized the Programme, as evidenced by the timeliness and predictability of the number of daily meals consumed over the past five years. Transfers are deemed foreseeable when PSNP participants are adequately informed about their program eligibility and are aware of the type, quantity, and timing of the transfers they would receive. Notably, 100% of beneficiary households reported awareness of the food aid distribution schedule. The 100% level of awareness among beneficiary households regarding the food aid distribution schedule in the PSNP can likely be attributed to several key factors including Effective Communication Strategies (Community Engagement and Multimodal Information Dissemination**),** Involvement of Local Leaders and Agents **(**Training and Empowerment, Peer-to-Peer Networks**),** Routine Distribution Processes **(**Regular Scheduling and Reminders through Established Practices), Targeted Training and Awareness Programs(Orientation Sessions and Feedback Mechanisms), Monitoring and Evaluation (Data Utilization and Responsive Adjustments), and Social Cohesion and Trust(Community Trust and Shared Experiences). By integrating these strategies and approaches,

the PSNP not only ensures beneficiaries are informed but also fosters an environment of trust and reliance on the program that can lead to its overall success in achieving awareness and meeting its objectives.

Despite its successes, the PSNP faces several challenges and criticisms that warrant attention for a balanced evaluation such as delays in transfers, service quality discrepancies, and the need for more inclusive targeting mechanisms. This issue provides an opportunity for improvement. By addressing them properly, the PSNP can evolve to better serve its intended purpose.

Additionally, 97.8% and 95.7% of beneficiary households confirmed that they received food and cash transfers, respectively, in a timely manner (Table 6). In accordance with this principle, payments for public works participants are contingent upon attendance, as well as the quantity and quality of work completed, as assessed by the Development Agent and Food Security Taskforce in collaboration with the foreman. All payments are disbursed to clients on a monthly basis, within two days following the commencement of the next month. Furthermore, the principle stipulates that payments to direct support clients are made monthly, irrespective of the status of public works payments. Respondents were also queried regarding their awareness of the monthly referral schedule. Consequently, a significant majority of PSNP participants demonstrated the ability to anticipate annual food deliveries and cash payments to a considerable extent. Similarly, the program is designed to assist households in the study area in fulfilling their consumption needs through various means, including an enhancement in their knowledge compared to baseline consumption levels, as indicated during focus group discussions and key informant interviews.

Table 7 Conditions of transfer system by the Programme in study area

Variables	Response variable	Frequency (N)	Percent (%)
Do you know when to receive food each year?	Yes	92	100%
	No.	0	
Have you received food transfer in a timely manner?	Yes	90	97.8%
	No.	0	
Have you received cash transfer in a timely manner?	Yes	88	95.7
	No.	4	4.3
Did you receive cash monthly?	Yes	92	100.0
	No.	0	

The productive safety net has significantly enhanced the living conditions of impoverished individuals (Yitagesu Fikadu, 2014; Bahru et al., 2020). In the current study area, among the 92 households benefiting from the PSNP, 39.1% reported that the transfer amount is very adequate to fulfill their household needs, while 58.7% indicated that the support received is adequate for their requirements (Table 7). Additionally, during focus group discussions, participants confirmed that the transfer amount suffices to cover various household expenses. More specifically, personal conversations with several beneficiary households revealed that the transfers are sufficient for them to accumulate assets. For instance, following their involvement in the PSNP, particularly in soil conservation and other activities, they earned 1,580 birr each month, which they saved and used to purchase cows and sheep with the funds obtained from the program.

The respondents indicated that their current living standards have improved, and they have replaced their thatched grass roofing with corrugated iron. As highlighted in the previous presentation, both qualitative and quantitative responses suggest that the Productive Safety Net Program (PSNP) has positively impacted the lives of its beneficiaries. Prior to the implementation of PSNP in the study area, food insecurity was not only a challenge for food-insecure households but also placed a burden on economically better-off individuals who endeavored to support those in need. Therefore, the data presented suggests that the PSNP has played a significant role in enhancing food consumption among participants, particularly among the rural poor. In a similar vein, Slater (2006) noted that the program has already had a substantial impact, with clear evidence of significant changes in the socio-economic status of beneficiary households.

Table 8 Adequacy of support by the Programme to cover Beneficiary households needs

How adequate is the support provided by the PSNP in meeting your household's needs?	Response variables	Frequency (N)	Percent (%)
- Very adequate	Yes	36	39.1%
	No	56	60.9%
- Adequate	Yes	54	58.7%
	No	36	39.1%
- Neutral	Yes	0	0.00%
	No	92	100.0%
- Very inadequate	Yes	0	0.00%
	No	92	100.0%

4.2.4 Perception of Beneficiary Households on Food Security Impact of PSNP

Ethiopia's Productive Safety Net Program (PSNP) stands as a prominent social protection initiative in Sub-Saharan Africa, specifically targeting households that experience chronic food insecurity and poverty (Coll-Black et al., 2011; Welteji et al., 2017). The primary objective of this program is to secure food for vulnerable households while empowering them to address their vulnerabilities without depleting their assets, ultimately aiding them in asset accumulation over time (Hailu and Amare, 2022). In 2015, the PSNP provided support to over seven million individuals (Cochrane and Tamiru, 2016) and has enhanced the food security of participating households by improving both food availability and accessibility (Berhane et al., 2015; Gebrehiwot and Castilla, 2017; Zerhun Ganewo, 2020; Nuru Muhammed et al., 2023). Within the study area, data indicates that the majority of beneficiary respondents acknowledged an increase in food availability (100.0%), with 72.8% reporting improvements in nutritional quality (Table 8).

Furthermore, Desta Mussa (2017) found, through the Pearson chi-square association test, that a significant proportion of beneficiary households (76.3%) reported sufficient food items following their participation in the PSNP in the Gamo highlands of Ethiopia. This aligns with the findings of Hailu and Amare (2022), which indicated that the food intake status of households improved after joining the PSNP, as the program focused on enhancing food availability and accessibility. Supporting this conclusion, various authors have noted that participation in the PSNP significantly contributes to food security, particularly in terms of calorie intake (Bezawit Adugna et al., 2020). Safety nets have the potential to enhance access to quality food, increase food production, and promote ownership of productive assets (Desta Mussa, 2017; Nuru Muhammed et al., 2022). Additionally, the analysis of data regarding the PSNP's impact on the food security status of beneficiary households revealed a reduction in the frequency of meal skipping, thereby increasing the regularity of meals.

Table 9 Roles of PSNP in improving beneficiary households Food Security

		Responses		Percent of
		N	Percent	Cases
HOW FS	Increased food availability	92	31.0%	100.0%
IMPROVED	Improved nutritional quality	67	22.6%	72.8%
	Reduced frequency of skipping meals	44	14.8%	47.8%
	Reduced hunger	92	31.0%	100.0%

Other (please specify)	2	0.7%	2.2%
Total	297	100.0%	322.8%

4.3 Challenges of the Implementation of the PSNP Program

4.3.1 Targeting related issues

The productive safety net, as a vital element of food security initiatives, operates under specific guidelines, objectives, principles, and management structures that span from federal to community levels, all aimed at achieving the program's intended goals. According to the Ministry of Agriculture and Rural Development (MoARD, 2010), the beneficiary targeting within the Productive Safety Net Program (PSNP) employs a dual approach that combines administrative and community-based targeting methods. The administrative components encompass the allocation of PSNP clients (the number of individuals eligible for targeting within a particular region, woreda, kebele, etc.), the establishment of key targeting criteria relevant to the locality, and the oversight to ensure the accuracy and transparency of the targeting process. On the community side, the approach involves the identification of target households by the Community Food Security Task Force, followed by a public meeting where the entire client list is presented and discussed for verification.

Nonetheless, the implementation of the program at the grassroots level has encountered various challenges. This section addresses the obstacles faced in the study woreda, which primarily pertain to beneficiary screening or targeting, the transfer of benefits to beneficiaries, public work initiatives, institutional and managerial frameworks, and the graduation process. In line with the principles of the PSNP, particular emphasis is placed on identifying labor-poor, chronically food-insecure households within the local community during the beneficiary selection process. The targeting initiative commences at the village level, as validated by the Community Food Security Task Force and approved by local administration. Despite the existence of clear guidelines for beneficiary identification, several challenges have emerged, including errors of inclusion and exclusion in targeting, issues with fully targeting families, a lack of interest in graduation leading to dependency syndrome, insufficient grievance redress mechanisms, delays in food and cash payments, and varying levels of satisfaction regarding payment modalities (cash versus food), among others.

Several significant challenges have been addressed in this discussion. The data gathered in the current study area indicated that 8.1% of household respondents acknowledged the occurrence of targeting errors related to exclusion (see Table 9). Mebratu Negera (2021) noted a substantial risk of excluding those in need while including households that do not qualify in the targeting process. Although the Productive Safety Net Program (PSNP) was designed specifically for households in need, discussions among community elders, including both beneficiaries and non-beneficiaries, revealed that certain vulnerable groups such as marginalized individuals lacking connections to the administrative body, those without access to information, and individuals with differing political views were likely to be excluded during the screening process. Focus group discussions (FGD) and interviews with key informants from the Kebele Food Security Task Force (KFSTF) also corroborated the existence of excluded needy households, noting that their appeals were often dismissed due to delays in processing their cases. Furthermore, they linked these issues to a misalignment between actual needs and available resources.

4.3.2 Full Family Targeting Problems

One of the criteria for beneficiary screening in the Productive Safety Net Program (PSNP) is the comprehensive targeting of families. According to the program's Product Implementation Manual (PIM), “If a household is identified as being chronically food insecure and eligible for the PSNP, all household members will be listed as clients of the programme.” Despite this clear guideline, approximately 7.9% of the households surveyed reported issues related to full family targeting (see Table 9). Respondents indicated that only a limited number of their family members were receiving benefits from the program. Conversely, an analysis of secondary documents revealed that over 82% of beneficiary households had around 50% of their family members included in the program. This quantitative finding was echoed in discussions with focus group participants, who highlighted the reality of this issue as a significant challenge for beneficiary households, especially during drought years when agricultural production is severely limited.

4.3.3 Other Problems

Additionally, the study identified several other significant challenges in the implementation of the PSNP in the area, including a lack of interest in graduation and a dependency syndrome (8.2%), absence of a grievance redress mechanism (5.4%), issues related to poverty and vulnerability (7.8%), occurrences of drought (7.7%), insufficient credit availability from microfinance institutions (5.0%), and staff turnover or lack of commitment (5.0%) (Table 9).

Table 10 Challenges associated with implementation of PSNP

		Responses		Percent of Cases
		N	Percent	
Challenges[a]	Targeting as error of exclusion	160	8.1%	93.0%
	Targeting as error of inclusion	97	4.9%	56.4%
	Fully family targeting problem	155	7.9%	90.1%
	Less interest in graduation/dependency syndrome	162	8.2%	94.2%
	Lack of grievance redress mechanism (GRM)	107	5.4%	62.2%
	Lack of timeliness of food payments	4	0.2%	2.3%
	Lack of timeliness of cash payments	4	0.2%	2.3%
	Less satisfaction in payment modality (cash vs food)	40	2.0%	23.3%
	Delay in PW attendance filling /collection	28	1.4%	16.3%
	Less attendant in PW implementation	50	2.5%	29.1%
	Poor watershed management	43	2.2%	25.0%
	PW labor competition for mass mobilization	77	3.9%	44.8%
	Low wage rate payment	59	3.0%	34.3%
	Lack of market for purchasing agricultural input and food crops	11	0.6%	6.4%
	Weak institutions support/Lack of accountability	62	3.2%	36.0%
	Poverty and vulnerability issues	153	7.8%	89.0%
	Drought incidence	152	7.7%	88.4%
	Malnutrition /child stunting	41	2.1%	23.8%
	Human disease	47	2.4%	27.3%
	Crop pests (Fall worm/Desert locust /armyworm	46	2.3%	26.7%
	Lack of awareness /training/skills	86	4.4%	50.0%
	Lack of coordination among stakeholders	55	2.8%	32.0%
	Lack of technical support and close supervision	38	1.9%	22.1%
	Centralized decision making in planning	42	2.1%	24.4%
	Lack of credit by MFI	98	5.0%	57.0%
	Staff turnover /reshuffling/less commitment	99	5.0%	57.6%
	Political interference/poor governance	28	1.4%	16.3%
	Security problems	12	0.6%	7.0%
	Corruption/theft/cash/food diversion	8	0.4%	4.7%
Total		**1964**	**100.0%**	**1141.9%**

a. Dichotomy group tabulated at value 1

4.3.4 Preference in Types of Payment

According to PSNP program implementation manual, the beneficiaries have the right to choose what form of the transfer is better. Thus, the program aims to provide transfers in the form most needed by clients. As to manual guideline, it is possible for a single district to decide to make

payments in cash in some kebeles and in food in other kebeles, depending on the factors affecting the beneficiaries and as a general starting point, cash should be given after the harvest when food is in good supply and food may be given in the hungry period leading up to the harvest if food is scarce and unavailable in the market or at a very high price. Even though the manual was prepared at country level, the local community from the present study area have forwarded handful of implementation preference of their own. Accordingly, some of the PSNP implementation comments of the beneficiary households in the present study area were: Increase knowledge about food security dimensions, Increase financial capital of households, Increase access to agricultural input technology, Increase market access, Increasing access to irrigation technology, Increasing natural resource restoration, Strengthening human and social capital, Increase access to extension services!, Dissemination of weather forecasts and early warning information and Applying adaptation and mitigation measures (Annex 4).

4.4 Descriptive Statistics of Food Consumption Score of Sample Households

Food security within households is achieved when all members consistently have access to food that is adequate in both quantity and quality, enabling them to lead healthy and active lives. The Productive Safety Net Program (PSNP) was designed to stabilize household consumption, thereby reducing the necessity for families to liquidate productive assets to address food shortages. Utilizing a food consumption score of 35 as a reference point, along with the mean food consumption details provided in Annex 1, this subsection summarizes the food security status of the community studied in the Chiro district. Among the 92 PSNP households sampled, 33.7% achieved a food consumption score of 35 or higher, while 42.9% of the 98 non-PSNP households reached the same threshold. Furthermore, of the 73 households in the study area that scored 35 or above, PSNP households constituted approximately 42.5%, whereas non-PSNP households made up 57.5%. Overall, only 38.4% of the 190 sampled households attained an acceptable mean food consumption score exceeding 35. In comparison to the overall sample population, 22.1% of non-PSNP households and 16.3% of PSNP households scored above 35. Among the total of 198 sampled households, 56.3% fell into the borderline category, with scores ranging from 21.5 to 35. Within the 107 households classified as borderline, PSNP households represented 53.3% (57 households), while non-PSNP households accounted for 46.7% (50 households). However, an analysis of food consumption levels revealed that 62.0% of the 92 PSNP households fell within the borderline category, compared to 51.0% of the 98 non-PSNP households.

Table 10 below indicates that 5.3% of the total sample households achieved a mean food consumption score ranging from 0 to 21, which signifies a poor food security status. Among the ten households in the study area with a mean FC below 21, 60.0% were non-PSNP households, while 40.0% were PSNP households. A comparative analysis revealed that 4.3% of the 92 PSNP households and 6.1% of the non-PSNP households fell within the poor food security category, defined as a food consumption score of less than 21 (Table 10). These findings align with the research conducted by Mada (2015) and Tsegaye (2017), which reported a higher proportion of non-PSNP households achieving an acceptable mean FCS compared to PSNP beneficiary households. Notably, a greater percentage of PSNP beneficiaries were found in the borderline category compared to their non-beneficiary counterparts, suggesting a relatively better food security status.

Furthermore, numerous studies within the Sub-Saharan African context have consistently demonstrated that PSNPs are effective in improving food security and alleviating poverty among participating households (Sibhatu et al., 2015; Abay et al., 2021; Belete and Bayu, 2023). However, it is important to note that this result does not definitively indicate that the observed differences are solely attributable to the program. In reality, it is challenging to ascribe the differences in calorie intake between the two groups exclusively to the program, as the comparisons have not been limited to households with similar characteristics.

Table 11 Category of group of households in terms food consumption

Food consumption of households	Proportions	Category of households		Total
		Non-PSNP	PSNP	
Greater than 35 (> 35)-Acceptable	Count	42	31	73
	% within food consumption level	57.5%	42.5%	100.0%
	% Category of HH?	42.9%	33.7%	38.4%
	% of Total	22.1%	16.3%	38.4%
Between 21.5 and 35 (21.5-35)-Borderline	Count	50	57	107
	% within food consumption level	46.7%	53.3%	100.0%
	% Category of HH?	51.0%	62.0%	56.3%
	% of Total	26.3%	30.0%	56.3%
Between o and 21 (0-21)-Poor	Count	6	4	10
	% within food consumption level	60.0%	40.0%	100.0%
	% Category of HH?	6.1%	4.3%	5.3%
	% of Total	3.2%	2.1%	5.3%

The analysis of food security among smallholder farming households in the Chiro district reveals that 60.0% of the ten households classified as having a poor Food Consumption Score (FCS) were non-Productive Safety Net Program (PSNP) participants, while 40.0% were part of the PSNP group. Conversely, Figure 6 illustrates that within the 107 households categorized as having a borderline FCS, 53.3% were PSNP beneficiaries, whereas 46.7% were non-PSNP participants (refer to Fig. 5). Furthermore, Mebratu Negera (2021) found a statistically significant difference in food security status between PSNP beneficiaries and non-beneficiaries, with a p-value of 0.000, indicating a higher proportion of food-secure households among non-beneficiaries (Mebratu Negera, 2021). This suggests that non-beneficiaries tend to be more food secure than beneficiaries. However, other research highlights the positive impact of safety net programs on improving food intake and access for beneficiaries (Misgana, 2018). Additionally, focus group discussions indicated that there has been no significant change in living conditions, aside from meeting household needs for up to two weeks.

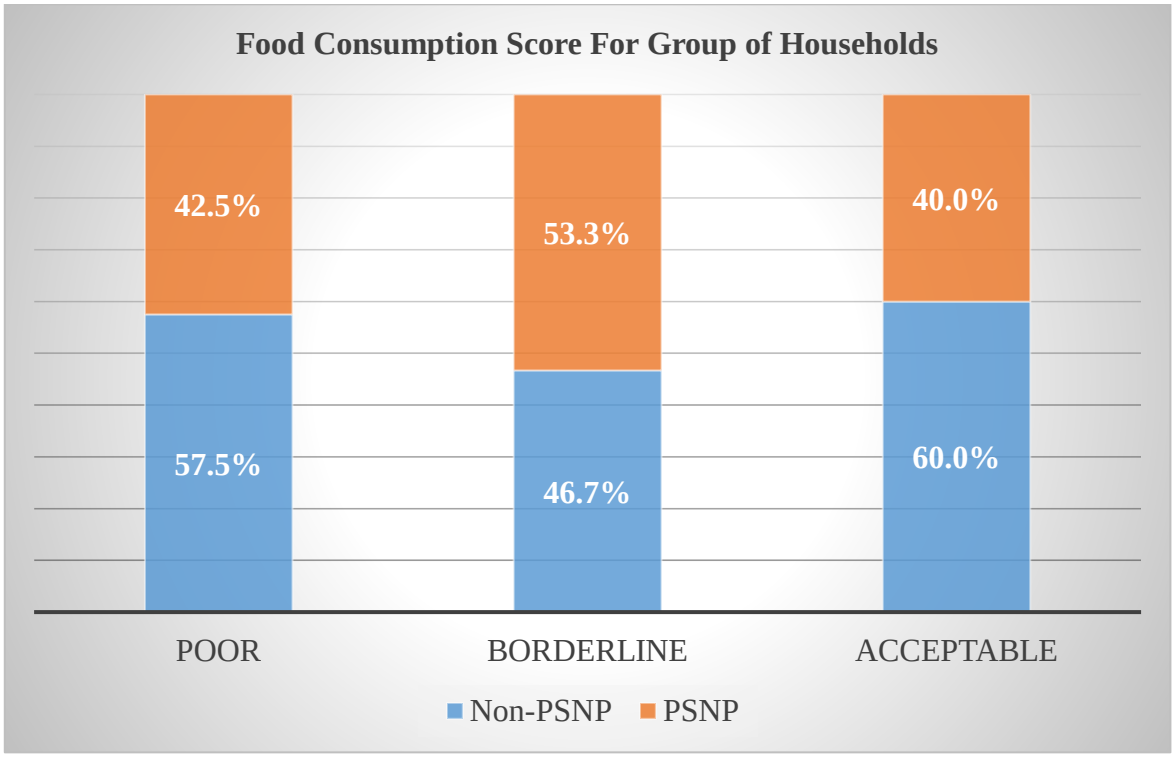

Figure 6 Food consumption score distribution among the PSNP/non-PSNP groups in study area

The analysis of the sex distribution among the sample households in this study revealed that 42.2% of the respondents who were heads of households were female, while 57.8% were male. The predominance of male-headed households participating in the Productive Safety Net Program (PSNP) aligns with the findings of Nesredin (2014) and Abduselam (2018), yet it contradicts the

observations made by Mesfin (2018), who noted a higher participation rate of female-headed households. A comparison of food security status within the genders indicated that female-headed households represented 37.0%, 58.0%, and 4.9% of households classified as having acceptable (>35 Food Consumption Score), borderline (21.5-35), and poor (0-21) food security status, respectively. In contrast, male-headed households accounted for 40.5% in the acceptable range, 54.1% in the borderline range, and 5.4% in the poor food consumption score range (Fig. 7). The study found that both male and female-headed households exhibited the lowest proportion of households classified as having poor food security status, which is consistent with the 7.72% of severely food insecure households reported in the Ley Guint district of northern Ethiopia (Muluken Moges, 2019).

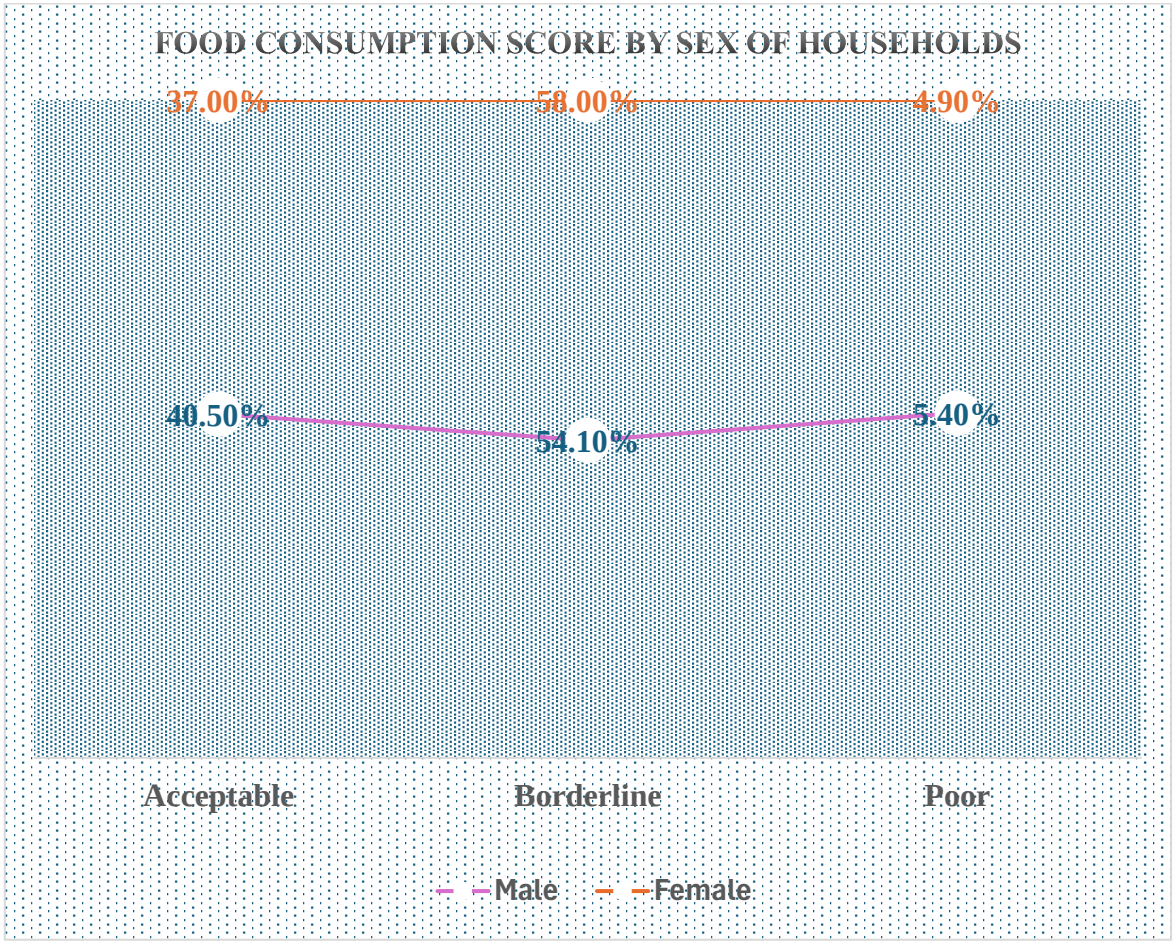

Figure 7 Food security status of sample households in sex using food consumption score

The analysis of the food consumption score (FCS) means between male and female-headed households revealed that out of the 75 households with an FCS mean exceeding 35, 40.0% were female-headed, while male-headed households comprised 60.0%. In terms of food security status, male-headed households represented 56.1% and 60.0% of those classified as borderline and poor,

respectively. Conversely, female-headed households accounted for 43.9% and 40.0% within these categories. Overall, the findings indicated that the majority of households fell into the borderline food security status category, comprising 55.7%, followed by those in the acceptable range at 39.1% (see Table 11).

Table 12 Category of household's in terms food consumption by Sex of head of HH

		Sex of head of HH?		Total
		Male	Female	
Greater than 35 (> 35)-Acceptable	Count	45	30	75
	% within What is the category of households in terms food consumption	60.0%	40.0%	100.0%
	% within Sex of head of HH?	40.5%	37.0%	39.1%
	% of Total	23.4%	15.6%	39.1%
Between 21.5 and 35 (21.5-35)-Borderline	Count	60	47	107
	% within What is the category of households in terms food consumption	56.1%	43.9%	100.0%
	% within Sex of head of HH?	54.1%	58.0%	55.7%
	% of Total	31.3%	24.5%	55.7%
Between o and 21 (0-21)-Poor	Count	6	4	10
	% within What is the category of households in terms food consumption	60.0%	40.0%	100.0%
	% within Sex of head of HH?	5.4%	4.9%	5.2%
	% of Total	3.1%	2.1%	5.2%

4.5 Impact of PSNP on Food Security Status of Households Using PSM

Propensity score matching facilitates the identification of a comparison group from a sample of non-participants that most closely aligns with the participant group regarding observable characteristics. This method enables the matching of both groups based on the propensity score, which represents the predicted probability of participation given the observed characteristics. This section presents and discusses the results of the propensity score matching in detail. To estimate the average treatment effect on the treated (ATT) concerning the intended outcome variables, the following steps were undertaken. Initially, a logit model was employed to estimate the propensity scores and identify the factors influencing participation in the PSNP program. Subsequently, a matching estimator appropriate for the data was selected. Finally, using the estimated scores, matching was conducted between beneficiaries and non-beneficiaries to assess the program's impact on the mean values of the outcome variables. Thus, this section outlines all the necessary

procedures implemented to calculate the average treatment effect on the treated, which aids in evaluating the impact of the PSNP on household food security within the study area.

4.5.1 Multicollinearity problem tests among independent variables

Prior to running the logistic regression to estimate propensity scores, it is necessary to test important cross-sectional data problems by using econometric assumption, whether it is holding or not. Variance inflation factor (VIF) was used to test the presence of strong multicollinearity problem among all the covariate variables hypothesized. The explanatory variables that were selected to measure its association with participation in the PSNP in this study were: FARM SIZE, Distance of Market center, EDUCATION of HHs head, Household SIZE, LOAN ACCESS, TRAINING, TOTAL Food Consumption Score, age, sex, agricultural extension, farm technology, off/non-farm income, and climate information. However, the use of multicollinearity checking among independent variables showed that Variables such as age, sex, agricultural extension, farm technology, off/non-farm, and climate information sharing have multicollinearity effects and hence, omitted from model analysis. Then, other variables such as FARM SIZE, Distance of Market center, EDUCATION of HHs head, Household SIZE, LOAN ACCESS, TRAINING, and TOTAL Food Consumption Score were maintained for farther analysis. After omitting those variables having serious problem of multicollinearity, the remaining variables were checked again and the VIF (xi) result shows that for all covariate variables, the Mean VIF is 1.32, so that these covariate variables were included in the model (Annex 3).

4.5.2 Determinants of household food security

The second phase of the Propensity Score Matching (PSM) involves the application of a binary logistic regression model aimed at identifying the factors influencing participation in the Productive Safety Net Programme (PSNP). In this research, the binary logistic regression model was utilized to ascertain the determinants affecting household participation in the program. This method was chosen to evaluate the variables that significantly contribute to the food security of households. The application of F-statistics revealed that the explanatory variables were statistically significant, with a p-value of 0.0348, indicating a good fit of the binary logistic regression model to the data. Consequently, the Goodness-of-Fit Test for the model was satisfactory, as the significance levels of the independent variables fell within the optimal range. Additionally, the results from the logit estimation analysis indicated a pseudo-R2 value of 0.1506, which is relatively low, suggesting a systematic difference in the distribution of covariate variables between participants and non-

participants. The pseudo-R2 value reflects the extent to which the model explains the food security variables. Following the matching process, it is expected that there will be no systematic differences in the distribution of covariates between the two groups, resulting in a relatively low pseudo-R^2 (Caliendo and Kopeinig, 2005). To identify the variables that significantly impact food security, the researcher incorporated eight socio-economic variables into the model analysis: cons, Market_CENT, TRAINING, LOAN_ACCESS, SIZEHH, SIZEFARM, EDUCATION, and TOTAL_FCS. Among these eight explanatory variables, only two Household head's EDUCATION status (0.032) and LOAN ACCESS (0.018) were found to have a significant effect on the food security of farming households. The coefficients of these variables indicated that while the educational status of the household head was negatively associated with participation in the PSNP, access to loans had a positive influence on household participation in the program, highlighting the critical role of this factor.

Table 13 Regression output table for determinants of food security

Source	SS	df	MS		Number of obs =	98
	F(7, 90) =	2.28				
Model	3.56603379	7	.509433398		Prob > F =	0.0348
Residual	20.1074356	90	.223415951		R-squared =	0.1506
	=				Adj R-squared=	0.0846
Total	23.6734694	97	.244056385		Root MSE =	.47267
TYPE_BENEF	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
TOTAL_FCS	.0033391	.0052736	0.63	0.528	0-.0071379	.013816
EDUCATION	-.1929632	.0884091	-2.18	0.032	0-.3686032	-.0173231
SIZEFARM	-.1604683	.4409731	-0.36	0.717	0-1.036538	.7156017
SIZEHH	-.0089853	.0296851	-0.30	0.763	0-.06796	.0499894
LOAN_ACCESS	.2638749	.1098912	2.40	0.018	0 .0455567	.482193
TRAINING	.0460315	.1481936	0.31	0.757	0 -.2483809	.3404439
Market CENT	.1506923	.186988	0.81	0.422	0 -.220792	.5221765
_cons	.3308001	.3253831	1.02	0.312	0-.3156302	.9772304

4.5.3 Matching quality and common support

An additional crucial aspect of assessing the validity or effectiveness of the PSM estimate involves evaluating the common support or overlap condition. It is posited that the probability of engaging in the PSNP program ranges from 0 to 1. Furthermore, a key component in analyzing the validity or performance of the PSM estimation is the confirmation of the common support or overlap condition. It is assumed that the probability of participation in the PSNP program, given the observed characteristics, falls between 0 and 1 ($0 < P(D = 1/X) < 1$). The accompanying figure illustrates the balanced distribution between treatment and control households, highlighting the cases excluded from the analysis to prevent poor matches. A visual examination of the density distribution for both participants and non-participants indicates that the general support condition is satisfied, as evidenced by the exclusion of four unmatched households from the PSNP cohort, as depicted in Figure 8 below.

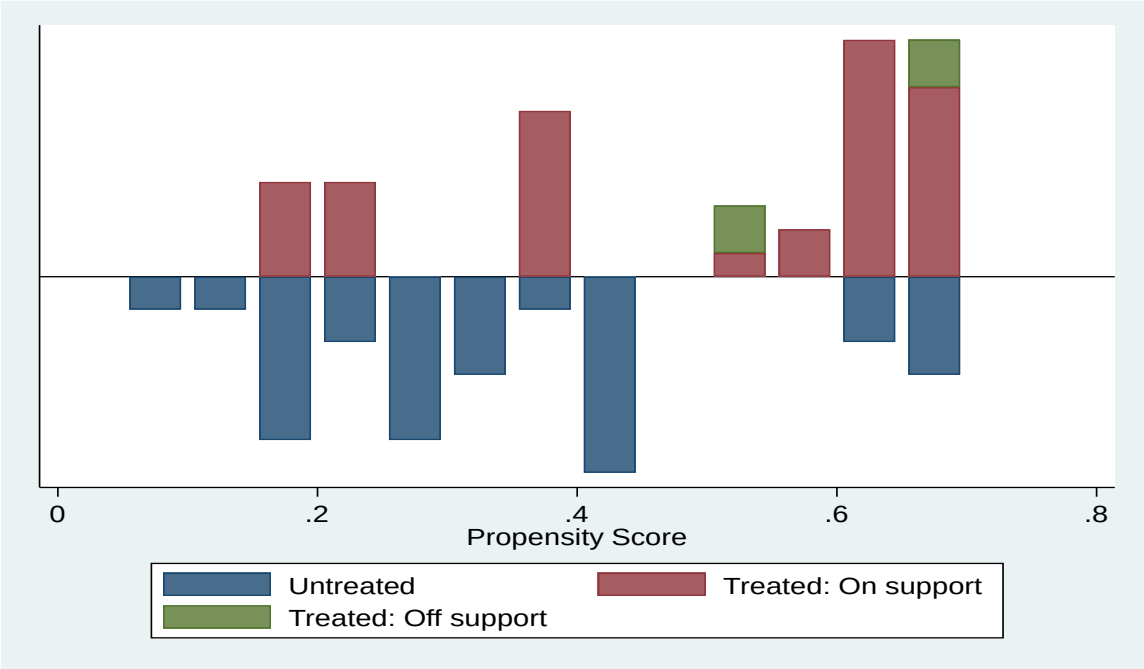

Figure 8 Common support area by comparison of participant and non-participant

Propensity score values showed that the households obtained a mean value of 0.497706, that ranges between 0.1809964- 0.6645323. On the other hand, the PSNP households obtained the mean value of 0.3464097 that ranges from 0.0579759- 0.6633588 (Table 13).

Table 14 Summary of propensity score for common support region

Group	Observation	Mean	STD	Min	Max
Non-PSNP HHs	96	.497706	.1835987	.1809964	.6645323
PSNP HHs	96	.3464097	.171482	.0579759	.6633588

This indicates that the overall common support region for farther comparison is conducted on households who obtained FCS within a range of 0.1809964-0.6633588 only. This means those households who obtained a propensity score less than 0.1809964 and larger than 0.6633588 were removed from impact comparison and considered in farther analysis as indicated in Figure 9.

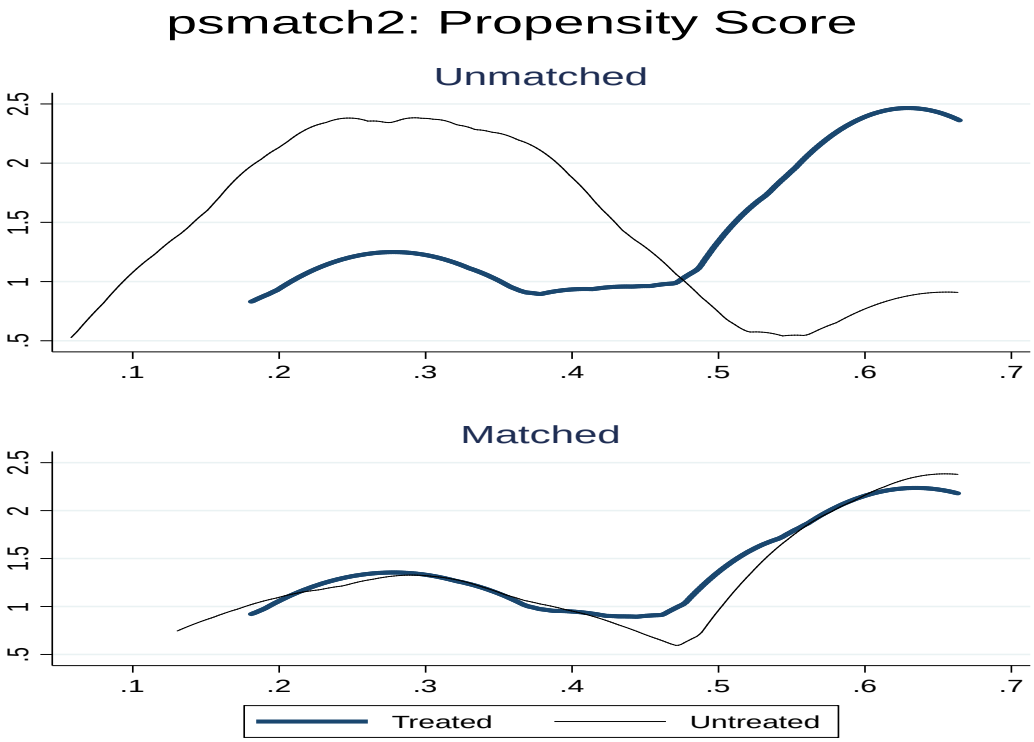

Figure 9 Propensity score for matching versus unmatched

4.5.4 Matching PSNP households with non-PSNP households by choosing matching algorithm

In this research, the optimal matching algorithm selected was characterized by a substantial matched sample size, a number of insignificant variables post-matching, a low pseudo-R2 value, and minimal mean standardized bias. The predominant matching estimators utilized included Nearest Neighbor Matching, Caliper and Radius Matching, Stratification and Interval Matching, as

well as Kernel and Local Linear Matching. Consequently, one of the matching algorithms was chosen based on its high matching sample size, low pseudo-R2 value, and strong matching balance (Dehejia and Wahba, 2002). The findings presented in Table 23 revealed that the Kernel bandwidth estimator with a value of 0.1 emerged as the most effective matching estimator, fulfilling all the aforementioned criteria and being employed for the final analysis of the impacts of the PSNP on the food security status of participant households, in comparison to non-PSNP households that were well-aligned within the common support region. The results indicated that the Bandwidth (0.1) estimator was the most suitable for the data, exhibiting a low pseudo-R2 value of 0.008 and the smallest mean standardized bias of 3.7 when compared to other alternative matching estimators, as shown in Table 14.

Table 15 Performance criteria of different Matching algorithms

Matching estimators	# insignificant after matching	Pseudo-R^2 after matching	Sample size	Matched Mean SB
Kernel matching				
- Bandwidth 0.1	6	0.008	192	3.7
- Bandwidth 0.50	5	0.055	192	9.7
- Bandwidth 0.25	5	0.011	192	8.1
Nearest neighbor matching				
- logit neighbor (1)	5	0.051	192	15.8
- logit neighbor (2)	6	0.051	192	15.6
Caliper matching				
- Bandwidth 0.1	5	0.061	192	19.2
- Radius 0.5	6	0.051	192	15.8

4.5.5 Testing the balance of propensity score and covariates

Following the selection of the most effective matching algorithm, the subsequent task is to evaluate the balance of propensity scores and covariates through a series of steps utilizing the chosen matching algorithm. The primary objective of estimating the propensity score is not to achieve an exact prediction of treatment selection, but to ensure that the distribution of relevant variables is balanced across both groups. The effectiveness of the estimation in achieving this balance is assessed through various testing methods, including the reduction of mean standardized bias between matched and unmatched households, as well as the equality of means assessed via t-tests and chi-square tests for joint significance concerning the covariate variables employed. In this study, the selected optimal matching algorithm, specifically Kernel matching with a bandwidth of

0.1, is applied to evaluate the balance of propensity scores and explanatory variables. The findings revealed that the standardized bias difference among explanatory variables prior to matching ranged from 0.24% to 36.31% (Annex 5) in absolute terms; however, post-matching, the remaining standardized error differences among explanatory variables fell between 0.9% and 13.6% (Table 15). Consequently, these values remained within the recommended acceptable threshold, with the mean bias below the critical level of 20% after the matching process was completed (Rosenbaum and Rubin, 1985). Thus, the matching procedure effectively establishes a high degree of covariate balance between the treatment and control groups, making them suitable for subsequent estimation analyses.

Table 16 Propensity score and covariate balancing

Variable	Mean		t-test	V(T)/		V(C)
	Treated	Control	% bias	t	p>t	
EDUCATION	1.2778	1.2638	2.5	0.12	0.908	1.61
SIZEFARM	0.22041	.23608	13.6	0.61	0.544	1.07
SIZEHH	5.4722	5.373	4.9	0.23	0.819	1.24
LOAN_ACCES	.69444	0.69002	0.9	0.04	0.968	.
TRAINING	0.89145	.86111	-7.2	-0.39	0.701	.
Market_CENT	0.94012	.94444	1.6	0.08	0.938	.

Furthermore, following the matching process, the low pseudo-R2 value (0.008) and the insignificant likelihood ratio tests lend support to the hypothesis that both groups exhibit the same distribution in covariates post-matching (refer to Table 16). These findings distinctly indicate that the matching procedure effectively balances the characteristics of the treated group and the matched comparison group. Consequently, we utilized these results to assess the impact of PSNP participation among households with comparable observed characteristics. This enabled us to compare the observed outcomes of beneficiary households with those of non-beneficiary households.

Table 17 Overall, balance indicators of covariates using Kernel bwidth 0.1 matching

Sample	Pseudo-R2	LR chi2	p>chi2	Mean Bias	Med Bias
Un matched	0.011	0.978	7.9	8.1	24.7
Matched	.008	0.992	5.1	3.7	20.7

4.5.6 Estimating average treatment effect on treated

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. Hence, this section evaluates the program's impact on outcome variables, specifically food security, as measured by the Food Consumption Score (FCS), and the total annual income of households. The analysis employs the Propensity Score Matching (PSM) model, controlling for pre-intervention differences. As noted by Caliendo and Kopeinig (2008), a critical decision in the empirical analysis involved the measurement of effects. The results from the Kernel bandwidth estimation (0.1), conducted after matching households within the common support region, indicated that PSNP households achieved a mean FCS of 37.0833, while non-PSNP households had a mean FCS of 37.1487652. Although the non-PSNP households exhibited a slightly higher score, the difference in FCS between the two groups was not statistically significant according to T-test statistics. Furthermore, the estimation results revealed that non-PSNP households had a significantly higher mean annual income of 28,300.00 ETB compared to the PSNP participants, who earned a mean annual income of 23,768.44 ETB, with a significance level of 1% (refer to Table 17). This finding aligns with the conclusions drawn by Hadush (2014).

Table 18 Average Treatment impact on Treated using Food Consumption Score

Variable	Sample	Mean Score		Difference	S.E.	T- stat
		Treated	Controls			
TOTAL_FCS	ATT	37.083333	37.1487652	-.065431916	2.52261198	-0.03
ANNUAL_INCO		23768.44	28300.00	-4,531.56	27.07051	1.9845*

*= significant at 1%

4.5.7 Sensitivity analysis

The final phase of implementing Propensity Score Matching (PSM) involves assessing the sensitivity of the estimated outcomes (Caliendo and Kopeining, 2005). The robustness test aims to quantify the increase in uncertainty that arises when a critical assumption is relaxed. This test was conducted to investigate the presence of unobservable variables that may affect participation in the Productive Safety Net Program (PSNP) and subsequently alter the estimated Average Treatment Effect on the Treated (ATT) as well as the conclusions regarding the impact of participation on outcome variables, such as Food Consumption Score and Annual Household Income. However, it is important to note that this assumption cannot be tested in principle, as the data lacks information

regarding the distribution of untreated outcomes for treated groups and vice versa (Becker and Caliendo, 2007). To evaluate potential unobservable biases, a sensitivity analysis was performed on the calculated outcome variables utilizing the Rosenbaum bounding method, focusing on deviations from the conditional independence assumption.

As presented in Table 18, various critical levels of e raise questions regarding the causal inference of significant outcomes associated with PSNP participation. The first column of the table lists different gamma (e) values for selected outcome variables that exhibit statistical differences between households participating in PSNP and those that do not, as reflected in the impact estimates. The remaining values in each row correspond to p-critical values (or the Wilcox upper bound at the −Sig+ level of significance) at varying critical levels. The findings indicate that while there is a notable difference of up to 340% (e = 3.4) in treatment chances between participating and non-participating households concerning unobserved covariates on an annual basis, the conclusion regarding the impact of PSNP on the Food Consumption Score (FCS) remains unchanged. This suggests that for all outcome variables assessed at different critical values of e, the p-critical values were significant, further demonstrating that the study adequately accounted for essential covariates influencing both participation and outcome variables.

Consequently, it is concluded that the average treatment effect on the treated (ATT) estimates for each outcome variable in this study are robust against unobserved selection bias. This implies that for the estimated outcome variable at various critical levels of eY, the p-critical values remain significant, indicating that the researcher has taken into account crucial covariates affecting both participation and outcome variables. The researcher was unable to identify a critical value eY at which the estimated ATT could be questioned, even when setting eY as high as 2, a value referenced in various literature (Caliendo and Kopeinig, 2005). Therefore, it can be concluded that the impact estimates (ATT) derived from this study are not sensitive to unobserved selection bias and represent the true effect of PSNP, as illustrated in Tables 18 and 19.

Table 19 Rosenbaum bounds for TOTAL_FCS (N = 192 matched pairs)

Gamma	sig+	sig-	t-hat+	t-hat-	CI+	CI-
1	0	0	34	34	32.5	35.5
1.1	0	0	33.75	34.5	32.25	36
1.2	0	0	33.25	34.75	32	36.5
1.3	0	0	33	35.25	31.5	36.75
1.4	0	0	32.5	35.5	31.25	37.25

1.5	0	0	32.25	36	31	37.5
1.6	0	0	32	36.25	30.75	38
1.7	0	0	31.75	36.5	30.5	38
1.8	0	0	31.75	36.75	30.25	38.5
1.9	0	0	31.5	37	30	38.75
2	0	0	31.25	37.25	30	39

* Gamma - log odds of differential assignment due to unobserved factors

sig+ - upper bound significance level

sig- - lower bound significance level

t-hat+ - upper bound Hodges-Lehmann point estimate

t-hat- - lower bound Hodges-Lehmann point estimate

CI+ - upper bound confidence interval (a= .95)

CI- - lower bound confidence interval (a= .95)

Table 20 Rosenbaum rbound for different critical level of gamma

Gamma level	Outcome	sig+	sig-	t-hat+	t-hat-
$e^{\gamma} = \Gamma = 1$	TOTAL_FCS	0	0	34	34
$e^{\gamma} = \Gamma = 1$	ANNUAL_INCO	0	0	22768.33	22768.33

4.6 Comparison of Participants with Non-Participants by Using Different Parameters

4.6.1 Income sources of the respondent households

The income sources of the households surveyed in the study area encompassed various categories, including agricultural, non-agricultural, and casual employment activities. Specifically, farmers derived income from the sale of agricultural products such as grains, fruits, and vegetables. Additionally, income was generated through livestock sales, which included oxen, shoats, and poultry, as well as beekeeping and honey production. Non-agricultural income sources were identified as livestock trading (involving shoats, oxen, poultry, eggs, and camels), produce trading, grain trading, chat trading, leasing of farms, and participation in other income-generating ventures. Furthermore, examples of casual non-agricultural income sources included charcoal collection, firewood gathering, logging, construction work, water transportation, mud work, and stone carving.

4.6.1.3 On-farm income

In the study area, the mean annual income from farm activity is 15711.32±12258.62 birr. The result also shows that the PSNP households obtained a mean total of 11295.11±7662.675 birr of annual income, while those of the non-PSNP households obtained 19857.14±14207.53 birr of an annual income from on-farm activities. The independent t-test statistics show that statistically, the non-PSNP households got significantly higher annual income (p= 0.0000, df= 192, t = 5.1225) than the PSNP households from on-farm activities (Table 20). The data shows that non-PSNP households have significantly higher on-farm incomes compared to PSNP households. This suggests a disparity in agricultural productivity or resource utilization, possibly impacting overall food security and economic stability for PSNP households. The lower on-farm incomes among PSNP households might indicate that the program does not adequately support agricultural development. This could mean that PSNP primarily functions as a safety net rather than empowering households to increase agricultural output and profits. Reasons for Non-PSNP Better Performance in On-Farm Income is Non-PSNP households may have better access to agricultural inputs, land, water, or credit facilities, allowing them to achieve higher productivity. They might also possess more extensive agricultural knowledge or engage in higher-value crops. The income disparity could point to systemic issues like unequal land distribution or insufficient agricultural support services for PSNP households. Access to improved seeds, technology, and training might be less available to PSNP participants, contributing to lower on-farm income.

Table 21 Two-sample t test with equal variances for On-farm income level

Group	**Obs**	**Mean**	**Std. Err.**	**Std. Dev.**
Non PSNP	98	19857.14	1435.178	14207.53
PSNP	92	11295.11	798.8891	7662.675
Combined HH	190	15711.32	889.3335	12258.62
Difference	8562.034	1671.443	5264.841	11859.23

diff = mean(No)	**- mean(Yes)**			**t =**	**5.1225**
Ho: diff = 0		degrees	of	freedom =	188
Ha: diff < 0	Ha:	Diff	!= 0	Ha: diff	> 0
Pr(T < t) = 1.0000	Pr(T >	t)	= 0.0000	Pr(T > t) =	0.0000

4.6.1.4 Off-farm income

In the research area, the average annual income derived from non-farm activities for the households involved in the study is 4605.789±9153.488 birr. The findings further indicate that the mean annual income from off-farm activities for the total PSNP household respondents is 3925 birr, while non-PSNP household respondents report a mean annual income of 5244.898 birr. The t-test results (p=0.0000, t= -14.915) demonstrate that non-PSNP households significantly earn a higher annual income from off-farm activities (refer to Table 21). The findings reveal that non-PSNP households also earn significantly higher off-farm incomes. This suggests that these households may have more diversified income streams and opportunities beyond agriculture, which could provide economic resilience.

Lower off-farm incomes for PSNP households suggest that the program might not effectively facilitate access to non-agricultural employment or entrepreneurship opportunities. This could limit the economic independence and diversification potential for PSNP participants. Non-PSNP households likely benefit from better access to employment opportunities, education, or business networks. These households might be situated in areas with better infrastructure, allowing easier engagement in trade or services. The differences in off-farm income could highlight systemic barriers such as limited access to education and vocational training, financial services, or entrepreneurial support for PSNP households. Addressing these barriers could improve income diversification and resilience.

Table 22 Two-sample t test with equal variances for Off-farm income level

Group	Obs	Mean	Std. Err.	Std. Dev.
Non-PSNP	98	5244.898	1070.182	10594.26
PSNP	92	3925	762.3664	7312.362
combined	190	4605.789	664.0638	9153.488
diff	1319.898	1328.837	-1301.45	3941.246
diff = mean (No)- mean (Yes)			t = 0.9933	
Ho: diff = 0		Degree of freedom= 188		
Ha: diff < 0 Ha: diff >0			Ha: diff > 0	
Pr(T < t) = 0.8391 Pr(T > 1) = 0.3219			Pr(T > t) =0.1609	

4.6.1.5 Income from remittance

In the present study area, the mean annual income from remittance, gift or other transfer to combined household is 3304.455±4214.593 birr. The result also shows that the total income from remittance to PSNP household was about 6498.332±3962.537 birr, while the non-PSNP households earn a total of 306.1224±1059.159 birr. The comparative statistics between the two household groups showed that concerning the total annual income from remittance, gift or other transfer, the PSNP households earn significantly (t= -14.915, df= 188, p=0.0000) higher annual income (Table 22). Like this result, Mesfin Woldetsadik (2018) reported that regarding to income from remittance, the PSNP beneficiary households obtained significantly higher income from remittance, gift or other transfer from Kuyu district, Central Ethiopia.

Remittances significantly enhance the economic stability of PSNP households, as indicated by their substantially higher remittance incomes compared to non-PSNP households. This additional income can provide a crucial financial buffer, helping PSNP households meet immediate needs and potentially invest in income-generating activities, thereby enhancing their economic resilience. The disparity in remittance income between PSNP and non-PSNP households might be attributed to differences in migration patterns or network connections. PSNP households may have stronger familial or community ties abroad, leading to more substantial remittance flows. Furthermore, economic necessity might drive more members of PSNP households to migrate and send money back home, compared to non-PSNP households. The findings of Adams and Cuecuecha (2010) on remittances and poverty alleviation support this findings.

Table 23 Two-sample t test with equal variances for Remittance from Relatives and others

Group	**Obs**	**Mean**	**Std. Err.**	**Std. Dev.**	**[95% Conf.**	**Interval]**
Non-PSNP	98	306.1224	106.9912	1059.159	93.7745	518.4704
PSNP	92	6498.332	413.123	3962.537	5677.713	7318.95
combined	190	3304.455	305.7587	4214.593	2701.317	3907.593
diff	-	415.1668	-7011.193	-5373.225	6192.209	

diff = mean(No) - mean(Yes)				t = -14.9150
Ho: diff = 0		degrees	of	freedom = 188
Ha: diff < 0	Ha:	diff	!= 0	Ha: diff > 0
Pr(T < t) = 0.0000	Pr(T >	t)	= 0.0000	Pr(T > t) = 1.0000

4.6.1.6 Income from daily laborer

The data regarding income from daily laborer, the combined households obtained 1889.362±4211.519. Beside this the result also shows that the PSNP household respondents' obtained a total of 1132.609±2246.81 birr, while the non-PSNP households obtained a mean total of 2614.583±' 5384.422 birr. The t- test (p=0.0155, t= -14.915) showing that the non-PSNP households obtained significantly higher annual income from daily laborer than the PSNP households (Table 23).

Table 24 Two-sample t test with equal variances daily labours

Group	Obs	Mean	Std. Err.	Std. Dev.
Non-PSNP	96	2614.583	549.5452	5384.422
PSNP	92	1132.609	234.2461	2246.81
combined	188	1889.362	307.1566	4211.519
diff	1481.975	606.4434	285.583	2678.366
diff = mean(No)- mean(Yes)			t = 2.4437	
Ho: diff = 0		Degree of freedom= 186		
Ha: diff < 0 Ha: diff >0			Ha: diff > 0	
Pr(T < t) = 0.8391 Pr(T > 1) = 0.0155			Pr(T > t) =0.0077	

4.6.1.7 Annual income of households

The annual income of households is a crucial determinant in asset accumulation, significantly influencing food security within the study area. The overall descriptive statistics indicate that the mean annual income for the sampled households, which encompasses earnings from on-farm, off-farm, and non-farm activities, amounts to 26,105.77 ± 15,851.59 birr. A detailed analysis reveals that households participating in the Productive Safety Net Program (PSNP) have an average annual income of approximately 23,768.44 ± 12,717.6 birr, whereas non-PSNP households report a higher average of 28,300 ± 18,105.66 birr. An independent t-test demonstrates that non-PSNP households achieve a significantly greater annual income (p = 0.0155, t = -14.915) when aggregating income from all sources compared to their PSNP counterparts (refer to Table 24).

Table 25 Two-sample t test with equal variances for annual income level

Group	Obs	Mean	Std. Err.	Std. Dev.
Non-PSNP	98	28300	1828.948	18105.66
PSNP	92	23768.44	1325.901	12717.6
combined	190	26105.77	1149.995	15851.59
diff	4531.56	2283.456	27.07051	9036.049
diff = mean(No)- mean(Yes)			t = 1.9845	
Ho: diff = 0		Degree of freedom= 188		
Ha: diff < 0 Ha: diff >0			Ha: diff > 0	
Pr(T < t) = 0.8391 Pr(T > 1) = 0.0487			Pr(T > t) =0.0243	

Source: own data

Household income is derived from various activities, including livestock and crop production, small-scale trade, employment, and the sale of natural products, which support diverse economic, social, and cultural endeavors. Additionally, Mesfin Getaneh (2024) indicates that, overall, PSNP members possess lower asset levels and resilience, along with significantly reduced income compared to non-members in the Wolita Zone of southern Ethiopia. Furthermore, Tirungo Leimango (2018) corroborates that PSNP beneficiary households earn statistically significantly higher annual incomes than non-PSNP households in Misha Woreda, Hadiya Zone, Southern Region, Ethiopia. Conversely, Muluken MogeS (2019) reported that PSNP beneficiaries have higher annual incomes than non-beneficiary households, highlighting a statistically significant difference in annual income between the two groups. income (Muluken Moges, 2019).

Table 26 Effects of PSNP on usual number of meals taken per day on participant households

	Category of HH	N	Mean	Std. Deviation	Sig. (2-tailed)
Do you take one meal per day for your household?	Non-PSNP	98	.2041	.40510	
	PSNP	92	.1196	.32623	.114
Do you take two meals per day for your household?	Non-PSNP	98	.7959	.45315	
	PSNP	92	.8370	.37143	.495
Do you take three meals per day for your household?	Non-PSNP	98	.7959	.40510	
	PSNP	92	.5326	.50167	.000

4.6.2 Engagement in public work

Data collected from participants in this study indicated that households involved in the PSNP are more engaged in public work and TDS BCC (p=.004) compared to those not participating in the PSNP. The program is designed to assist households in the study area in fulfilling their consumption requirements through various means, particularly by enhancing their knowledge relative to baseline consumption levels. For instance, PSNP households reported significantly (p=0.017) greater discussions regarding health and nutrition services than their non-PSNP counterparts (Table 26). These results align with findings from Diriba (2017), who noted that 44% of respondents observed improvements in their living conditions and food security after becoming beneficiaries of the program. Consequently, this conclusion is consistent with the objectives outlined in the PSNP Program Implementation Manual (FDRE-MoA, 2016).

4.6.3 Impact of PSNP on food consumption smoothening

As a fundamental element of the food security initiative implemented by the Ethiopian Government in collaboration with donors, the Productive Safety Net Program (PSNP) seeks to deliver more consistent and timely support to households experiencing chronic food insecurity. Consequently, food consumption is utilized as an impact indicator for evaluating the effectiveness of productive safety net programs in safeguarding household food intake. In this framework, the effect of the PSNP on the food security status of households within the selected study area is analyzed. The current study revealed that data on daily consumption frequency indicated that non-PSNP households were significantly more likely to consume food three times a day (p = .000), as evidenced by a relatively higher mean value (0.7959±0.40510) compared to PSNP households (Table 25). This observation aligns with the findings of Mebratu Negera (2021), who noted a significant difference in daily meal frequency favoring non-PSNP households in his research on the impact of the Productive Safety Net Program on household food consumption and dietary diversity in Ethiopia. Conversely, this result contradicts the findings of Bahru et al. (2020), which indicated that during the third round of the PSNP, households participating in the program had a greater meal frequency ($p < 0.001$).

Table 27 Participation and access of household groups in social affairs

	Category of HH	N	Mean	Std. Deviation	Sig. (2-tailed)
Public work and TDS BCC	Non PSNP	98	.3061	.46325	
	PSNP	92	.5109	.50262	.004
Food demonstration	Non PSNP	98	.2449	.43224	
	PSNP	92	.2717	.44729	.675
Community participatory	Non PSNP	98	.0408	.19888	
	PSNP	92	.0000	.00000	.045
VESA discussion on health and nutrition services	Non PSNP	98	.6122	.48974	
	PSNP	92	.7717	.42201	.017

4.6.4 Impact of PSNP on livelihood diversification options

In the study area, data on livelihood diversification options showed that, while the two groups of households were not significantly differed on on-farm (agricultural activities) and off-farm activities, the PSNP households more significantly accessed the non-farm livelihood diversification options than those of the non-PSNP households. As confirmed during focus group discussion, the PSNP beneficiary households has got more created by the programme and have more option to participate in non-farm activities like beekeeping and beekeeping/honey production, trade in produce, trade in grain, chat trade, lease farms, and others income-generating activities were grouped as non-agricultural sources of income (Table 27). Similar to this result, Mesfin Woldetsadik (2018) reported that regarding to non-farming income like from remittance, the PSNP beneficiary households obtained significantly higher income like from remittance, gift or other transfer from Kuyu district, Central Ethiopia.

Table 28 Livelihood diversification options for households over the last 12 months

What is the livelihood diversification options for households over the last 12 months?	Category of Households	N	Mean	Sig. (2-tailed)	Std. Deviation
On-farm (agricultural activities) was practiced for the households in the area?	Non PSNP	98	.9388		.24097
	PSNP	92	.9783	.171	.14663
What types of off-farm practiced in the study area?	Non PSNP	98	.4082		.49402
	PSNP	92	.3261	.243	.47135
What types of non-farm	Non PSNP	98	.1224		.32949

practiced in the study area?	PSNP	92	.9783	.000	.14663
Casual labor activity	Non PSNP	98	.3673		.48456
	PSNP	92	.2826	.214	.45273

4.6.5 Impacts of PSNP in soil-water conservation and rehabilitation

Land degradation resulting from soil erosion and deforestation is a prevalent issue in Ethiopia, particularly in the highland regions, which constitute approximately 45% of the nation's total land area. In areas with steep slopes, the estimated annual soil erosion rate reaches about 114.59 tons per hectare per year (Tegegne, 2014). The degradation of land resources, especially due to water-induced soil erosion and adverse climatic conditions, has hindered productivity in the agricultural sector. To combat this decline in agricultural productivity, the country has implemented soil conservation measures for an extended period (Simeneh, 2016). In this context, the Ethiopian Productive Safety Net Project has been established as a key component of the program and is currently being executed.

This study aims to evaluate the practices and impacts of soil and water conservation in the designated area. Based on insights gathered from focus group discussions and key informant interviews, both households participating in the PSNP and those not involved reported engagement in soil and water conservation practices. The quantitative analysis presented in Table 20 indicates that non-PSNP households significantly ($p= 0.004$) engage in physical soil and water conservation practices more than their PSNP counterparts.

The PSNP households exhibit a significantly higher engagement in conservation agricultural practices ($p=0.009$) compared to non-PSNP households. These practices include physical soil and water conservation measures, biological interventions, integrated biophysical strategies, afforestation through tree planting, natural regeneration and reforestation, as well as the implementation of climate-smart agriculture and integrated watershed management activities. The Project plays a vital role by providing cash payments, energy-saving cooking stoves, and solar pumps and lanterns (refer to Table 28).

In a similar vein, Abineh Tilahun and Bogale Teferie (2015) noted that the Ethiopian Productive Safety Net Programme invested substantial funds to support soil and water conservation practices through labor payments, the distribution of energy-saving cooking stoves, and the installation of

solar panels in the Matekel district of the West Gojam zone, Ethiopia. Furthermore, Porras et al. (2007) highlighted that while the PSNP has offered various short-term incentives that have promoted the adoption of conservation measures, some direct incentives, such as cash and Food-For-Work programs, have led to a diminished sense of ownership once these incentives are withdrawn. In terms of the utilization of energy-saving cooking stoves, solar pumps, and solar lights, PSNP households demonstrated a significant ($p<0.05$) preference for these technologies. These innovations are particularly beneficial for smallholder households facing shortages of firewood and the excessive smoke produced by traditional wood and dung fuels. The expansion of these technologies would yield dual benefits by mitigating deforestation and alleviating the workload of women.

Table 29 The roles of PSNP interventions in land rehabilitation and Restoration

	Are you currently a beneficiary of the PSNP?	N	Mean	Sig. (2-tailed)	Std. Deviation	Std. Error Mean
Physical SWCs	No	76	.5526		.50053	.05741
	Non PSNP	86	.6395	.004	.48295	.05208
Biological measures	PSNP	76	.3684	.264	.48558	.05570
	Non PSNP	86	.3605		.48295	.05208
Integrated biophysical measures	PSNP	76	.3947	.917	.49204	.05644
	Non PSNP	86	.5233		.50239	.05417
Afforestation through tree plantation measures	PSNP	76	.9474	.102	.22478	.02578
	Non PSNP	86	1.0000		.00000	.00000
Natural regeneration/reforestation	PSNP	76	.9474	.045	.22478	.02578
	Non PSNP	86	.9767		.15160	.01635
Supply of energy saving cooking stoves	PSNP	76	.1316	.038	.34028	.03903
	Non PSNP	86	.0930		.29217	.03151
Supply of solar pump and lantern	PSNP	76	.3421	.043	.47757	.05478
	Non PSNP	86	.1628	.	.37134	.04004
Implementation of CSA and integrated watershed management activities	PSNP	76	.6053	.009	.49204	.05644
	Non PSNP	86	.6512	.549	.47940	.05169

5 SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Summary and Conclusion

Chronic food insecurity has been a significant issue impacting millions of Ethiopians for centuries. To address this challenge, the Ethiopian government, in partnership with development organizations, initiated the Productive Safety Net Program in 2005, moving away from the previous reliance on annual emergency appeals. Consequently, it is essential for the government to assess the outcomes of this program to inform future poverty reduction strategies. This study focused on evaluating the effects of the Productive Safety Net Program on the food security of rural households in Chiro Woreda, located in the West Hararghe Zone of the Oromia Regional State, Ethiopia. A multi-stage probability sampling technique was utilized to select the sample respondents. To gather comprehensive information for this research, both primary and secondary data collection methods were employed. Primary data were collected from 192 respondents, comprising both program beneficiaries and non-beneficiary households, through survey questionnaires, focus group discussions, and interviews with key informants. Additionally, relevant secondary data were reviewed from various sources. The gathered data were meticulously analyzed using descriptive and inferential statistical methods, as well as econometric analyses.

The demographic information pertinent to household food security presented here includes family size, dependency ratio, age of the household head, and gender. In the Chiro district of this study area, the data indicates that the average family size is 5.4526±2.069. The proportion of dependent members within households is approximately 47.70%, which appears significantly high in comparison to other regions. Regarding the age of the household heads, the average age among respondents is 41.6458±12.041. The age of the household head is a critical characteristic that may influence the food security status of the household. Additionally, the socio-economic data reveals that a majority of households in the study area possess farmland (96.9%), although the average plot size is notably small.

The findings of this study indicate that, although only a limited number of households reported participating in the process, the targeting criteria outlined in the implementation guidelines are, to some extent, being utilized by the food security task forces operating at various levels, from woreda to community. Factors taken into account include experiences of shocks, land ownership, livestock ownership, age, female-headed households, and asset loss, which contribute to their inability to sustain themselves. Additionally, the payment method aligns with the preferences of the majority of

beneficiaries, being provided in both cash and food. The community has also affirmed that the payment amounts have significantly aided them in alleviating poverty.

The findings from the logit model indicate that, out of the eight covert variables analyzed, only two had a statistically significant effect ($p<0.05$) on household participation in the Productive Safety Net Program (PSNP). Specifically, access to loans was found to have a positive influence on household participation, whereas the educational status of the household head negatively impacted participation in the program. After accounting for confounding variables, the initial sample of 92 beneficiary households and 98 non-beneficiary households was refined, resulting in a matched sample of 35 beneficiary households paired with 50 non-beneficiary households using a kernel matching estimator with a bandwidth of 0.1. Consequently, 85 households were ultimately selected for the estimation process after excluding those with propensity score values outside the common support region. Following the established criteria for the matching algorithm, the Average Treatment Effect on the Treated (ATT) was computed. The results indicated that participation in the PSNP did not have a positive effect on the Food Consumption Score (FCS) or the total annual income of the households. However, the project appeared to have a favorable impact on the daily meal frequency and off-farm income of participating households when compared to non-PSNP households. Overall, the evidence suggests that the program did not significantly alter the food security status of participant households, as reflected in the food consumption score and total annual income. Therefore, it is advisable for development interventions to concentrate on enhancing the benefits available to program beneficiaries.

A sensitivity analysis was ultimately conducted on the estimated average treatment effect utilizing Rosenbaum bounding procedures to assess the potential hidden bias arising from unobservable selection. The results demonstrate that all estimated average treatment effects for both outcome variables exhibit insensitivity, thereby clearly indicating their robustness.

5.2 Conclusions

Numerous household characteristics, particularly the accessibility of loans and the educational attainment of the household head, play a crucial role in determining household participation in the PSNP program. The findings of this study indicate that the targeting criteria outlined in the implementation guideline manual have been instrumental in the selection of beneficiary households.

Despite the fact that most households in the study area achieved an average Food Consumption Score (FCS) within the borderline range, participation in the productive safety net program has not yielded a positive effect on either the FCS or the total annual income of these households. Nevertheless, when considering the frequency of daily meals and off-farm income, the project appears to have a favorable impact compared to households not participating in the PSNP. Overall, the results imply that the program has not significantly altered the food security status of participating households, as reflected in the food consumption score and total annual income. Therefore, it is advisable for development interventions to concentrate on enhancing the benefits available to program beneficiaries.

5.3 Recommendations

Based on the above conclusions drawn from the present study results, the researcher would like to forward the following recommendations:

- It is better to consider critically about the targeting process since the researcher observed that some chronically food insecure households in the study area left unconsidered in the project beneficiaries. This might be associated to few biasedness tendencies on behalf of responsible committees as well as some administrative bodies.
- It is better if the program increases its coverage to reach the whole food insecure households and also increasing numbers of family members under the benefit
- As the results imply that the program has not significantly altered the food security status of participating households, it is advisable for development interventions to concentrate on enhancing the benefits available to program beneficiaries.

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LIST OF APPENDICES

Annex 1. Number of days that most members of your household (50% +) eat over the last 7 days food items inside or outside the home

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Cereals, grains, roots and tubers	192	2.00	7.00	6.4687	1.10167
Pulses/legumes, nuts and seeds	192	.00	7.00	2.3958	2.24648
Milk and other dairy products,	192	.00	7.00	1.2083	1.72093
Meat, fish and eggs	192	.00	3.00	.0990	.41642
Vegetables and leaves	192	.00	7.00	4.6406	2.33369
Fruits	192	.00	3.00	.3490	.73655
Oil/fat/butter	192	.00	7.00	5.9323	2.22800
Sugar, or sweet/sugary drinks	192	.00	7.00	2.8750	1.84334
Condiments	192	.00	7.00	5.6979	2.20005

Annex 2. Recommendations of benefit transfer modality

		Responses		Percent of Cases
		N	Percent	
Recommendations[a]	Increasing awareness about climate change induced shocks and vulnerability issues	180	12.1%	93.8%
	Increase knowledge about food security dimensions!	153	10.3%	79.7%
	Increase financial capital of households!	173	11.6%	90.1%
	Increase access to agricultural input technology.	145	9.7%	75.5%
	Increase market access.	114	7.7%	59.4%
	Increasing access to irrigation technology	118	7.9%	61.5%
	Increasing natural resource restoration	153	10.3%	79.7%
	Strengthening human and social capital	135	9.1%	70.3%
	Increase access to extension services!	128	8.6%	66.7%
	Dissemination of weather forecasts and early warning information	115	7.7%	59.9%
	Applying adaptation and mitigation measures	74	5.0%	38.5%
Total		1488	100.0%	775.0%

a. Dichotomy group tabulated at value 1.

Annex 3. Multicollinearity and contingency coefficient results

Variable VIF	1/VIF	
TRAINING	1.73	0.577953
SIZEHH	1.59	0.627037
LOAN_ACCES	1.32	0.760196
TOTAL_FCS	1.20	0.832184
Market_CENT	1.15	0.869722
SIZEFARM	1.14	0.875546
EDUCATION	1.11	0.902454
Mean VIF	1.32	

Annex 4. Recommendations Frequencies for PSNP Targeting and payment model

		Responses		
		N	Percent	Percent of Cases
Recommendations[a]	Increasing awareness about climate change induced shocks and vulnerability issues	180	12.1%	93.8%
	Increase knowledge about food security dimensions!	153	10.3%	79.7%
	Increase financial capital of households!	173	11.6%	90.1%
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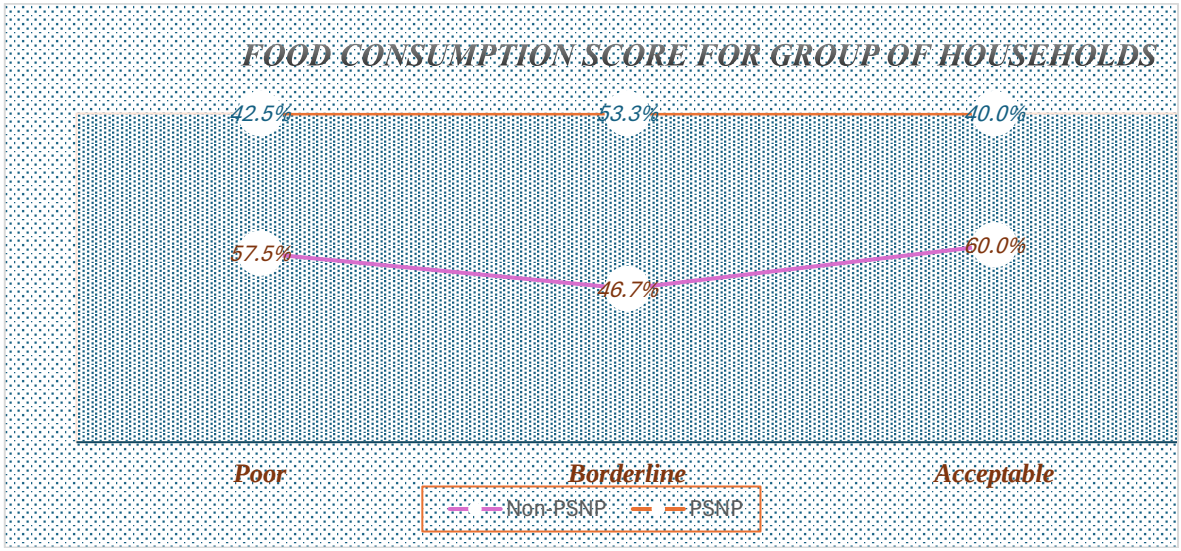
	Applying adaptation and mitigation measures	74	5.0%	38.5%
Total		1488	100.0%	775.0%

a. Dichotomy group tabulated at value 1.

Annex 5. Food Consumption Score for group of households



Annex 6. The impacts of socio-demographic data on PSNP participation

Logistic regression							
Number of obs	98						
LR chi2(7)	15.87						
Prob > chi2	0.0263						
Log likelihood	0-58.331135						
Pseudo R2	0.1197						
Marginal	effects after logit						
y	= Pr(TYPE_BENEF) (predict)						
= .38915553							
variable	dy/dx	Std. Err.	Z	P>z	[95%	C.I.]	X
TOTAL_~S	.0043258	.00592	0.73	0.465	-.007285	.015937	36.3061
EDUCAT~N	-.2359944	.11144	-2.12	0.034	-.454405	-.017584	1.40816
SIZEFARM	-.1852681	.48	-0.39	0.700	-1.12605	.755513	.241061
SIZEHH	-.0060674	.03427	-0.18	0.859	-.073232	.061097	5.54082
LOAN_A~S*	.2709054	.11222	2.41	0.016	.050963	.490847	.540816
TRAINING*	.0747943	.16595	0.45	0.652	-.250453	.400041	.765306
Market~T*	.1488419	.17769	0.84	0.402	-.199421	.497105	.918367

Annex 7. Sample households on common support and off common support region

psmatch2:	psmatch2: Common		
Treatment	Support		
assignment	Off suppo	On support	Total
Untreated	0	58	58
Treated	4	36	40
Total	4	94	98

Annex 8. Propensity score and covariate balancing

	Mean		t-test	V(T)/		
Variable	Treated	Control	%bias	t	p>t	V(C)
EDUCATION	1.2778	1.2638	2.5	0.12	0.908	1.61
SIZEFARM	.23608	0.22041	13.6	0.61	0.544	1.07
SIZEHH	5.4722	5.373	4.9	0.23	0.819	1.24
LOAN_ACCES	.69444	0.69002	0.9	0.04	0.968	.
TRAINING	.86111	0.89145	-7.2	-0.39	0.701	.
Market_CENT	.94444	.94012	1.6	0.08	0.938	.

QUESTIONERS

Appendix 9. Household's interview questions

Good morning/afternoon. My name is Yalew Gizachew postgraduate student at Haramaya University. I have been conducting research titled: "Impacts of Productive Safety Net Program (PSNP) on Households Food Security Status in Chiro Woreda, West Hararghe Zone, Oromia Regional State, Ethiopia" in the partial fulfillments of Master of Science Degree in Climate Chane and Disaster Risk Management (M.Sc.)

I would like to appreciate the participation of households in this survey. This survey requires 60 minutes to complete all parties of questionnaires'''. The information you provide will be keep confidential and will not be shown to any other person. Participation in this survey is voluntary and you can choose not to answer any individual question or all the questions. At this time, if you wanted to ask me anything about the survey before proceeding, you are welcome!

May I begin the interview now?

Respondent agrees to be interviewed. Insert in the box the appropriate number	1 = Yes Proceed with interview 2 = No Go to the next respondent	

Interviewer	**1)** Before starting the interview, ask the household if they are the beneficiary of PSNP or not. 2) Make sure all answers are recorded **correctly, or missing** answers are obtained **before** leaving the survey location
Field Supervisor	**1)** Check all answers in every section ensuring gaps or missing answers are obtained before leaving the survey location **2)** If you make a revision, please use different marker (red) to put new data record beside to prior data recorded

I. PART I: GENERAL BACKGROUND OF THE SAMPLE RESPONDENT

1. How long years is the head of household? It is _____Years.

2. What is the gender/sex of the household head?

1=Female

0=Male

3. What is the marital status of the head of household?

S/N	Marital status	Yes=1	No=0
1	Married		
2	Divorced		
3	Widowed		
4	Single		

4. Does anyone in your household members read or write?

1=Yes

0=No

5. If yes for the above Q4, what is the maximum educational level for any of HH members?

1= Primary

2= High school

3= Higher education

6. Did you have your farming land?

1=Yes

0=No

7. If your answer is yes for Q6, what is the size of farmland? It is _____Ha.

8. Does anyone of household members participate in agriculture and food security related training in the past five years?

1=Yes

0=No

9. Have you access to market centre to purchase and sell food crops?

1=Yes

0=No

10. Have you access to agricultural extension service?

1=Yes

0=No

11. Do you have access to modern farming technologies in your area?

1=Yes

0=No

12. If your answer is Yes for Q11, select one that apply to all

1. Improved seed
2. Irrigation
3. Chemical fertilizer
4. Pesticides

13. Do you have access to off farm /non-farm activities?

1=Yes
0=No

14. Did any climate change induced shocks occur between (FY 2019 – FY 2023)?

1=Yes
0=No

15. What is the method targeting method of households in PSNP program?

1=Full family targeting 0= some member of HHs

16. How many members of your households targeted in PSNP program? It is_____ in numerals.

17. What is your household size? It is_____ in numerals.

18. Write the exact numbers of HH members within appropriate age range to know dependency ratio and productive age group.

Choice	**Age range in years**	**# of HH members**
1	Number of family members from 15 + years - 60 years	
2	Number of family members less than 15 years (<15)	
3	Number of family members greater than 64 years (>64)	
	Total household members	

19. Did you regularly save cash and access to savings?

1=Yes
0=No

20. Have you regularly accessed to credit service in your areas?

1=Yes
0=No

21. If your answer is yes for Q20, what were the institutions that provided saving and credit services?

S/N	**Types of institutions**	**Yes=1**	**No=0**
1	VESA group		
2	OSCCo/Sinqe Bank		
3	RuSACCo		
4	Equb group		

22. Ask household members if any one of them participated in bonding of social capital. Have they provided and got help from people living within community?

1=Yes
0=No

23. Did household have social network with others (PMGs and other mutual helping groups).

1=Yes

0=No

24. Have you experienced drought shock in last five years?

1=Yes

0=No

25. Did you have food shortages?

1=Yes

0=No

26. For how many months did you have food shortages? _____

27. Did you have crop production last year?

1=Yes

0=No

28. **If** your answer was yes for 26, what was the trend of annual crop production from harvest?

1=Increase

0=No change

29. How do you rate your current food security status from all different types of food sources?

1=Improved food security

0=No change in food security

30. What was the usual number of meals taken per day for your household?

Questions	**Number of meals per day (many options)**	**1=yes**	**0=No**
1.	Only one time a day		
2.	Two times a day		
3.	Three times a day		

31. What type of community level nutrition interventions are provided to CU2 through mothers?

S/N	**Community level interventions for CU2**	**Yes=1**	**No=0**
1	Public work and TDS BCC sessions		
2	Food demonstration sessions		
3	Community participatory nutrition promotion (CPNP)		
4	VESA discussion on health and nutrition services		

32. What is the livelihood diversification options for households over the last 12 months?

S/N	**Livelihood diversification/options**	Yes=1	No=0
A	**On-farm (Agricultural activities)**		
1	Crop production like grain, fruit production and vegetable production		
2	Livestock activities (ox fattening, shoat fattening, poultry		
3	Chat production		
4	Bee keeping		
B	**Off-farm activities**		
1	Trading of livestock shoat, ox, poultry, egg and camels		
2	vegetable trade of food grain, chat trade		
3	Rental of farmland, and IGAS		
C	**Non-farm activities**		
1	Petty trade like oil, sugar, shopping, local beer, soft drinks, hair braiding, hand crafting, mining activities		
	Employment activities like salaried, construction, textiles and		

	cobblestone		
	PSNP, JEOP, contingency, remittances, Gifts/inheritance		
E	**Non-agricultural causal labor activities** like charcoal collection, firewood collection, lumbering work, construction work, water transportation, mud work, stone cutting		

33. What is your annual cash income in ETB from different combined sources stated below?

S/N	**Livelihood strategies/pathways**	**Income in ETB**
1.	**On-farm** include agricultural crop production such as sale of grain, fruit and vegetable and Chat sales; livestock sales include such as ox fattening, shoat fattening, poultry and bee keeping	
2.	**Off-farm** include trading of livestock, shoat, ox, poultry, egg and camels, vegetable trade of food grain and chat trade and rental of farmland	
3.	**Non-farm** includes petty trade like oil, sugar, shopping, local beer, soft drinks, hair braiding, hand crafting, mining activities,	
4.	Remittances, retirements, and gifts/inheritance related incomes	
4.	**Daily labour** activities like charcoal collection, lumbering work, construction work, water transportation, mud work, stone cutting,)	
	Total income from all sources	

34. Did you think that land rehabilitation and restorations achieved in the past 5 years?

1=Yes 0=No

35. If yes for above Q44, what kind of interventions contributed for land rehabilitation?

S/N	**Types of intervention category**	**Yes=1**	**No=0**
1	Physical SWCs		
2	Biological measures		
3	Integrated biophysical measures		
4	Afforestation through tree plantation		
5	Natural regeneration/reforestation		
6	Supply of energy saving cooking stoves		
7	Supply of solar pump and lantern		
8	Implementation of CSA and integrated watershed management activities		

36. Are you currently a beneficiary of the PSNP?

1. Yes
2. No

37. If yes, how long have you been participating in the PSNP? _____ years

38. What type of support do you receive from the PSNP? (check all that apply)

1. Food assistance
2. Cash transfer
3. Agricultural inputs
4. Public works employment
5. Training and capacity building
6. Other (specify): _____

39. How often do you receive this support?

1. Monthly
2. Quarterly
3. Biannually
4. Annually

40. How adequate is the support provided by the PSNP in meeting your household's needs?

1. Very adequate
2. Adequate
3. Neutral
4. Inadequate
5. Very inadequate

41. Has your household's food security improved since joining the PSNP?

1. Yes
2. No

42. If yes for Q41, in what ways has it improved? (Check all that apply)

1. Increased food availability
2. Improved nutritional quality
3. Reduced frequency of skipping meals
4. Reduced hunger
5. Other (please specify): _____

43. Have you received food transfer in a timely manner?

1=Yes 0=No

44. Have you received cash transfer in a timely manner?

1=Yes 0=No

45. Which type of PSNP transfer do you prefer?

1) Cash transfer alone.
2) Food transfer alone
3) Mixed transfer (food and cash)

46. Do you know when to receive food each year?

1=Yes 0=No

47. What are the key challenges for quality PSNP implementation/delivery?

S/N	Types of institutions	Yes=1	No=0
1.	Targeting as error of exclusion		

2.	Targeting as error of inclusion		
3.	Fully family targeting problem		
4.	Less interest in graduation/dependency syndrome		

	Food sources	Number of days eaten in the past **7 days**. If 0 days, do not specify the main source.	FCS

5.	Lack of Grievance redress mechanism (GRM)		
6.	Lack of timeliness of food payments		
7.	Lack of timeliness of cash payments		
8.	Less satisfaction in payment modality (cash vs food)		
9.	Delay in PW attendance filling /collection		
10.	Less attendant in PW implementation		
11.	Poor watershed management		
12.	PW labor competition for mass mobilization		
13.	Low wage rate payment		
14.	Lack of market for purchasing and buying food crops		
15.	Weak institutions support/Lack of accountability		
16.	Poverty and vulnerability issues		
17.	Drought incidence		
18.	Malnutrition /child stunting		
19.	Human disease		
20.	Poverty and vulnerability issues		
21.	Crop pests (Fall worm/Desert locust /armyworm		
22.	Climate induced shocks (drought)		
23.	Lack of awareness /training/skills		
24.	Lack of coordination among stakeholders		
25.	Lack of technical support and close supervision		
26.	Centralized decision making in planning		
27.	Lack of credit by MFI		
28.	Staff turnover /reshuffling/less commitment		
29.	Political interference/poor governance		
30.	Security problems		
31.	Corruption/theft/cash/food diversion		

48. How many days over the last 7 days, did most members of your household (50% +) eat the following food items, inside or outside the home? And what was their source? (Use codes below, write 0 if not consumed in the last 7 days) Rate from zero to seven (0-7).

1.	**Cereals, grains, roots and tubers, such as:** Rice, pasta, bread, sorghum, millet, maize, potato, yam, cassava, white sweet potato, plantain	|___|	FCSStap
2.	**Pulses/legumes, nuts and seeds, such as:** beans, cowpeas, lentils, soy, pigeon pea, peanuts, or other nuts	|___|	FCSPulse
3.	**Milk and other dairy products, such as:** milk, yoghurt, cheese, and other dairy products. [Exclude margarine/butter or small amounts of milk for tea/coffee]	|___|	FCSDairy
4.	**Meat, fish and eggs, such as:** goat, beef, chicken, pork, fish, including canned tuna, insects, escargot, and/or other seafood, eggs (meat and fish consumed in large quantities and not as a condiment)	|___|	FCSPr
5.	**Vegetables and leaves, such as:** spinach, onion, tomatoes, carrots, peppers, green beans, lettuce, etc	|___|	FCSVeg
6.	**Fruits, such as:** bananas, apples, lemon, mango, papaya, apricot, peach, etc	|___|	FCSFruit
7.	**Oil/fat/butter, such as:** vegetable oil, palm oil, shea butter, margarine, and other fats/oil	|___|	FCSFat
8.	**Sugar, or sweet, such as:** sugar, honey, jam, candy, cookies, pastries, cakes and other sweet (sugary drinks)	|___|	FCSSugar
9.	**Condiments / Spices, such as:** tea, coffee, cocoa powder, salt, garlic, spices, yeast/baking powder, tomato paste or sauce, and small amounts of meat, fish, milk or other food items consumed as a condiment.	|___|	FCSCond

49. What type of policy measures do you recommend improving household food security and reducing vulnerability to climate change induced shocks? Circle all possible options.

1) Increasing awareness about climate change induced shocks and vulnerability issues
2) Increase knowledge about food security dimensions!
3) Increase financial capital of households!
4) Increase access to agricultural input technology.
5) Increase market access.
6) Increasing access to irrigation technology
7) Increasing natural resource restoration
8) Strengthening human and social capital
9) Increase access to extension services!
10) Dissemination of weather forecasts and early warning information
11) Applying adaptation and mitigation measures

1) Appendix 10. Key Informants Interview Questions

1) How many months did households face food gaps in the last year? Describe both for PSNP and non PSNP households? It is ___months.

2) How do you describe about PSNP selection process? Is that the targeting process is fair and transparent and that targeting within the kebele is carried out by PSNP structures?
3) Have PSNP targeting committees established according to the PIM and local level implementers aware of their roles and responsibilities?
4) What are the characteristics of recipients of PSNP food assistance (and how well are resources targeted)?
5) How much PSNP food assistance to beneficiaries receive and for how long? Are payments to clients timely and predictable?
6) Which households' food security status have improved? Do we see any difference between PSNP and non-PSNP households?
7) To what extent has the PSNP improved food security (including dietary diversity) among households participating in the program?
8) Which households are more vulnerable to climate related shocks? PSNP participants or non PSNP participants ?

9) Has PSNP improved household resilience to shocks? Has the PSNP reduced poverty and vulnerability?
10) How does the shock responsive component of PSNP (the federal contingency budget) protect people against covariate shocks?
11) Have there been any notable changes in social relationships, community cohesion, or other social factors because of the PSNP?
12) What are the socio-economic impacts of PSNP in the study area for PSNP and non PSNP households? (Food security, annual income increment, expanding and options, social bonding, social network, health and nutrition, land rehabilitation and restoration, reducing vulnerability?
13) What are the main challenges faced while implementing PSNP in the study area? Explain briefly?

2) Appendix 11. Focus Group Discussion (FGD)

1) Please discuss on the four core components of the programme from which individual households receive benefits and therefore resources need to be targeted.
   - ✓ Permanent direct support component
   - ✓ Public works and temporary direct support component
   - ✓ Livelihoods component (Livelihoods technical support and Livelihoods transfer)
   - ✓ Risk management component!

2) Please discuss on the PSNP5 five six outputs through which PSNP5 will focus its efforts.
   - ✓ Timely and adequate transfers received by eligible core caseload of clients.
   - ✓ Shock-responsive transfers received by eligible clients when needed.
   - ✓ Public Works respond to community livelihoods needs.
   - ✓ Linkages to available social services facilitated for core PSNP clients.
   - ✓ PSNP management and capacity enhanced. This

3) Discuss the socio-economic impacts of the PSNP for households and local community in general particularly regarding food security in the study area?
   - ✓ Food security based on the four components.
   - ✓ Increasing annual income
   - ✓ Protecting household's asset
   - ✓ Motivate the local economy.
   - ✓ Health and nutrition improvement
   - ✓ Land restoration and rehabilitation!
   - ✓ Expanding livelihood options
   - ✓ Reducing vulnerability/increase resilience
   - ✓ Gender equality and women empowerment
   - ✓ Social bonding
   - ✓ Social networking

4) Discuss on the main challenges of PSNP implementation in the study area?

5) Based on your expertise, what you would recommend for improving the effectiveness of the PSNP in enhancing household food security?