IMPACT ASSESSMENT OF INPUT AND OUTPUT MARKET DEVELOPMENT INTERVENTIONS OF THE IPMS PROJECT: THE CASE OF ALABA AND DALE WOREDAS, SNNPRS, ETHIOPIA

M. Sc. Thesis

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October, 2010

Haramaya University

SCHOOL OF GRADUATE STUDIES

HARAMAYA UNIVERSITY

IMPACT ASSESSMENT OF INPUT AND OUTPUT MARKET DEVELOPMENT INTERVENTIONS OF THE IPMS PROJECT: THE CASE OF ALABA AND DALE WOREDAS, SNNPRS, ETHIOPIA

A Thesis Submitted to the

Department of Agricultural Economics, School of Graduate Studies

HARAMAYA UNIVERSITY

In Partial Fulfillment of the Requirements for the Degree of

MASTER OF SCIENCE IN AGRICULTURE

(AGRICULTURAL ECONOMICS)

BY

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October, 2010

Haramaya University

SCHOOL OF GRADUATE STUDIES

HARAMAYA UNIVERSITY

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BIOGRAPHY

The author was born on October 1, 1983 in Teppi town of the SNNPRs. She attended her elementary, junior and secondary schools at Teppi elementary & junior school and Teppi senior secondary school. After successful completion of her high school education, she joined the then Debub University, now Hawassa University for her B.Sc. degree and graduated in July 2005.

After graduation, she served as an agricultural management expert at Teppi Agricultural and Rural Development Office for six months. In June 2006, she joined the Southern Agricultural Research Institute as a junior researcher. By the year 2008 she joined Haramaya University, school of graduate studies to pursue her M.Sc. degree in Agricultural Economics.

ACKNOWLEDGEMENTS

Fist and for most, I want to thank the almighty God who gave me the wisdom, endurance and all aspects to successfully pursue the task.

My heartfelt appreciation and gratitude goes to my major advisor Dr. Moti Jaleta for his invaluable guidance during the entire work of the thesis. His endurance and helpful comments on the entire thesis is greatly appreciated. I also remain thankful to my co-advisor Dr. Berhanu Gebremedhin.

Special thanks are due to my mother Miss Abonesh Fanta for her encouragement, enthusiasm and the sacrifice she made for my success. I am also grateful to the only brother I have Mr. Dagne Getachew for his responsibility in taking care of our mother and encouragements during my study time.

I am very much indebted to my dearest Kiya which words are superfluous to express my feeling for his love, professional guidance, patience during my stay at field work, encouragement and sharing the burdens of the study.

I am grateful to Southern Agricultural Research Institute for granting me the scholarship to undertake my M.Sc. education. I extend my special thanks to Improving Productivity and Market Success of Ethiopian farmers' project (IPMS) for awarding me graduate fellow position and for financial support for this study. I am very much grateful to the staff of the pilot learning woreda's of IPMS, experts & DAs of MoARD, the enumerators (Adugna Adem, Birhanu XXX , Mebrat XXX , Nibret Tadesse and Kassa XXX at Dale and Medhanit , Mohamed, Abayinesh, Somono and XXX) and sample respondents of both Alaba and Dale sites for their support in briefing about the project interventions and facilitating the farm household survey.

I remain grateful to Mr. Aklilu Bogale of the IPMS project for providing me STATA 10 software with the necessary package which I failed to get from the market as well as other sources for more than a month and half.

ACRONYMS AND ABBREVATIONS

AWoA	Alaba Wereda office of Agriculture
AE	Agri-Environment
AIEI	African Impact Evaluation Initiative
ALVs	African Leafy Vegetables
ATT	Average Treatment Effect
CI	Commodity of Intervention
CIA	Conditional Independence Assumption
CIDA	Canadian International Development Agency
DWoA	Dale Wereda office of Agriculture
ESE	Ethiopian Seed Enterprise
FTC	Farmers Training Center
HH	Household
IE	Impact Evaluation
IFSP	Integrated Food Security Program
ILRI	International Livestock Research Institute
IPMS	Improving Productivity through Market Success
LFA	Less Favored Area
MD	Market Development
MDG	Market Development Group
Mktpp	Market Participation
MoARD	Ministry of Agricultural and Rural Development
NGO	Non-Governmental Organization
PA	Peasant Association
PLW	Pilot Learning Woreda
PRA	Participatory Rural Appraisal
PSM	Propensity Score Matching
Qts	Quintals
R&D	Research and Development
RSS_P	Residual Sum of Squares of Participants
RSS_{Np}	Residual Sum of Squares of Non-Participants
RSS_s	Sum of Residual Sum of Squares
RSS_D	Difference of Residual Sum of Squares of Participants
SNNPR	Southern Nations and Nationalities Peoples Region
VIF	Variance Inflation Factor
WCPO	Woreda Co-operative Promotion Office
WoA	Woreda Office of Agriculture

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ABSTRACT

Agricultural marketing is the main driving force for economic growth. But it is poorly developed in most developing countries. The main cause for the poor development of the agricultural production is the poor development of the agricultural marketing. To overcome this problem the government of Ethiopia has developed a master plan to enhance market-oriented production. To realize this plan different projects have been developed and implemented in different parts of the country. Of these projects, Improving Productivity and Market Success of Ethiopian farmers' is the one being implement by ILRI at 10 pilot learning woredas in the country. Though it is implemented for about five years its impact has not been evaluated so far. This study therefore evaluates the impact of input and output market development interventions of the project at Alaba and Dale PLW, SNNPR on institutional and organizational, input use and productivity, total net income, marketed surplus and market orientation of the participant households. The study has used cross-sectional survey of 200 sample households which was taken from both Alaba and Dale intervention PAs. A propensity score matching method was applied to assess the impact of the project on outcome variables on the treated households. The intervention has resulted in positive and significant effect on level of input use on the treated households. This increased amount of input use made participants to earn on average a total net income of about birr 1,483 at Alaba and birr 2,228 at Dale form the commodities of intervention over the counter parts. It also enabled them to supply more produce to the market and to be market oriented. Based on the results obtained the continuity/ presence of such market development interventions (input and output) has a paramount importance for the achievement of development and transformation plan and the overall development endeavors of the country.

Key words: Input and output market development intervention, propensity score matching, Pilot learning woreda

1. BACKGROUND

Economic growth in Ethiopia has been highly associated with the performance of the agricultural sector. However, Ethiopian agriculture as well as the agricultural marketing has been poorly developed. None the less agricultural marketing is the main driving force for economic development and has a guiding and stimulating impact on production and distribution of agricultural produce (Rehima, 2007). The weak performance of the agricultural markets (both input and output markets) in Ethiopia has been recognized in various studies as a major impediment to growth in the agricultural sector and the overall economy (Dawit, 2005). Hence, breaking this vicious circle has upper hand contribution to the improvement of the well-being of the societies. Generally, to attain rapid economic growth the country needs to improve the agriculture sector through the introduction of different development interventions of the poorly developed input and output markets on top of the provision of improved agricultural technologies.

Recently, improving the efficiency of agricultural marketing is an integral part of policies and programs directed towards raising agricultural production. As agricultural and food marketing contributes towards attempts to improve rural incomes in developing countries, rurally based enterprises, including small-holdings, can greatly improve their earning potential by adopting a market orientation. With an inefficient marketing system, the surplus resulting from increased production benefits neither the farmers nor the country (Eleni *et al*., 2004). Therefore, a well operating market is vital to attain better return from agricultural production and productivity improvement.

To fuel the level of agricultural development policies, plans and projects play vital role. To this effect, the country has many years of experience in implementing development plans and projects. According to Wubie (1988), Ethiopia is the first in Africa to formulate development plans in 1955. At present, the Ethiopian Ministry of Agriculture and Rural Development (MoARD) has developed a master plan to enhance market-oriented production for priority crops (wheat, barley, teff, lentil, chickpea, faba and haricot beans, cotton, sesame, coffee and spices) and livestock (dairy, meat, poultry, apiculture, sericulture, fisheries, skins and hides)

commodities. To realize this market oriented production master plan, projects of many kinds by many NGOs have been implemented to enhance the performance of the sector. Improving Productivity and Market Success of Ethiopian farmers' project is one among those development projects which has been working for the development of agricultural production and productivity via input and output market development interventions.

Improving Productivity & Market Success (IPMS) of Ethiopian Farmers is a five-year (2005-2009) project funded by the Canadian International Development Agency (CIDA) and implemented by the International Livestock Research Institute (ILRI) on behalf of the Ethiopian Ministry of Agriculture and Rural Development (MoARD). The goal of this project is to contribute towards improved agricultural productivity and production through market-oriented agricultural development, as a means for achieving improved and sustainable livelihoods for the rural population. To achieve this purpose, four key components are targeted: knowledge management; innovation capacity development of partners; participatory marketable commodity development and development and promotion of recommendations for scaling out. Currently, it is being implemented at 10 pilot learning woredas (PLWs) though out the country, Ethiopia, of which the two study woredas (Dale and Alaba) are in the Southern region (IPMS, 2005).

The project uses "participatory market oriented commodity value chain development" approach to implement its intervention. Prior to the implementation of the project, potential marketable commodities and their constraints were identified with different stakeholders. Based on the identified opportunities and constraint the project has started to intervene using the participatory value chain components i.e., input supply, innovative credit, extension, production and marketing through capacity development, innovative credit and dissemination of market information.

In this framework, market, broadly defined, is a key element for the delivery of the project outputs and objectives. It is generally recognized that well functioning markets for inputs, outputs and services e.g. extension, health, information, facilitate easy conversion of products to cash, which further facilitate other exchanges of goods and services required for increased production and consumption. Markets, therefore, promote specialization and increased

productivity and growth through realization of comparative advantage and accessing regional and global markets. Therefore, commercialization and market expansion are essential for exploiting the potential of any commodity in the economic development process (Mohamed, 2004).

Improved information and marketing facilities enable farmers to plan their production more in line with market demand, to schedule their harvests at the most profitable times, to decide which markets to send their produce to and negotiate on a more even footing with traders. It also enable traders to move produce profitably from a surplus to a deficit market and to make decisions about the economics of storage, where technically possible (Rehima, 2007). Though the project has been implementing different market development interventions since 2005, its impact has not been yet studied.

Therefore, the purpose of this particular study is to assess the impact of the IPMS project (input and output market development interventions) on organizational and institutional changes, crop and livestock intensification, net income of households, marketed surplus and market orientation of households outcome variables at the two PLWs, Alaba and Dale woredas of the SNNPR, Ethiopia.

1.1. Statement of the Problem

Agriculture is central to the Ethiopian economy. However, agricultural production and productivity is very low and the volume in agricultural output is incompatible with the growth in population. The incompatible increase in volume of agricultural outputs and the country's population result in a widespread food insecurity and poverty in the country. Hence, the country is continuously confronted with a challenge of feeding its growing population. To tackle this problem the country needs to speed up production and increase productivity thereby to achieve economic growth. This can be done by the introduction of improved technologies. The possible increment in output resulting from the introduction of improved technologies could not be exploited in the absence of convenient marketing conditions. Hence, efficient, integrated, and responsive market mechanism is of critical importance for optimal use of resources in agriculture and in stimulating farmers to increase their output. To

this end, IPMS project has been implementing input and output market development interventions since 2005 in ten PLWs. However, the impact/ effect of those market development interventions on the participant households have not yet been studied.

In developing countries, evaluating the development interventions has greater importance for the economical allocation of scarce resources. Furthermore, project evaluation helps to understand the progress, success, and effectiveness of a project. Project evaluation is a step-by-step process of collecting, recording and organizing information about project results, including short-term outputs (immediate results of activities, or project deliverables), and immediate and longer-term project outcomes (changes in behavior, practice or policy resulting from the project) (Government of Ontario, 2006). Project evaluation performed skillfully, identifies key consequences of proposed project and provides quantitative information about them in order to guide policy makers (Kenneth, 1998).

Economic impact studies also measure the effectiveness of interventions. There are three types of economic impacts: direct effects, indirect effects and induced effects. Direct effects include direct effects within the final demand sector (those associated with the use of primary factors, i.e. labor and capital). Indirect effects consist of those felt among subsequent users. Induced effects, new economic activities generated by individuals following an increase in their disposable income (Investissement-Québec, 2001). For the reason that the IPMS project market development intervention is implemented for about five years, only the direct economic impact was analyzed.

Though many efforts have been exerted and financial resources have been committed, its impact has not been evaluated so far. Hence, this particular study has tried to empirically assess the impact of the project on outcome variables as indicators of the impact of the project.

1.2. Objectives of the Study

The study has a general objective of assessing the impact of input and output market development interventions of the IPMS project at Alaba and Dale PLWs.

The Specific objectives were to:

- Describe changes in the organizational and institutional aspects of agricultural markets due to the intervention in the woredas;
- Assess the impact of market interventions on crop and livestock intensification (input use) and productivity of the commodities of intervention;
- Assess the impact of the market interventions on household total net income from the commodities of intervention;
- Assess the impact of the market interventions on marketed surplus of the commodities of intervention; and
- Assess the impact of the market interventions on market orientation of households.

1.3. Significance of the Study

The attainment of the aforementioned objectives is important for the investigation of the impact of the project on one hand and for future adjustment and scaling out of the experiences to resource poor farmers of the country. By determining/quantifying the impacts or the contributions of IPMS project to the listed outcome variables, the study is expected to generate pertinent information for different stakeholders. Evaluation is an important tool that any organization can use to demonstrate its accountability, improve its performance, increase its abilities for obtaining funds or future planning, and fulfill the organizational objectives (Zarinpoush, 2006). Furthermore, this effort is important for policy formulation and implementation.

Decision makers also require information on the contributions of interventions made by different development actors. It is believed that information which will be generated through this study will help them to justify whether or not further interventions by these institutions are needed.

Moreover, depending on the success of the project, it could be considered as a model for helping resource poor smallholder farmers by designing similar interventions. This is because, the knowledge gained from impact evaluation studies will also provide critical input to the appropriate design of future programs and projects.

1.4. Scope and Limitation of the Study

Though impact study of a given intervention encompasses the subsequent/ spillover effects on production, income, environment, and on social welfare in general, this study will be limited only to the direct effect, particularly on production and income, of the project's intervention. Given time and financial resource limitations, the study covers two woredas and data were collected from sampled households in the study area. Despite these resource limitations the study has generated important information for the project owners as well as the policy makers.

2. LITERATURE REVIEW

In this section the basic concepts of market, market development, market development interventions, project evaluation, methodological framework and related empirical studies was reviewed.

2.1. Basic Concepts

2.1.1. Market and market development interventions

The term market refers to the group of consumers and organizations that is interested in the product, has the resources to purchase the product, and is permitted by law and other regulations to acquire the product (NetMBA, 2002-2010). Market can be defined as a convenient meeting place for buyers and sellers to conduct buying and selling activities; aggregate demand of the potential buyers for a product/service; an area for potential exchanges; the economic institution which enables sellers and buyers of a defined good or service to negotiate the legitimate transfer of the good or service between them and over space and/or time. From this all definitions we can understand that market has area, demand and place concept.

The concept related to market is marketing. Marketing is traditionally defined as Selling of goods and services. And also it is defined as all business activities involved in the determination, creation and satisfaction of human wants at fair prices; a group of business activities in order to create and promote consumer demand and to direct the flow of goods/services from the original producer to the final consumer in the process of distribution.

Moreover it has modern definitions as: a continuous process of discovering and translating consumer wants into appropriate products and services, creating demand for these products under keen competition, and serving the demand with the help of channels of distribution; the art of earning profit through profitable sales, i.e., sale of right products to the right people at the right price and through the right channels and by the right promotion.

Market development is a business development, when it is helping companies achieve their revenue and profit goals quickly and cost effectively and it is done through developing new markets, growing current markets and the like. Business development is about fresh thinking, creative solutions and measurable results (MDG, 2009).

Market development is a process for developing sales – new business and new markets. This process is effective for developing all types of business, and delivers business growth via: new products or services to existing customers, existing products or services to new customers, or new products or services to new customers (Chapman, 2009).

The basic idea behind market development is instead of strengthening just 1 or 2 suppliers; it is multiplying the impact of the project by helping many. Major areas of market development interventions are: training and technical assistance, market information, technology clusters and networks; Subcontracting chains and Cross-cutting interventions (Westley, 2001)

2.1.2. Project evaluation

Evaluation is the collection, analysis and interpretation of information about any aspect of a program as part of a recognized process of judging its effectiveness, its efficiency and any other outcomes it may have (Barker, 1999).

Economic impact studies also measure the effectiveness of the programs, guide their development and highlight the importance of their employees' work. There are three types of economic impacts: direct effects, indirect effects and induced effects. The effects of a project are similar to those associated with a specific shock in the form of autonomous spending that has an impact on a final demand sector. In other words, direct effects include direct effects within the final demand sector (those associated with the use of primary factors, i.e. labor and capital, and which generate added value within the sector) and direct effects on productive "immediate supplier" sectors (businesses involved in implementing a firm's project), which supply the final demand sector directly. In the latter case, however, direct effects consist only of effects on immediate suppliers during the implementation of a project in a particular sector or under a particular program. Indirect effects consist of those felt among subsequent suppliers. Induced effects, which may be defined as additional direct and indirect effects (total

wages), reflecting the re-spending of income by people who have earned it, over and above autonomous spending (increased spending within a sector that may have an impact on the economy): in other words, new economic activities generated by individuals following an increase in their disposable income (Investissement-Québec, 2001).

2.2. Methodological Framework

There are two approaches to study impact of a given project. These are the 'before and after' and 'with and without' approaches. "Before and after" compares the performance of key variables during and after the program, with those prior to the program. This approach uses statistical methods to evaluate whether there is a significant change in some essential variables over time. The approach often gives biased results because it assumes that had it not been for the program, the performance indicators would have taken their pre-crisis-period values. With and without comparisons compares the behavior in the key variables in a sample of program beneficiaries, with their behavior in non-program takings (a comparison group). This is an approach to the counterfactual question, using the experiences of the comparison group as a proxy for what would otherwise have happened in the program beneficiaries. Therefore, this particular study used the with and without approach.

Impact evaluations are technical exercises that rely on econometric and statistical models. There are three main kinds of impact evaluation designs. These are experimental, quasi-experimental and non-experimental with which are respectively associated with control groups, comparison groups, and non-participants. Impact Evaluation (IE) rigorously measures the impact that a project has on beneficiaries. It typically does this by comparing outcomes between beneficiaries and a control group (AIEI, 2010*)*.

In Experimental or Randomized Control Design method selection into the treatment and control groups is random within some well-defined set of people. In this case there should be no difference (in expectation) between the two groups besides the fact that the treatment group had access to the program. In Non-experimental or Quasi-Experimental Design methods it can be used to carry out an evaluation when it is not possible to construct treatment and comparison groups through experimental design. These techniques generate comparison

groups that resemble the treatment group, at least in observed characteristics, through econometric methodologies, which include double difference methods, reflexive comparisons, instrumental variables methods and matching methods (Baker, 2000).

Regarding the double difference method the difference in a given outcome between recipients of the project (the treatment group) and a comparison or control group is computed before the project is implemented. This difference is called the "first difference". The difference in outcomes between treatment and control groups is again computed some time after the project is implemented, and this is called the "second difference". Under the difference-in-difference technique, the impact of the project is the second difference less the first difference. The logic is that the impact of the project is the difference in outcomes for treatment and control groups after the project is implemented, net of any pre-existing differences in outcomes between treatment and control groups that pre-date the project (AIEI, 2010).

The reflexive comparison involves constructing a counterfactual based on the characteristics of individuals prior to their involvement in the policy under study. Participants are thus compared to themselves before and after their involvement. The main advantage of reflexive methods is that they make possible the evaluation of policies that cover the entire population, not just subgroups. A major limit, however, is that the changes in the situation of a group before and after the implementation of a policy may be linked to a whole range of factors independent from the policy itself (Baker, 2000).

Instrumental variables (statistical control) method is a method which one uses one or more variables that matter to participation but not to outcomes given participation. This identifies the exogenous variation in outcomes attributable to the program, recognizing that its placement is not random but purposive. The "instrumental variables" are first used to predict program participation; then one sees how the outcome indicator varies with the predicted values (Baker, 2000).

Instrumental Variables is a technique that identifies a factor that determines receipt of a project, but which does not influence outcomes of interest. This factor is then used to simulate who would have been in the treatment group, and who would have been in the control group

if receipt of the project was based on that factor. The difference in outcomes between these simulated treatment and control groups is then the impact of the project (AIEI, 2010).

Matching methods or constructed controls, in which one tries to pick an ideal comparison that, matches the treatment group from a larger survey. The most widely used type of matching is propensity score matching, in which the comparison group is matched to the treatment group on the basis of a set of observed characteristics or by using the "propensity score" (predicted probability of participation given observed characteristics); the closer the propensity score, the better the match. A good comparison group comes from the same economic environment and was administered the same questionnaire by similarly trained interviewers as the treatment group (Baker, 2000).

Propensity-score matching is a non-experimental method for estimating the average effect of social programs (Rosenbaum and Rubin, 1983; Heckman et al., 1998b). The method compares average outcomes of participants and non-participants, conditioning on the propensity score value. The parameter of interest is the average treatment effect and has focused on strong identification conditions.

Matching, especially in its propensity score flavors, has become an extremely popular evaluation method. Both in the academic and applied literature the amount of research based on matching methods has been steadily growing. Matching is in fact the best available method for selecting a matched (or re-weighted) comparison group which 'looks like' the (treatment) group of interest (Barbara, 2009).

Propensity score matching methods require that a separate propensity score specification be estimated for each treatment, group-comparison, and group combination. Furthermore, a researcher should always examine the sensitivity of the estimated treatment effect to small changes in the propensity score specification; this is a useful diagnostic on the quality of the comparison group (Baker, 2000).

In the estimation of average treatment effect using propensity score matching method there are about five steps that is to be followed. First the propensity score is estimated using a

choice model. To estimate the participation probability, logit model with maximum likelihood method is often preferred due to the consistency of parameter estimation associated with the assumption that error term *v* in the equation has a logistic distribution (Baker 2000, Ravallion 2001). Caliendo and Kopeinig (2008) note that the logit model which has more density mass in the bounds could be used to estimate the propensity score $p(X)$. In the second step matching algorithm is selected based on the data at hand after undertaking matching quality test. In the third stage overlap condition or common support condition is identified. In the fourth stage the treatment effect is estimated based on the matching estimator selected on the common support region. Finally, sensitivity analysis is undertaken to check the strength of the conditional independence assumption identified. Sensitivity analysis can also be undertaken to check if the influence of an unmeasured variable on the selection process is so strong to undermine the matching procedure (Owusu and Awudu, 2009).

Propensity Score Matching (PSM) has become a popular approach to estimate causal treatment effects. It is widely applied when evaluating labor market policies, (see e.g. Dehejia and Wahba (1999) or Heckman, Ichimura, and Todd (1997)), but empirical examples can be found in very diverse fields of study. It applies for all situations where one has a treatment, a group of treated individuals and a group of untreated individuals. The nature of treatment may be very diverse (Caliendo and Kopeinig, 2005). The objective of this paper is to evaluate the impact of IPMS project using this method and identify the difference in outcomes: intensity of input use & level of productivity, household net income, marketed surplus and market orientation between beneficiaries and non-beneficiaries of this project since the propensity score method dramatically highlights the fact that most of the comparison units are very different from the treated units. Therefore PSM is used to measure the impact of the market development intervention average treatment effect on the treated on outcome variables.

2.3. Related Empirical Studies

Now days propensity score matching has become a popular impact evaluation method to estimate the average treatment effect on the treated of the intervention worldwide on different interventions. There are few research findings that are done recently applying the method to assess impact of an intervention in and out of the country. However there is no prior research

that has been done on impact evaluation of input and output market development interventions using PSM method. This study will be pioneer in the literature of input and output market development intervention impact evaluation. In addition, production function model was also used to estimate the impact of technology or innovation. Therefore, studies which are related to the current study in their methodology are briefly discussed hereunder. Many research outcomes depict a positive and significant impact of a program on outcome variables.

Pufahl and Weiss (2008) applied a non-parametric propensity score matching approach to evaluate the effects of two types of farm programs (agri-environment (AE) programs and the less favored area (LFA) scheme) on input use and farm output of individual farms in Germany. The analysis reveals a positive and significant treatment effect of the LFA scheme for farm sales and the area under cultivation. Participants in AE schemes are found to significantly increase the area under cultivation (in particular grassland), resulting in a decrease of livestock densities. Furthermore, participation in AE programs significantly reduced the purchase of farm chemicals (fertilizer, pesticide). They also find substantial differences in the treatment effect between individual farms (heterogeneous treatment effects). Farms which can generate the largest benefit from the program are most likely to participate.

Results of Inha and his colleagues (2008) on evaluation of credit guarantee policy using propensity score matching in Korea suggest that credit guarantees influenced significantly firms' ability to maintain their size, and increase their survival rate, but not to increase their R&D and investment and hence, their growth in productivity. Moreover, due to the adverse selection problem, firms with lower productivity were receiving guarantees.

Saigenji and Manfred (2009) have evaluated the impact of contract farming participation on income by applying Propensity Score Matching in north western Vietnam. They found that a significant effect of contract participation on income by about 8,000 VND daily per capita. They used family size, proportion of adults, age, education, ethnicity, number of household member in association and number of income sources.

Diagne *et al* (2009) used propensity score matching methods to estimate the actual and potential adoption rates and the determinants of a new technology the case of NERICA rice varieties in Guinea. The results of the analysis indicated that only 37% of the sample households were exposed to NERICA rice varieties in 2001 and that 20% of the sampled rice farmers adopted NERICA. The potential adoption rate for the population is estimated at 61% with the adoption gap (difference between the 61% potential adoption rate and the 20% actual adoption rate) resulting from the incomplete exposure of the population to the NERICA varieties estimated at 41%. The findings suggest a relatively large unmet demand for the NERICA varieties in Guinea that justify investment in its further dissemination in Guinea.

A study done in Zimbabwe by Zikhali (2008) employed PSM to investigate the impact of fast track land reform program on perceptions of tenure security and investments in soil conservation. For his study he used gender, age of household, education, male adults and female adults to capture the situation before the start of the program. He found that gender, age, male adults was positive and significant except livestock holding which is negative though significant.

Owusu and Awudu (2009) investigated the impact of non-farm employment on farm household income and way out of poverty, using farm household data from Brong-Ahafo region of Ghana employing PSM. The results shown that non-farm employment has a positive and robust effect on farm household income and a negative and significant effect on the likelihood of being poor. Self-employment was found to have much higher impacts than wage employment, reflecting the fact that most employment opportunities in the rural areas are in the former sector.

Degnet *et al* (2010) have used the PSM method to analyze the impact of food security program on household food consumption in northern Ethiopia, which is the first of its kind to apply the method in the country. The study examined the impact of household food calorie intake of an integrated food security program. The estimated results provide evidence that IFSP has a positive and statistically significant effect on food calorie intake. The study also found that the program has differential impact depending on family size, land ownership and

gender of household. Overall, the paper provides evidence that supporting integrated food security programs is important to improve food security in rural areas.

Assefa *et al* (2009) used PSM to evaluate the short and intermediate term impacts of the Ethiopian health services extension program. Their finding revealed that the program has significantly increased the proportion of children fully and individually vaccinated against tuberculosis, polio, diphtheria-pertussis-tetanus, and measles. The proportions of children and women using insecticide treated bed nets for malaria protection are significantly larger in program villages than in non-program villages. The effect on preventive maternal care is rather limited. Whereas women in the program villages appeared to make their first contact with skilled health service provider significantly earlier during pregnancy, very little effect is detected on other prenatal and postnatal care services. Moreover, the program has not reduced the incidence and duration of diarrhea and cough diseases among under-five children.

Daniel *et al* (2009) also used the PSM method to evaluate the impact of social protection on food security and coping mechanisms: Evidence from Ethiopia's productive safety net program. And also the same author except Neha Rati Kumar in 2008 used PSM to analyze the effect of Productive safety net program and its linkage in Ethiopia after 18 months of intervention.

Tanguy *et al* (2007) examined the impact of co-operatives on smallholder commercialization of cereals, using detailed household data from rural Ethiopia. They found that while cooperatives obtain higher prices for their members, they are not associated with a significant increase in the overall share of cereal production sold by their members. And these average results hide considerable heterogeneity in the impact across households. In particular, they found smaller farmers tend to reduce their marketable surplus as a result of higher prices, while the opposite is true for larger farmers.

A study done by Irungu *et al* (2008) on the effect of market development on on-farm conservation of diversity of African Leafy Vegetables (ALVs) around Nairobi revealed that the effect of market development on on-farm diversity of intra and inter-specific ALVs species is mixed. While market development in terms of gross sales has no significant effect,

spatial dimension of market development reduces intra-diversity of ALVs. Market access which is directly related to market development in terms of gross sales also showed the expected influence which particularly had a significant influence on intra-diversity. It was found that increased access to market reduces the number of subspecies grown in the farms. This implies that as market develops spatially, only fewer subspecies that are demanded by the market will be grown.

3. METHODOLOGY

3.1. Description of the Study Area

Dale woreda

Dale woreda is found in sidama zone of Southern Nations and Nationalitities Peoples' Regional State (SNNPRS). The woreda is located 47 kms far from the regional as well as zonal capital, Hawassa. The woreda has a total area of 28,444 hectare; total population of 222,068 and 37,027 households. Out of the total households 34,962 are male headed households and the remaining 2,065 are female headed households. The woreda has 36 kebeles out of this 15 PAs (105 HH) are reached by IPMS intervention. The woreda is also characterized by 1% *dega* and 99% *woinadega* agro-ecologies and produces a variety of crops and livestock. The woreda is known for its coffee production (DWoA, 2009). It is found at an average altitude of 1161-3167masl, receives mean annual rain fall of 1300mm and average temperature of 15-19^{o}c. The soil type of the woreda constitutes Haplic Luvisols (orthic), Chromic Luvisols (nitic), Chromic Luvisols (orthic), Humic Nitisols (mollic), Eutric Vertisols (chernic), Eutric Vertisols (ferralic). The woreda is able to produce different crops such as Coffee, Haricot bean, Fruit, Spices and Vegetables and livestock. (IPMS PRA, 2005).

Alaba special woreda

Alaba Special woreda is one of the eight special woredas in the SNNPR. The woreda has a total area of 973.8 square kilometers and a total population of 210,243. Out of the total population; 104, 517 are male and the remaining 105, 726 are female. In the woreda there are about 79 rural kebeles and 2 urban kebeles out of these 18 PAs (107 HH) were targeted by IPMS market development interventions (AWoA, 2009). The woreda is found at an altitude of 1553-2194 masl, receives 853-1080 mm annual rain falls, and has a temperature of 17-20 ^{o}c. The soil type of the woreda constitutes Andosol (orthic), Solonchak (orthic), Phaeozem (ortic), and Chromic Luvisols (-orthic). The woreda is also characterized by *woinadega* agro-ecologies and produces a variety of crops and livestock's. The woreda is able to produces different crops such as hot pepper, pulses, and Fruit and varieties of livestock. (IPMS PRA, 2005).

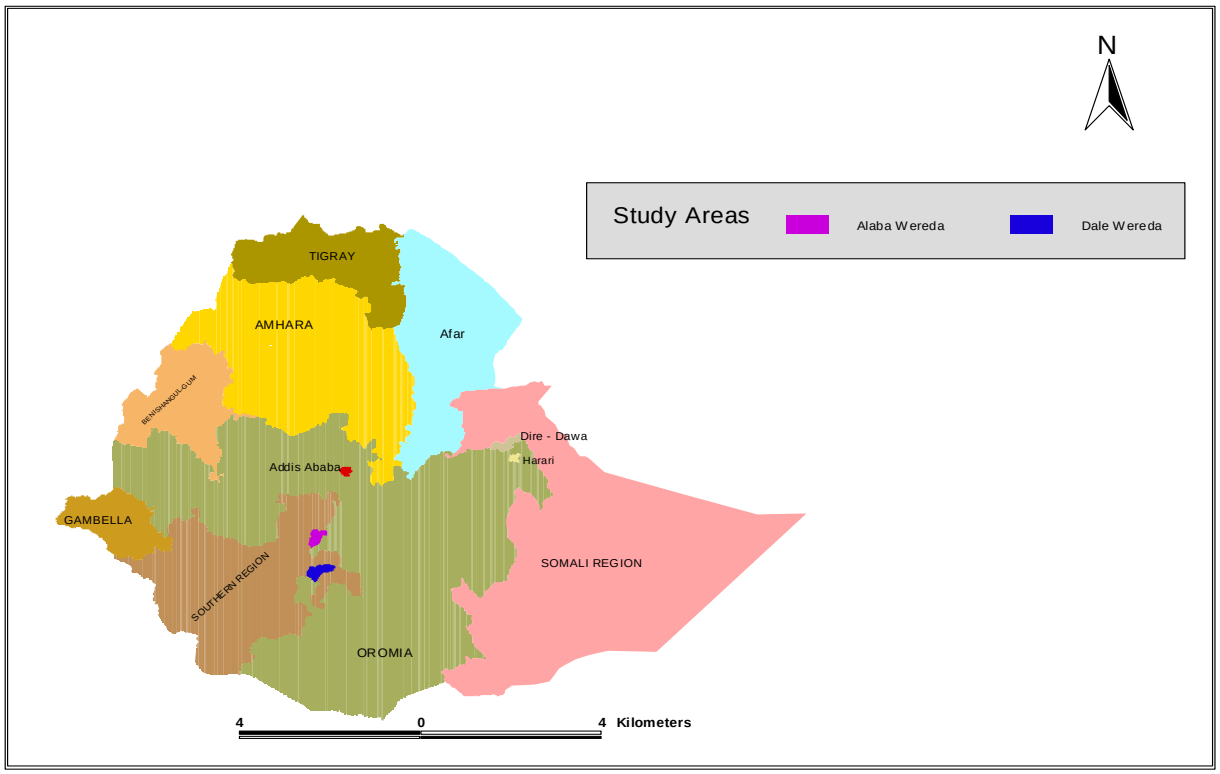

Figure 1 Geographical location of the study areas

3.2. Description of the Interventions

Due to low production and productivity of agriculture and highly growing population density the country faces problems of food insecurity which emanate from lack of improved agricultural technologies. To this end the IPMS project has been implementing different and multifaceted interventions using a participatory commodity development value chain approach to develop input and output markets. From input market development interventions both at Alaba and Dale, the project has provided innovative credit to the cooperatives to supply inputs. Capacity development to extension workers as well as farmers basically is being facilitated by the project on different aspects of technical knowledge about the commodities of intervention using intensive trainings, tours and demonstrations. For example, on apiculture commodity value chain, training on improving and improved traditional bee hives, wax printing, innovative credit to own modern hive and bee accessories, on input supply introduction of different bee forage varieties and their managements were the

interventions made. The project also embarked two innovative methods of chicken supply at Alaba. The first is water charcoal hatchery method and the second is hatchery using the "Tegene" incubator and several training was given. At Dale day old pullet was supplied for organized women, though there was a problem of sustainable supply. In Dale on fruit seedling input supply system for improved marketable fruit varieties of four improved varieties of avocado and one improved variety of apple mango grafting was introduced to disseminate for potential grower to the value chain development of the fruits. On output market development side, market information was delivered via bill board, loud speakers in order to enable farmers to have prior price information about their product in the market and to help them from being cheated and to strengthen their bargaining power in negotiating price at Alaba. Table 1 presents types of interventions that are exerted on specific commodities of interventions.

Table 1 Types of interventions on different commodities

Commodity of intervention	Interventions made	
	Alaba	**Dale**
Poultry	• Provision of *Tegene* incubator and introduction of water charcoal hatchery method; • Provision of three month old chickens on credit basis; • Training on poultry management.	• Provision of day old chickens on credit basis; • Provision of formulated poultry feed and vaccines.
Apiculture	• Supply of improved bee hives and accessories on credit basis; • Introduction of bee forages; • Establishment of private hive supply via innovative credit; • Training and tour on bee management, bee forage management; • Establishment of bee keepers cooperatives.	-
Teff	• Establishing Linkage between *teff* seed producers and ESE so that they can produce quality seed and benefit a fifteen percent plus market price.	-
Haricot bean	• Creating linkage between research-extension and farmers so that farmers are able to get improved seeds from research and benefit better market price by supplying the produce for their local co-operative • Establishing a co-operative	• Creating linkage between research-extension and farmers so that farmers are able to get improved seeds from research and benefit better market price by supplying their produce for their local co-operative • Strengthening the scope of the existing *weinenata* co-operative
Fruits seedling	-	• Facilitation of the provision of improved fruits (4 avocado varieties and 1 apple mango) sions so that this sions are grafted with the local stocks to get better yield • Training on how to graft and its management for couples
Coffee seedling	-	• Facilitation of the provision of Angafa coffee seed from research to farmers.

3.3 Sources and Method of Data Collection

Both qualitative and quantitative data were collected from primary and secondary sources. The primary sources include beneficiaries/participant and non-beneficiaries/ non-participant of the project and specialists who are implementing the project including the PLW coordinator. The primary data were collected through sampled household survey. Secondary data were also collected from published and unpublished sources.

Formal sample survey was conducted to collect primary data. The formal survey was also supplemented by informal survey with an aim of collecting baseline information. In the informal survey, group discussion and key informant interview was held using a checklist. In the formal sample survey structured and semi-structured questionnaire was pre-tested to endorse new information before the formal survey was carried out. Then the questionnaire was administered to collect pertinent data. Enumeration was done by recruiting five experienced enumerators at each study site. Enumeration was done from 5 – 19 of December, 2009 at Dale and from 2-16 of February, 2010 at Alaba.

3.4. Sampling Techniques and Sample Size

A multi-stage sampling technique was employed to draw sample respondents from each PLW. In the first stage PA's where the intervention has been made for some time was selected purposively from the total number of PAs in the PLWs. In the second stage, 6 PAs (3 PA's from each PLW) were randomly selected. Accordingly, Dagiya, Debub kege and Soyama from Dale and Galeto, Hulegaba Kukie and Andegna Ansha from Alaba were selected. In the third stage, households in the selected PAs were stratified in to participant and non-participant as well as in to commodity of participation. In the final stage, a total sample of 200 households (100 participants and 100 non-participants) was randomly selected from the two PLWs. Table 2 presents the sampling procedure of the study.

Table 2 Sampled PAs and Respondents

District (No. of PAs in the district)	Name of PAs	Total No. of HHs	Intervened HHs				Number of samples selected per commodity				
			Fruit	Coffee	Haricot bean	Poultry	Fruit	Coffee	Haricot bean	Poultry	Total
Dale (36 PAs)	Debub kege	5135	-	-	38	20	-	-	13	20	33
	Dagia	7422	4	5	-	-	4*	5*	-	-	7
	Soyama	7028	-	-	22	20			5	5	10
Sub Total			4	5	38	20	**4***	**5***	**18**	**25**	**50**
			Teff	**Apiculture**	**Haricot bean**	**poultry**	**Teff**	**Apiculture**	**Haricot bean**	**poultry**	**Total**
Alaba (79 PAs)	Galeto	2211	-	4	20	10	-	4	7	7	18
	Hulegaba kukie	6019	32	-	40	-	12	-	10	-	22
	Andegna Ansha	4130	-	-	25	-	-	-	10	-	10
Sub total			32	4	85	10	**12**	**4**	**27**	**7**	**50**
Grand Total							**14**	**9**	**35**	**32**	**100**

Source: six monthly reports of Dale and Alaba PLW.

* Two households participated in two commodities of intervention i.e. coffee and fruits

3.5. Method of Data Analysis

The impact analysis used both descriptive statistics and econometric model. Among econometric methods propensity score matching was employed to quantify important empirical results. STATA Software was employed for the analysis of the data.

3.5.1. Descriptive statistics

Descriptive statistics techniques that were used to describe the collected data include mean, standard deviation, independent sample t-test, etc. Since descriptive statistics help one to have clear picture of socio-economic and socio-demographic situations of the respondents, it was used wherever it is appropriate.

3.5.2. Econometric models

The IPMS project works in support of the tasks of the Bureau of Agriculture, which has been there before and after the implementation of the project. On top of that the efforts of the Bureau of Agriculture continue even after the IPMS's intervention. Hence, there is a need to decompose the IPMS's effect from that of the Bureau's. Therefore, this study uses with and without approach which best suits the purpose of this particular study i.e. participant non-participant comparison.

The first step in estimating the treatment effect is to estimate the propensity score. To get this propensity scores any standard probability model can be used (for example, logit, probit or multi-nominal logit) (Rajeev et al., 2007). Since the propensity to participate is unknown, the first task in matching is to estimate this propensity. Any resulting estimates of program effect rest on the quality of the participation estimate. This can be routinely carried out using a choice model. Which choice model is appropriate depends on the nature of the program being evaluated. If the program offers a single treatment, the propensity score can be estimated in a standard way using, for example, a probit or logit model, where the dependent variable is 'participation' and the independent variables are the factors thought to influence participation and outcome.

Following Pindyck and Rubinfeld (1981), the cumulative logistic probability function is specified as:

$$P_i = F(Z_i) = F\left[\alpha + \sum_{i=1}^{m} \beta_i X_i\right] = \left[\frac{1}{1 + e^{-\left[\alpha + \sum \beta_i X_i\right]}}\right] \quad (1)$$

Where e represents the base of natural logarithms (2.718…)

X_i represents the i^{th} explanatory variable

P_i the probability that an individual participates in the market intervention of the IPMS project

α and β_i are parameters to be estimated.

Interpretation of coefficients will be easier if the logistic model can be written in terms of the odds and log of odds (Gujarati, 2004). The odds ratio implies the ratio of the probability that an individual will be a participant (P_i) to the probability that he/she will not be a participant ($1-P_i$). The probability that he/she will not be a participant is defined by:

$$[1 - P_i] = \left[\frac{1}{1 + e^{Z_i}}\right] \quad (2)$$

Using equations (1) and (2), the odds ratio becomes

$$\left[\frac{P_i}{1 - P_i}\right] = \left[\frac{1 + e^{Z_i}}{1 + e^{-Z_i}}\right] = e^{Z_i} \quad (3)$$

Alternatively,

$$\left[\frac{P_i}{1 - P_i}\right] = \left[\frac{1 + e^{Z_i}}{1 + e^{-Z_i}}\right] = e^{\left[\alpha + \sum_{t=1}^{m} \beta_t X_{ti}\right]} \quad (4)$$

Taking the natural logarithms of equation (4) will give the logit model as indicated below.

$$Z_i = \ln\left[\frac{P_i}{1-P_i}\right] = \alpha + \beta_1 X_{1i} + \beta_{2i} X_{2i} + - - - - - + \beta_m X_{mi} \quad (5)$$

If we consider a disturbance term, u_i, the logit model becomes

$$Z_i = \alpha + \sum_{t=1}^{m} \beta_t X_{ti} + U_i \quad (6)$$

So the binary logit will become:

$$Pr\ (ppp) = f(X) \quad (7)$$

Where *ppp* is project participation, *f(X)* is the dependent variable project participation and *X* is a vector of observable covariates of the households;

X = [L, F, DDA, MktD, Ed, A, Ls, S].

Where: L represents the total cultivated land holding of household in ha;

F represents Family size;

DDA represents distance (km) between the DAs office & the sampled HH residence;

MktD represents Market distance from samples household residence;

Ed represents education level of household head;

A represents age of household head;

Ls represents Size of Livestock holding;

S represents sex of the household head.

After obtaining the predicted probability values conditional on the observable covariates (the propensity scores) from the binary estimation, matching will be done using a matching algorithm that is selected based on the data at hand. Then the effect of household's participation in the markets developed by IPMS intervention on a given outcome (outcome in this study is intensity of input use, level of productivity attained, household net income, marketed surplus and market orientation)(Y) is specified as:

$$\tau_i = Y_i(D_i = 1) - Y_i(D_i = 0) \quad (8)$$

Where τ_i is treatment effect (effect due to participation in the specific market), Y_i is the outcome on household i, D_i is whether household i has got the treatment or not (i.e., whether a household participated in the market developed by IMPS intervention or not).

However, one should note that $Y_i(D_i = 1)$ and $Y_i(D_i = 0)$ cannot be observed for the same household at the same time. Depending on the position of the household in the treatment (market participation), either $Y_i(D_i = 1)$ or $Y_i(D_i = 0)$ is unobserved outcome (called counterfactual outcome). Due to this fact, estimating individual treatment effect τ_i is not possible and one has to shift to estimating the average treatment effects of the population than the individual one. Most commonly used average treatment effect estimation is the 'average treatment effect on the treated (τ_{ATT}), and specified as:

$$\tau_{ATT} = E\left(\tau \middle| D = 1\right) = E[Y(1) \middle| D = 1] - E[Y(0) \middle| D = 1] \quad (9)$$

As the counterfactual mean for those being treated, $E[Y(0) \middle| D = 1]$ is not observed, one has to choose a proper substitute for it in order to estimate the average treatment effect (ATT). One may think to use the mean outcome of the untreated individuals, $E[Y(0) \middle| D = 0]$ as a substitute to the counterfactual mean for those being treated, $E[Y(0) \middle| D = 1]$. However, this is not a good idea especially in non-experimental studies. Because, it is most likely that components which determine the treatment decision also determine the outcome variable of interest.

In this particular case, variables that determine household's decision to participate in the markets developed by the IPMS intervention could also affect household's input use intensity, level of productivity, household income, etc. Therefore, the outcomes of individuals from treatment and comparison group would differ even in the absence of treatment leading to a self-selection bias.

By rearranging, and subtracting $E[Y(0) \middle| D = 0]$ from both sides, one can get the following specification for ATT.

$$E[Y(1) \middle| D = 1] - E[Y(0) \mid D = 0] = \tau_{ATT} + E[Y(0) \middle| D = 1] - E[Y(0) \middle| D = 0] \quad (10)$$

Both terms in the left hand side are observables and ATT can be identified, if and only if $E[Y(0)|D=1]-E[Y(0)|D=0]=0$. i.e., when there is no self-selection bias. This condition can be ensured only in social experiments where treatments are assigned to units randomly (i.e., when there is no self-selection bias). In non-experimental studies one has to introduce some identifying assumptions to solve the selection problem. The following are two strong assumptions to solve the selection problem.

1. Conditional Independence Assumption:

Given a set of observable covariates (X) which are not affected by treatment (in our case, market participation), potential outcomes (input use intensity, level of productivity, income, etc) are independent of treatment assignment (independent of how the market participation decision is made by the household). This assumption implies that the selection is solely based on observable characteristics, and variables that influence treatment assignment (market participation decision is made by the household) and potential outcomes (input use intensity, productivity level, income) are simultaneously observed.

2. Common support:

This assumption rules out perfect predictability of D given X. That is

$$0 < P(D=1 \mid X) < 1$$

This assumption ensures that persons with the same X values have a positive probability of being both participants and non-participants.

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

$$\tau_{ATT}^{PSM} = E_{P(X)/D=1}\left\{E\left[Y(1)|D=1,P(X)\right]-E\left[Y(0)|D=0,P(X)\right]\right\} \qquad (11)$$

Where P(X) is the propensity score computed on the covariates X. Equation (11) is explained as; the PSM estimator is the mean difference in outcomes over the common support, appropriately weighted by the propensity score distribution of participants.

Variable definition and Measurement

To determine the probability of participation socio-economic, demographic and location factors were used in the PSM model. Table 3 presents the measurement of those pre-intervention and outcome variables considered.

Table 3 Variable definitions and measurement

Variable	Type	Definition	Measurement
Dependent Variables			
participation	Dummy	participation in the interventions	1 if yes, 0 otherwise
Input use & productivity	Continuous	Kg of input use & productivity	Kilo gram
Net income	Continuous	value of output sold	Ethiopian Birr
Marketed surplus	Continuous	proportion of output sold	Percentage
Market orientation	Continuous	proportion of land allocated to CI	Percentage
Explanatory Variables			
Sex	Dummy	sex of household head	1 if male, 0 otherwise
Age	Continuous	pre- intervention age of household	years completed
Education	Continuous	pre- intervention education of household head	Years of formal education completed
Land holding	Continuous	pre- intervention landholding size	hectare
Distance from the DA office	Continuous	pre- intervention distance from DA's office	kilo meters
Market Distance	Continuous	pre- intervention distance from market	kilo meters
Livestock holding	Continuous	pre- intervention livestock-holding	tropical livestock units
Family size	Continuous	pre- intervention family size	No. of HH members

4. RESULTS AND DISCUSSION

In this part, descriptive statistics and econometric model results are presented and discussed. Under descriptive statistics important pre-treatment characteristics of households and outcome variables are displayed with appropriate statistical tools like mean, standard deviation and percentages. Subsequently, the details of PSM estimation are depicted.

4.1 Descriptive Results

4.1.1 Household characteristics

As discussed in the methodology part, the survey was conducted in the two districts, Alaba and Dale, in the SNNPR State, Ethiopia. These districts are two of the ten pilot learning sites of the IPMS project in the country. Of the total 200 sample households considered in this study, 100 are participants and the rest are non-participants in the project's market development interventions.

Of the total respondents, about 62% from Alaba and 72% from Dale reported that they know about the market development interventions of the project. This implies that, in addition to participants, about 24 and 44% of non-participants know the market development interventions of the project at Alaba and Dale, respectively (Table 4). When one look into the average years of involvement in the intervention, it was found to be 2.14 and 2.44 years for Alaba and Dale, respectively and it ranges from 2-4 years.

Table 4 Respondents knowledge about the market development interventions

Characteristics	District											
	Alaba						Dale					
	Participants		Non-participants		Total		Participants		Non-participants		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Know	50	100	12	24	62	62	50	100	22	44	72	72
Do not know	0	0	38	76	38	38	0	0	28	46	28	28

Table 5 depicts commodities for which market development interventions were made and respective number of participants constituting the sample households in each pilot learning site. Accordingly, at Alaba, the commodities of intervention include poultry, apiculture, haricot bean and teff whereas at Dale commodities intervened were poultry, haricot bean, coffee and fruits (Avocado and mango) seedling. With regard to participation, about 50% of the participants were involved in haricot bean commodity of intervention at both study sites.

Table 5 Commodities of intervention along with participants

Commodity of intervention	**District**			
	Alaba		**Dale**	
	N	**%**	**N**	**%**
Poultry	12	24	21	42
Apiculture	7	14	-	-
Teff	19	38	-	-
Coffee	-	-	6	12
Fruits	-	-	5	10
Haricot bean	25	50	25	50

4.1.1.1 Descriptive results of pre-treatment characteristics

Table 6 presents the descriptive results of Alaba site considering pre-intervention characteristics of both participants and non-participants. Accordingly, the two groups were found to be significantly different with respect to sex, education level of the household head, cultivated land holding and relative distance to market place. In contrast to non-participants, participants are male headed, have higher level of years of schooling, larger size of cultivated land holding and situated at a relatively nearer distance to market place. The difference between the two groups with respect to education level, sex, cultivated land holding and market distance were statistically significant at 1, 5,5 and 10% probability levels, respectively.

Table 6 Descriptive statistics of pre-intervention characteristics, Alaba site

Pre-intervention variables	All Sample HHs (N=100)		Participant (N=50)		Non-participant (N=50)		Mean difference		T-Value
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Sex	0.91	0.29	0.98	0.14	0.84	0.37	0.14	0.05	2.49**
Age	37.22	10.94	37.72	10.85	36.72	11.12	1.00	2.20	0.45
Education	3.43	3.35	4.50	3.44	2.36	2.91	2.14	0.64	3.36***
Cult. Land holding	1.42	0.69	1.58	0.77	1.25	0.57	0.32	0.14	2.38**
Dist. from DA's office	1.43	1.49	1.59	1.33	1.27	1.63	0.32	0.30	1.06
Livestock holding	4.11	2.27	4.40	1.99	3.81	2.50	0.59	0.45	1.30
Market Distance	2.84	2.22	2.46	1.54	3.22	2.70	-0.77	0.44	-1.74*
Family size	7.02	3.36	7.38	3.53	6.66	3.18	0.72	0.67	1.07

Source: Own estimation. ***, ** and* means significant at 1%, 5% and 10% probability levels, respectively. Dist. Refers to distance.

Table 7 shows the descriptive results of per-intervention characteristics of Dale site. The results depict that there is statistical difference between participants and non-participants with respect to education level, cultivated land holding, livestock holding, market distance and family size. A look at the years of education indicated that participants has relatively completed higher level of education than that of non-participants and this difference is significant at 1% level of significance. Compared to non-participants, participants have larger size of cultivated land and more family size which were significant at less than 1% significance level each. In addition, participants were situated nearer to market places than that of non-participants and this difference was significant at 10% probability level.

Table 7 Descriptive statistics of pre-intervention characteristics, Dale site

Pre-intervention variables	Sample HH(N=100)		Participant (N=50)		Non-participant (N=50)		Mean difference		T-Value
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Sex	0.80	0.40	0.80	0.40	0.80	0.40	0.00	0.08	0.00
Age	38.76	7.30	37.68	7.32	39.84	7.20	-2.16	1.45	-1.49
Education	6.31	2.75	7.20	2.26	5.42	2.92	1.78	0.52	3.41***
Cult. Land holding	1.08	0.67	1.36	0.74	0.81	0.45	0.55	0.12	4.45***
Dist. from DA's office	0.89	0.64	0.81	0.72	0.96	0.55	-0.15	0.13	-1.19
Livestock holding	3.71	2.05	4.46	2.26	2.97	1.51	1.50	0.38	3.89***
Market Distance	3.40	1.25	3.19	1.25	3.62	1.22	-0.43	0.25	-1.72*
Family size	6.65	1.92	7.30	2.14	6.00	1.43	1.30	0.36	3.57***

Source: Own estimation. *** and* means significant at 1% and 10% probability levels, respectively. Dist. Refers to distance.

4.1.1.2 Descriptive results of outcome variables

The outcome variables of the project, particular to this study, are level/ intensity of input use, productivity, net income, marketed surplus and market orientation of households. The before matching difference between the two groups with regard to these variables was displayed below.

Table 8 portrays level of input use in apiculture commodity of intervention at Alaba site. The two groups were significantly different in terms of intensity of input use in apiculture i.e. amount/quantity of bee forage purchased, number of bee colonies purchased, bee accessories owned and number of human being (labor) hired for harvesting. The difference in amount of bee forage used was found to be significant at 5% probability level whilst others: number of bee colony purchased, accessories owned and number of hired labor for honey harvesting were significant at 10% level of significance. Generally, the result shows that participants used more inputs compared to their counterparts. Regarding bee hives, the difference between the two groups of respondents were found to be insignificant. This is because the number of household which became owners of improved bee hives was minimal i.e. 4 households.

Table 8 Level of input use in apiculture, 2009

Input use	Unit	Participant	Non-participant	Mean difference	T-value
Bee Hive[1]	No.	5.12 (31.35)	0.00	5.12	1.16
Bee forage[2]	Kg	1.06 (3.58)	0.00	1.06	2.09**
purchased Bee colony	No.	0.18 (0.80)	0.00	0.18	1.59*
Accessories	No.	0.06 (0.24)	0.00	0.06	1.77*
Hired labor	No.	0.08 (0.34)	0.00	0.08	1.66*

Note: ** and* means significant at 5% and 10% probability levels, respectively.
[1] Bee hive constitutes transitional and modern bee hive types. [2] Supplementary feed like sugar, roasted pea, etc

Likewise, in poultry commodity of intervention, at Alaba though there was a mean difference between participants and non-participants in terms of feed and labor used in the production, the difference was not statistically significant. On the other hand, participants were statistically different from non-participants with respect to frequency of medicine (vaccine) used per hen per year at 5% level at Alaba. Whereas at Dale there was statistical difference between the two groups of respondents with regard to quantity of feed used and days spent per year to follow up activity. The mean difference between the two groups in terms of amount of feed used per hen per year was statistically significant at 5% significance level. Furthermore, with regard to days spent per year for follow up, the mean difference between the two groups was significant at 10% level. More importantly, participants practice relatively more input intensive poultry production than the non-participants at both pilot learning woredas (Table 9).

Table 9 Level of input use in poultry production

District	Input type	Participants	S.E.	Non-participants	S.E.	Mean difference	T-value
Alaba	Feed (Kg/hen/ Yr)	12.50	20.92	6.87	17.87	0.72	1.12
	Medication (amt/hen/yr)	0.95	1.86	0.68	1.35	0.34	2.59**
	Follow up (days spent/yr)	47.86	146.15	10.42	44.62	4.02	1.31
Dale	Feed (Kg/hen/ Yr)	11.59	11.27	6.43	7.46	5.16	2.70**
	Medication (amt/hen/yr)	5.02	21.25	0.85	2.39	4.17	1.38
	Follow up (Days spent/yr)	17.07	22.20	10.12	16.81	6.95	1.77*

** and * means significant at 5% and 10% probability levels, respectively.

Table 10 reveals the level of input use in haricot bean and *Teff* commodities of intervention at the two study sites. Looking in to the number of days used for the overall activities of haricot bean and *Teff* at Alaba, and haricot bean at Dale, participants work more days than non-participants. This difference was statistically significant at 10, 5 and 1% level of significance, respectively. With respect to seed rate, participants use more amounts of seed than non-participants per hectare and it is found to be significant at 5% probability level for teff at Alaba and at 1% probability levels for haricot bean at Dale. In case of fertilizer, participants apply more amount of inorganic fertilizer (DAP) per hectare as compared to non-participants. This difference was also statistically significant at 1, 5% levels at Alaba for teff and haricot bean, respectively and 1% levels at Dale's for haricot bean. Compared to non-participants, participants used more amounts of herbicide per hectare to control weeds on their teff fields at Alaba which was found to be statistically significant at 1% probability level. The mean difference in use of oxen was also statistically significant between the two groups of respondents at Alaba for teff and this difference was significant at 5% level.

Table 10 Level of input use in haricot bean and *Teff*

District/ CI [a]	Input type	Participant	S.E.	Non-participant	S.E.	Mean difference	T-value
Alaba 's Haricot bean	Labor	10.41	1.71	7.35	1.00	3.05	1.54
	Seed	12.41	2.34	8.23	2.15	4.18	1.32
	Fertilizer	27.30	5.55	19.50	3.62	7.80	1.17
	Oxen days	16.58	2.18	12.72	2.28	3.86	1.22
Alaba's Teff	Labor	25.10	5.55	9.87	1.59	15.25	2.64**
	Seed	9.71	1.74	5.14	1.23	4.57	2.15**
	Fertilizer	58.22	7.91	29.02	5.74	29.20	2.99**
	Herbicide	10.15	0.94	5.20	0.56	4.95	4.54***
	Oxen days	38.64	7.19	15.84	2.59	22.80	2.98**
Dale's Haricot bean	Labor	36.66	7.23	11.87	2.72	24.79	3.21***
	Seed	33.48	5.47	11.50	3.60	21.98	3.36***
	Fertilizer	51.21	5.64	29.37	4.29	21.84	3.08***

Note: *** and ** are significant at 1% and 5% probability levels, respectively.

[a] is commodity of intervention

Table 11 summarizes productivity of commodities of intervention in the two study sites. Accordingly, participants at Alaba were statistically different from non-participants in terms

of productivities of poultry, apiculture, haricot bean and teff. With regard to poultry the productivity advantage has been revealed in terms of number of eggs laid per cycle. Meanwhile, the mean difference between the two groups in terms of eggs laid per cycle was about four eggs and this was statistically significant at 10% probability level. Regarding apiculture, participants harvested about 4 kg more of honey per hive to that of non-participants and this difference was significant at 1% probability level. Likewise participants harvested about 3 more quintals (Qts) of haricot bean and about 2 more Qts of teff per hectare of land which was found to be significant at 1% probability level.

At Dale site, participants harvested about 5 Qts more of haricot bean per hectare compared to non-participants and this difference was found to be significant at 5% probability level. In terms of poultry productivity there were no statistically significant differences between participants and non-participants of the project. This might be due the fact that the intervention was in such a way that participants supply poultry to the market after growing day old chickens which is supplied by the project. Therefore, the venture has resulted in insignificant poultry productivity (Table 11).

Table 11 Productivity of commodities of intervention

Commodity of intervention	**District**							
	Alaba				**Dale**			
	participants	Non-participants	Mean difference	T-value	participants	non-participants	Mean difference	T-value
Eggs(No.)	5.70 (12.80)	2.19 (7.41)	3.51	1.68*	7.04 (20.98)	7.05 (16.45)	0.35	0.09
Honey(kg)	3.80 (7.98)	0.00 (0.00)	3.80	3.37***	-	-	-	-
H. bean (Qt)	3.56 (4.12)	0.81 (2.17)	2.75	4.26***	6.94 (9.08)	1.46 (4.58)	5.48	2.87**
Teff (Qt)	2.93 (4.62)	0.65 (1.99)	2.28	3.21***	-	-	-	-

Note: ***, ** and* means significant at 1%, 5% and 10% probability levels, respectively.

Regarding the total net income of sample households from commodities of intervention, participants of the project generated about birr 1899 and 2220 more than that of non-participants at Alaba and Dale, respectively. This indicates that the intervention has yielded a positive and significant net income difference between the two groups of households and this

difference was found to be significant at less than 1% probability level. Looking in to the net income from individual commodities of intervention, participants had earned more net income to that of non-participants from poultry, apiculture, haricot bean, teff, coffee and fruits seedling at their respective locations (Table 12).

Table 12 Net income of sample respondents, 2009

District	Net income	Participant	S.E.	Non-participant	S.E.	Mean difference	T-value
Alaba	Poultry	79.95	26.27	12.60	5.12	67.36	2.52**
	Apiculture	190.16	67.89	38.26	10.26	151.90	2.21**
	Teff	1718.25	361.98	477.95	100.99	1240.29	3.30***
	Haricot bean	627.89	112.56	219.25	47.44	408.64	3.35***
	Total Net Income	**2608.95**	**398.20**	**709.80**	**118.32**	**1899.15**	**4.57*** **
Dale	Poultry	582.39	124.52	5.21	1.61	577.18	9.03***
	Coffee seedling	666.83	271.60	51.53	19.92	615.30	4.26***
	Fruits seedling	622.24	324.08	0.00	0.00	622.24	3.75***
	Haricot bean	484.41	114.58	8.65	3.60	475.76	8.04***
	Total Net Income	**2295.87**	**510.19**	**76.03**	**24.73**	**2219.84**	**8.35*** **

Note: *** and ** means significant at 1% and 5% probability levels, respectively.

Table 13 depicts marketed surplus of commodities of interventions. Accordingly, participants have shown significant difference to that of non-participants in supplying poultry to the market at both study sites. The difference between the two groups was statistically significant at 5 and 1% levels for Alaba and Dale, respectively. Compared to non-participants, participants supply 12% more honey to the market. This difference was found to be significant at 5% level. Considering marketed surplus for teff, as it is solely market oriented crop, participants supply about 5% more to the market than that of non-participants though this difference was statistically insignificant.

Concomitantly, participants at Dale have supplied 4% of their grafted fruits seedlings to the market. There is no local practice of fruits seedling production in the area by the non-participants. According to participant households, the amount of grafted fruits seedlings sold was low which is attributed to lack of information about the commodity in the area. While coffee seedling venture has yielded also a positive and significant mean difference between

the two groups of respondents. Respondents reported that although coffee seedlings of 'Angafa' have considerable advantage over the other varieties in the area, it is less preferred by farmers due to lack of awareness about its comparative advantage. As to the marketed surplus of haricot bean, participants supply 31% more at Alaba and 35% more at Dale compared to non-participants, and this disparity was significant at less than 1% significance level (Table 13).

Table 13 Marketed surplus for commodities of intervention

District	Marketed surplus	Participant	S.E.	Non-participant	S.E.	Mean difference	T-value
Alaba	Poultry	14	0.34	5	0.15	9	2.28**
	Apiculture	17	0.04	6	0.13	12	2.42**
	Teff	41	0.06	36	0.06	5	0.61
	Haricot bean	53	0.04	22	0.04	31	6.09***
Dale	Poultry	38	0.04	5	0.01	33	11.82***
	Coffee seedling	9	0.04	3	0.01	6	2.23**
	Fruits seedling	4	0.02	0	0.00	4	3.80***
	Haricot bean	38	0.05	3	0.01	35	11.22***

***and** means significant at 1% and 5% probability levels, respectively.

Proportion of land (area) allocated to the commodities of intervention and consideration of market signal in production planning was taken as a proxy for the detection of households' market orientation. Consequently, participants have by far allocated more proportion of their land to commodities of intervention compared to non-participants and the difference in proportion of land allocated to haricot bean and teff at Alaba was significant at 5% level of significance while it is significant at 1% level for Dale's haricot bean (Table 14).

The same table also depicts the result of consideration of market signal in production planning/ decision. Accordingly, about 64% of participants at Alaba and 88% of participants at Dale reported that they take production decision based on market signal. Therefore, as the two proxy measures indicated significant difference between the two groups of respondents, the intervention has brought about market orientation in participant households.

Table 14 Proxy indicators of market orientation

District	Market orientation	Participant	S.E.	Non-participant	S.E.	Mean difference	T-value
Alaba	Land allocated to H. bean [a]	0.07	0.02	0.02	0.01	0.05	2.20**
	Land allocated to Teff [a]	0.12	0.03	0.02	0.01	0.10	3.20**
Dale	Land allocated to H. bean	0.18	0.3	0.03	0.2	0.15	4.31***
	market signal [b]	**N**	**%**	**N**	**%**		
Alaba		32	64				
Dale		44	88				

Note: *** and ** means significant at 1% and 5% probability levels, respectively.
[a] Proportion of land allocated to the commodity of intervention,
[b] Consideration of market signal in production decision

4.1.2 Institutional and organizational changes

4.1.2.1. Credit facility

With regard to credit facilities, about 72 and 62% of the sample respondents reported that they received credit in 2008/2009 production season at Alaba and Dale, respectively. All of participants (100%) at Alaba and 86% at Dale had received credit as compared to non-participants, which are about 24% at Alaba and 38% at Dale.

The main problem in getting credit as reported by 60% of the respondents was limited source and inadequacy of credit. In line with the above problem, 40% of respondents' rate credit availability and accessibility as poor at Alaba. The difference in rating credit availability between participant and non-participants was significant at 10% level. The major source of credit for non-participants is microfinance institution which account for 40% of the total credit received. The type of credit dominantly provided by microfinance was reported to be cash credit. On the other hand, participants received input credit from IPMS project indirectly. About 50 and 43% of participants received credit from IPMS project in kind like haricot bean seed and pullets both at Alaba and Dale, respectively.

Project participants indicated that the IPMS project has contributed much in availing input credit in kind both at Alaba and Dale study sites. At Alaba, the project has provided bee hive,

haricot bean seed and three months old chicken. Similarly at Dale haricot bean seed and pullets of day old were supplied in kind via credit by the project in collaboration with other institutions like 'Weinenata' local co-operative, Melkasa and Awassa Agricultural research centers and WoA. This indicates that the project has brought about a change in institutional aspect; typically credit availability via creating linkage among farmers, concerned institutions (Research and extension) and local cooperative. Moreover, the project has strengthened the co-operative, 'Weinenata', capacity by providing financial (loan) support.

4.1.2.2 Agricultural extension service

Agricultural extension services provided by agricultural development offices are believed to be important sources of information about new and improved agricultural technologies. About 99% of the sample respondents in Alaba and all respondents in Dale reported that they have contact with agricultural extension agents and get technical advice thereof, either in-groups or individually (Table 15). To this end the project has been strengthening the service by providing short and medium (B.Sc. and M.Sc.) training to the development agents as well as the experts so that they are able to give better service to the farmers. Moreover, the project involves in strengthening linkage among the institutions which are supposed to work together: research institutions, extension and farmers. It has also been providing the FTCs with necessary equipment like satellite dish, television, computers, chairs, tables, electric power supply and CDs to facilitate the farmers training program. Furthermore, the project introduces new ways of agricultural practices and technologies to the respective sites.

Table 15 Extension contact

Extension contact	District											
	Alaba						Dale					
	Participants		Non-participants		Total		Participants		Non-participants		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Have contact	50	100	49	98	99	98	50	100	50	100	100	100
Have no Contact	0	0	1	2	1	2	0	0	0	0	0	0

4.1.2.3. Farmers organization

At Alaba, most of the respondents had no membership to formal organizations other than Peasants Association (PA). As it can be seen from Table 16, about 74% of the respondents were not members to any formal organizations at Alaba site. When one compare membership to formal organization other than PA between the two farmers group the proportion is more for participants (36%) than for non-participants (16%) at Alaba site. This shows that formal farmer-institutions, which may serve as important information and input sources on agricultural technologies, were not well established in this particular study area though membership proportion seems better for participants.

With the initiative of the IPMS project, currently there is a start of organizing farmers in to cooperatives based on the commodities of intervention in collaboration with the WCPO. This is line with the information obtained from WCPO which indicates that currently there are about 2 co-operatives particularly on *Teff* seed multiplication and apiculture; similarly, 2 co-operatives are on the process of establishment on poultry and haricot bean seed multiplication with the initiative of the IPMS project for its intervention commodities. Furthermore, there is input shop which is functional by co-operative named 'Mencheno' at Alaba. This particular shop supplies important farm inputs such as fertilizer, herbicides, etc at a relatively reasonable price and better quality and the project provides innovative credit so that the shop is able to supply quality and timely inputs. Moreover, the project has trained private farmers to give paravet and crop protection services.

At Dale, there is a well organized co-operative named 'Weinenata' which is operational throughout the woreda. Formerly, this co-operative has been functional only on coffee marketing. However, the co-operative has widened its scope to haricot bean through the encouragement and support of the IPMS project. The project has given financial support and created a link to the important institutions which can provide the full package to the targeted commodity. As a result of these, the cooperative has started to handle the different marketing functions like storage, grading, labeling, packaging, etc of improved haricot bean seed which is collected from farmers and to be sold for them at different amount (packagels) when they need. Speaking differently, the project has facilitated input divisibility to farmers as per their

demand. This, in turn, indicates that the project has brought about organizational and institutional changes in input marketing.

Table 16 Membership to formal organization

Membership in formal organization	District											
	Alaba						Dale					
	Participants		Non-participants		Total		Participants		Non-participants		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Member	18	36	8	16	26	26	50	100	40	80	90	90
Non-member	32	64	42	84	74	74	0	0	10	20	10	10

4.1.2.4 Market information

With regard to market information, the market intervention has included market information delivery system through billboard and loud speakers at Alaba and through DAs at Dale. Accordingly, about 84% of respondents know and get market information on input and output price using the bill board directly and indirectly at Alaba. Of those who have access to the bill board information, about 20% of respondents reported that IPMS has brought benefit to them in providing market information. Owing to price information delivered, farmers reported that they are able to reduce frequency and cost of transportation as they only go once to the market and sale their product to the market by the indicated price with no hesitation. However, of those who know the market information delivery system, about 80% face a problem in using the information from the billboard due to illiteracy.

In addition, the project promotes new practices and technologies at the market place using loud speaker. From this about 60% of respondents are informed about the message delivered by the project using the speaker. Furthermore, the intervention has included balance calibration at hot pepper market which increases farmers benefit, enables them to make informed decision and saves them from being cheated. Whereas at Dale, even though there is no practice of using the above means of market information delivery systems, the project trains the DAs and experts of MoARD on market orientation related issues to support and advise farmers about market oriented production and give market information.

4.2 Economic Model Results

This section discusses the results of Propensity Score Matching in detail. To measure the average treatment effect on the treated (ATT) for intended outcome variables, a logit model was estimated in order to get the propensity scores. Next a matching estimator that best fit to the data was selected. Then based on those scores estimated and matching estimator selected, matching between participants and non-participants was done to find out the impact of the project on the mean values of the outcome variables. Therefore, this section illustrates all the required algorithms to calculate the average treatment effect on the treated, which helps us to identify the impact of the project.

4.2.1 Propensity scores

Prior to running the logistic regression model to estimate propensity scores, the explanatory variables were checked for existence of sever multicollinearity problem. A technique of Variance inflation factor (VIF) was calculated to detect the problem of multicollinearity among continuous explanatory variables. Accordingly, the VIF (X_i) result shows that the data had no serious problem of multicollinearity (Table 17). This is because, for all continuous explanatory variables, the values of VIF were by far less than 10. Therefore, all the explanatory variables were included in the model.

Table 17 Variance Inflation Factor (VIF) for continuous explanatory variables

Variable	District			
	Alaba		Dale	
	R^2	(VIF)= $(1-R^2_i)^{-1}$	R^2	(VIF)= $(1-R^2_i)^{-1}$
Age	0.41	1.68	0.14	1.16
Education	0.19	1.24	0.27	1.37
Cult. Land holding	0.25	1.33	0.23	1.29
Distance from DA office	0.09	1.10	0.07	1.07
Livestock holding	0.28	1.40	0.31	1.46
Market Distance	0.23	1.29	0.06	1.06
Family size	0.37	1.59	0.26	1.35

Moreover, hetroscedasticity test was done using Breusch-Pagan / Cook-Weisberg test for hetroscedasticity and the P-value was 0.8972 which is insignificant implying the absence of the problem of hetroscedasticity.

A logistic regression model was used to estimate the propensity scores of respondents which helps to put in to practice the matching algorithm between the treated and control groups. The matching process attempts to make use of the variables that capture the situation before the start of the intervention. The logit result revealed a fairly low pseudo R^2 of 0.2026 and 0.2778 for Alaba and Dale sites, respectively (Table 18). The pseudo-R^2 indicates how well the regressors $\boldsymbol{X}$ explain the participation probability (Caliendo and Kopeinig, 2005). A low R^2 value means participant households do not have much distinct characteristics over all and as such finding a good match between participant and non-participant households becomes easier (Yibeltal, 2008).

The maximum likelihood estimate of the logistic regression model result shows that participation was influenced by 4 variables at Alaba and 3 variables at Dale study sites (Table 18). At Alaba education level, cultivated land holding, sex, and number of livestock holding in tropical livestock unit affect the chance of participation. Meaning those farmers who have better level of schooling, male headed and relatively larger land holding has high chance of being participant. In addition, households having higher number of livestock are more likely to be a participant in the market development interventions of the IPMS project and this is on the contrary to the finding of Zikhali (2008) in Zimbabuwe.

At Dale, participation was significantly influenced by cultivated land holding, family size and livestock holding. Speaking differently, those farmers who have larger size of land, more number of family size and higher number of livestock holding have high chance to be included as participant. Cultivated land holding influenced participation moderately at 5% significant level while, family size and livestock holding influenced the probability of participation at 10% level of significance (Table 18).

Table 18 Logistic regression model estimation

Covariates	District					
	ALABA			DALE		
	Coefficients	S. E.	Z -Value	Coefficients	S. E.	Z-Value
Sex	2.35	1.22	1.96*	0.24	0.69	0.34
Age	-0.02	0.03	-0.70	-0.05	0.03	-1.42
Education	0.18	0.08	2.34**	0.15	0.11	1.35
Land	0.81	0.43	1.80*	1.17	0.55	2.13**
Distance from DA office	-0.03	0.15	-0.19	-0.33	0.40	-0.81
Livestock holding	0.22	0.13	1.63*	0.27	0.16	1.73 *
MktD	-0.24	0.19	-1.24	0.25	0.21	-1.18
Family size	0.10	0.09	1.07	0.31	0.17	1.85*
Constant	-3.98	1.62	-2.46	-2.31	1.99	-1.16
Number of observation (N)	100			100		
LR χ 2 (8)	28.09			38.51		
Prob > χ 2	0.0005			0.0000		
Pseudo R2	0.2026			0.2778		
Log pseudo likelihood	-55.27			-50.06		

Source: Own estimation. ** and* means significant at 5% and 10% probability levels, respectively.

According to Caliendo and Kopeinig (2005) there are two approaches to map a common support region for the propensity score distribution, these are minima & maxima and trimming approaches. Moreover, Leuven and Sianesi (2003) recommend the use of both the common and "trimming" approaches at the same time for the identification (imposition) of a common support. Even though it is recommended to use both approaches together, in evaluation studies using PSM the approach that yields in good match is preferred. Thus, the data set resulted in good matches in the case of minima and maxima approach. Therefore, this approach was employed to identify the common support region.

The histograms presented in Figure 2 reveal the distribution of the two groups of respondents for both Alaba and Dale sites before matching. The graphs depict that there is high chance of

getting good matches and large number of matched sample size from the distribution as the propensity score distribution is skewed to the left (right) for participants (non-participants). This is based on the minima and maxima approach of common support region identification (Caliendo and Kopeinig, 2005).

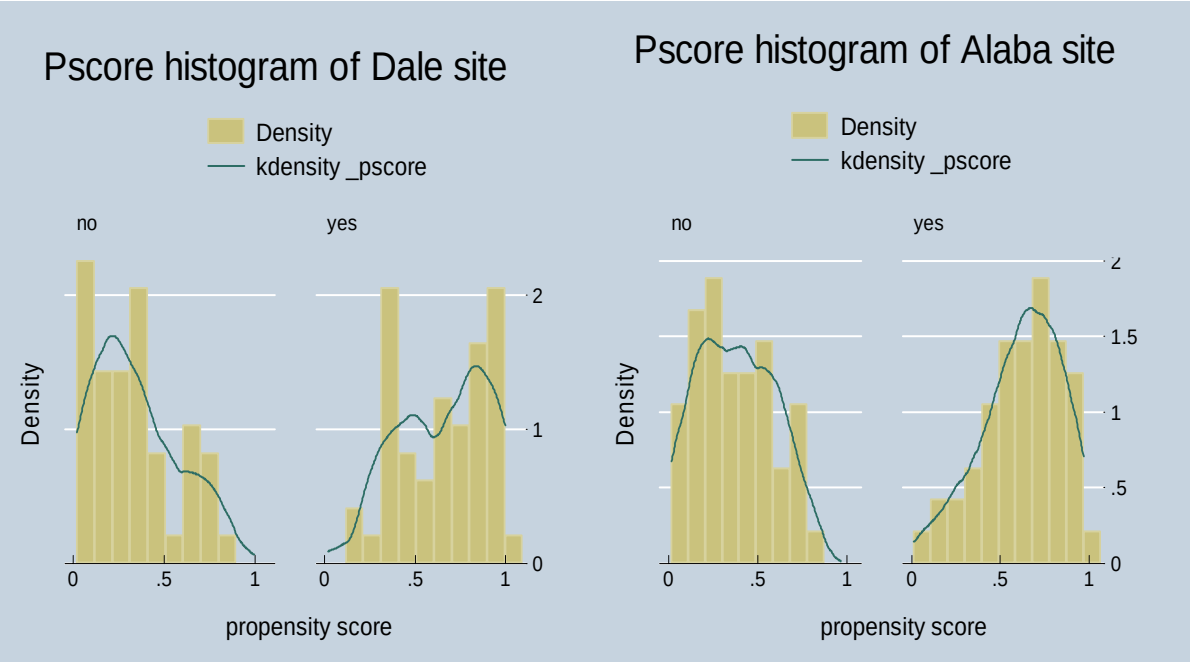

Figure 2 Pscore distributions of participants & non-participants at Alaba and Dale

4.2.2 Matching algorithms of participant and non-participant households

As already noted, choice of matching estimator is decided based on the balancing qualities of the estimators. According to Dehejia and Wahba (2002), the final choice of a matching estimator was guided by different criteria such as equal means test referred to as the balancing test, pseudo-R^2 and matched sample size. Balancing test is a test conducted to know whether there is statistically significant difference in mean value of per-treatment characteristics of the two groups of the respondents and preferred when there is no significant difference. Accordingly, matching estimators were evaluated via matching the participant and non-participant households in common support region. Therefore, a matching estimator having balanced (insignificant mean differences in all explanatory variables) mean, bears a low pseudo R^2 value and also the one that results in large matched sample size is preferred.

In line with the above indicators of matching quality, kernel of Epanechnikov type (default to kernel matching) with no band width is resulted in relatively low pseudo R^2 with best balancing test (all explanatory variables insignificant) and large matched sample size as compared to other alternative matching estimators indicated in Table 19. Then it was selected as a best fit matching estimator for Alaba's dataset.

Table 19 Performance measures of matching estimators at Alaba site

Matching Estimator	Performance Criteria		
	Balancing test	Pseudo-R^2	Matched sample size
NN			
No replacement NN	8	0.038	70
With replacement NN	8	0.012	78
Oversampling NN	8	0.024	78
Weights for oversampling NN	8	0.024	78
Caliper			
0.01	8	0.024	78
0.25	8	0.015	89
0.5	6	0.075	89
KM			
With no band width	8	0.005	89
Band width 0.1	8	0.006	89
Band width 0.25	8	0.040	89
Band width 0.5	6	0.090	89

Source: Own estimation

Epanechnikov kernel type was chosen, for the normal kernel type yielded relatively higher pseudo R^2 than Epanechnikov type. As indicated in Table 20, kernel with 0.1 band width was selected as the best matching estimator for Dale's dataset based on the performance criteria indicated. Most studies (Tanguy et al., 2007; Inha et al., 2008; Yibeltal, 2008) used the Kernel matching method, which matches a treated unit to all control units weighted in proportion to the closeness between the treated unit and the control unit.

Table 20 Performance measure of matching estimators at Dale site

Matching Estimator	Performance Criteria		
	Balancing test	Pseudo-R^2	Matched sample size
NN			
No replacement NN	8	0.045	70
With replacement NN	8	0.042	75
Oversampling NN	8	0.019	75
Weights for oversampling NN	8	0.021	75
Caliper			
0.01	8	0.021	75
0.25	8	0.020	89
0.5	6	0.101	89
KM			
With no band width	8	0.012	89
Band width 0.1	8	0.011	89
Band width 0.25	8	0.062	89
Band width 0.5	4	0.146	89

Source: Own estimation.

Table 21 shows the balancing tests of the covariates using the matching estimators for the two study sites. Moreover, the table displays results of balancing test of the covariate by comparing the before and after matching algorithm significant differences. Before matching, there were some variables which were significantly different for the two groups of respondents at both study sites. At Alaba, sex, education, cultivated land holding and livestock holding were significant. In the case of Dale, covariates like family size, cultivated land holding and livestock holding were significant. But after matching these significant covariates were conditioned to be insignificant which indicates that the balance that was made in terms of the covariates between participants and non-participants.

Table 21 Balancing tests of covariates

Variable	District											
	Alaba						Dale					
	Before matching(100)			After matching (89)			Before matching(100)			After matching (89)		
	Participant (50)	Non-participant (50)	T-value	Participant (39)	Non-participant (50)	T-value	Participant (50)	Non-participant (50)	T-value	Participant (39)	Non-participant (50)	T-value
Sex	2.35	1.22	1.92*	0.98	0.96	0.32	0.24	0.70	0.34	0.76	0.78	-0.13
Age	-0.02	0.03	-0.70	36.70	35.96	0.30	-0.05	0.03	-1.42	38.72	37.68	0.52
Ed	0.18	0.08	2.23**	3.88	3.95	-0.09	0.15	0.11	1.35	6.64	7.03	-0.63
L	0.81	0.43	1.88*	1.40	1.44	-0.28	1.17	0.55	2.13**	0.998	1.004	-0.04
DDA	-0.03	0.15	-0.19	1.55	1.52	0.08	-0.33	0.40	-0.81	0.77	0.81	-0.22
Ls	0.22	0.13	1.69*	4.00	3.88	0.27	0.27	0.16	1.73 *	3.53	3.33	0.44
MktD	-0.24	0.20	-1.24	2.49	2.61	-0.29	-0.25	0.21	-1.18	3.20	3.47	-0.83
Family size	0.10	0.10	1.07	6.48	6.57	-0.13	0.31	0.17	1.85*	6.60	6.67	-0.19

Source: Own estimation.

Note: ** and* means significant at 5% and 10% levels, respectively.

The initial observations were 50 participant and 50 non-participant sampled households at each study site. After the identification of the common support condition using minima and maxima approach, participants having a pscore below 0.0136 (0.0215) and above 0.7878 (0.8893) are dropped for Alaba (Dale) sites, 39 participant households were matched with 50 non-participants both for Alaba and Dale cases using respective matching estimators. This makes from 100 sample households of each study site, only 89 households were identified to be considered in the estimation process.

Figures 3 and 4 portray the kernel density distributions of the propensity score of the two study sites. The distribution for all respondents is relatively nearer to normal distribution whereas participants' propensity score distribution was skewed to the left while it was skewed to the right for non-participants. Both figures portray that there was a considerable overlap or common support between the two groups of respondents at both study sites.

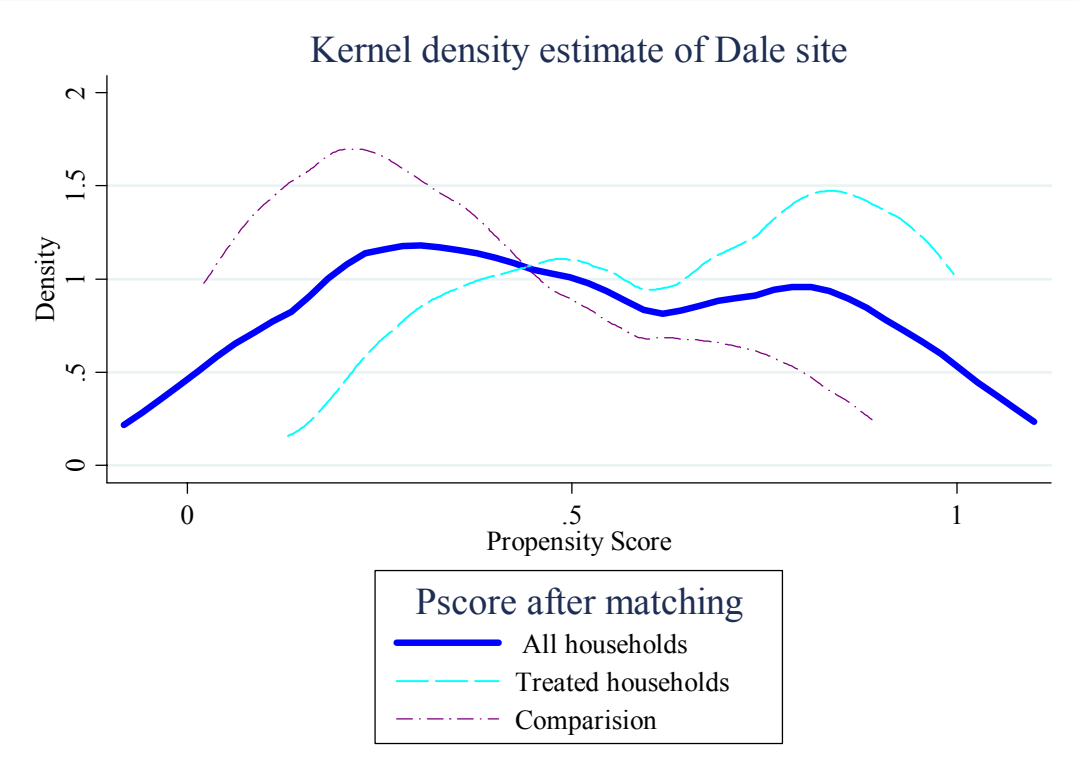

Figure 3 Kernel density distribution of propensity scores for Dale site

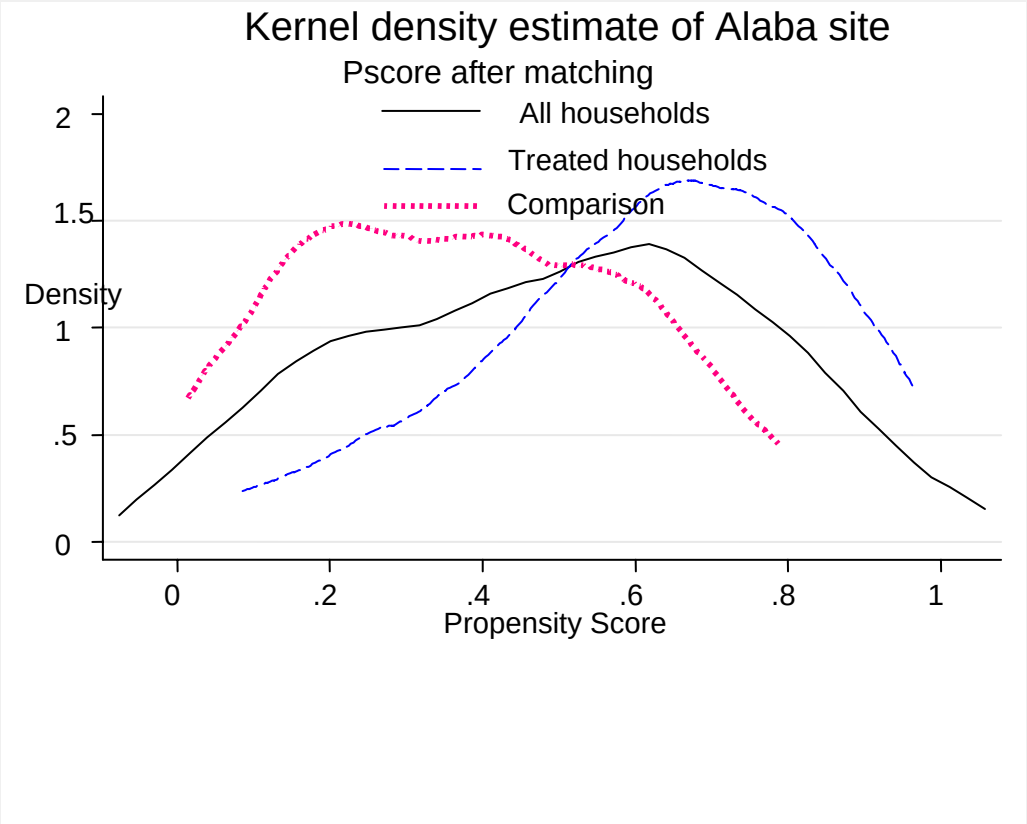

Figure 4 Kernel density distribution of propensity scores for Alaba Site

4.2.3 Treatment effect on the treated (ATT)

In this section, the project's impact on the outcome variables (level of input use, net income, marketed surplus and market orientation of households) are evaluated for their significant impact on participant households, after the pre-intervention differences were controlled.

A closer look at the level of input use in case of haricot bean intervention revealed that there was a statistically significant difference between participants and non-participants of the project in terms of their level of input use except for fertilizer at Alaba and seed rate at Dale. With respect to seed rate used at Alaba, the result shows that participants have used about 7 kg more of seed per hectare than non-participants and this difference was significant at 10% level. With regard to number of days used for all activities of haricot bean both at Alaba and Dale, participants work about 6 and 8 days more than non-participants and the difference was

statistically significant at 5 and 10% probability level, respectively. Considering fertilizer at Dale, the mean difference between the two groups of respondents was about 20 Kg per hectare, which means that participants applied 20 kg more of fertilizer per hectare of land than non-participants does. This difference was significant at 10% level of significance (Table 22).

When one looks in to level of input use in teff at Alaba, fertilizer and herbicide applied was significantly different between the two groups of farmers. In terms of fertilizer use, participants applied 27 kg more per hectare than non-participants and this difference was significant at 5% level. In addition, participants used about 6 ml more of herbicide per hectare to control weeds over the non-participants (Table 22). The average treatment effect of the intervention on input use for apiculture and poultry is also shown in the same table. Though there was a significant difference between the two groups before matching, after matching their difference with regard to input use for apiculture and poultry at both study sites was found to be insignificant except for poultry feed at Dale.

Table 22 Estimates of average treatment effect (ATT) of input use

Commodity of intervention	District									
	Alaba					Dale				
	Variable	Treated	Controls	Difference	S.E.[a]	T-stat	Treated	Controls	Difference	S.E.[a]	T-stat
H. bean	Fertilizer (Kg/ha)	29.23	19.74	9.49	10.94	0.87	47.96	28.34	19.62	9.20	1.80*
	Seed (Kg/ha)	11.87	5.31	6.56	4.15	1.58*	26.51	17.36	9.16	11.84	0.77
	Labor (days/ha)	11.45	5.03	6.41	2.99	2.14**	32.67	12.28	20.39	7.51	1.89*
	Oxen (Days/ha)	4.25	2.81	1.44	1.01	1.42	-	-	-	-	-
Teff	Fertilizer (Kg/ha)	57.65	30.64	27.01	11.18	2.42**	-	-	-	-	-
	Herbicide (ml/ha)	10.56	5.08	5.48	1.95	2.81**	-	-	-	-	-
	Seed (Kg/ha)	9.99	5.88	4.11	3.57	1.15	-	-	-	-	-
	Labor (days/ha)	22.20	12.50	9.70	6.24	1.55	-	-	-	-	-
	Oxen (days/ha)	7.00	3.93	3.07	1.61	1.90*	-	-	-	-	-
Apiculture	Bee hive	0.77	0.00	0.61	5.56	0.11	-	-	-	-	-
	Bee colony	0.10	0.00	0.10	0.10	1.00	-	-	-	-	-
	Bee forage	0.89	0.00	0.89	0.66	1.35	-	-	-	-	-
	B. accessories	0.05	0.00	0.05	0.04	1.43	-	-	-	-	-
	Hired labor	0.03	0.00	0.03	0.02	1.00	-	-	-	-	-
Poultry	Feeding	1.06	0.23	0.83	0.75	1.11	11.33	5.56	5.77	2.77	2.08**
	Follow up	28.48	0.33	28.15	28.08	1.00	18.18	16.44	1.74	5.11	0.34
	Medication	0.18	0.08	0.10	0.09	1.17	6.01	1.41	4.60	3.88	1.19

***, ** and* means significant at 1%, 5% and 10% probability levels, respectively. [a] Boot strapped standard error with 50 replication

Table 23 presents the change in productivity of the commodities of intervention at each study site. With respect to eggs laid, there was no significant difference between the two groups of farmers both Alaba and Dale, which is the proxy for poultry productivity. While in case of apiculture, kg of honey per transitional or modern hive, participants have gained about 23 kg more of honey over the non-participants and this difference was found to be significant at 5% level of significance. As compared to the non-participants, participants of teff intervention have harvested about 5 Qt more of teff per hectare of land. In this respect, the difference between the groups of farmers was significant at 1% probability level. Considering haricot bean productivity, participants harvested about 8 and 13 Qt more of haricot bean per hectare of land over non-participants at Alaba and Dale, respectively. This difference was significant at 10% for Alaba and 1% level of significance for Dale study sites.

Table 23 Estimates of average treatment effect (ATT) of productivity

Variable	District									
	Alaba					Dale				
	Treated	Controls	D/ce	S.E.[a]	T-stat	Treated	Control	D/ce	S.E.[a]	T-stat
Eggs laid	3.90	3.08	0.82	2.98	0.28	9.17	6.69	2.47	6.19	0.40
Honey	23.01	0	23.01	1.01	2.81 **	-	-	-	-	-
Teff	8.48	3.60	4.88	0.74	3.34***	-	-	-	-	-
H. bean	14.81	7.01	7.80	1.54	1.55*	14.56	2.60	12.96	1.30	3.45***

** and* means significant at 5% and 10% probability levels, respectively.
[a] Boot strapped standard error with 50 replications; D/ce refers to difference

When one look at the second outcome indicator of the project i.e. total net income of households, the average treatment effect on the treated was found to be positive and statistically significant at the two study sites. At Alaba, participants on average earned about birr 1,483 more from the commodities of intervention over non-participants and this was statistically significant at 5% level of significance. Similarly at Dale, participants earned on average about birr 2,228 more net income compared to non-participants and this difference was significant at 1% significance level (Table 24).

The same Table also shows mean differences in terms of net income from individual commodities of intervention. Accordingly, at Alaba participants got a net income of about birr

30 from poultry though it became insignificant after bootstrapping the standard error. Participants earned about birr 132 from apiculture over non-participants which was statistically significant at 5% significance level. While at Dale, participants of poultry intervention fetch a net income of about birr 497 over non-participants and this was found to be significant at less than 1% level of significance. Considering teff, participants realized a net income of about birr 967 over non-participants which was significant at 5% level of significance. As reported by participants, better income from teff enabled them to change their house form grass roofed ones to corrugated iron roofed. This had been practically observed during the survey work.

With regard to seedling intervention, participants earned about birr 575 more from coffee birr 798 from fruits seedling over non-participants. The difference between the two groups was insignificant in case of coffee after bootstrapping and significant at 5% level for fruits. Moreover, participants on average have earned about birr 331 and 354 net income from haricot bean over the non-participants at Alaba and Dale, respectively. This difference was significant at 5% level (Table 24).

The result indicates that the project intervention has resulted in a positive and statistically significant difference between participants and non-participants of the project in terms of net income of households. In total, the intervention has brought about 68% increases in net income of participants in Alaba and correspondingly 89% in Dale pilot learning site over the non-participants from the commodities of intervention.

Table 24 Estimates of average treatment effect (ATT) of net income

Variable	District									
	Alaba					Dale				
	Treated	**Controls**	**Difference**	**S.E.[a]**	**T-stat**	**Treated**	**Controls**	**Difference**	**S.E.[a]**	**T-stat**
Poultry	47.63	17.79	29.84	29.25	1.02	513.86	16.45	497.41	111.17	4.47***
Apiculture	164.36	32.82	131.54	65.89	2.00**	-	-	-	-	-
Teff	1445.38	478.44	966.94	474.62	2.04**	-	-	-	-	-
Coffee seedling	-	-	-	-	-	777.98	203.07	574.91	392.62	1.46
Fruits seedling	-	-	-	-	-	797.74	0	797.74	280.94	2.84**
Haricot bean	539.95	208.88	331.07	136.58	2.42**	410.48	56.60	353.88	146.44	2.43**
Total Net income [b]	**2187.97**	**705.10**	**1482.86**	**509.05**	**2.91****	**2509.13**	**281.25**	**2227.88**	**581.53**	**3.83*****

Note: ***, ** and* means significant at 1%, 5% and 10% probability levels, respectively.

[a] Boot strapped standard error with 50 replication

[b] Total Net income is the sum of net income from poultry, apiculture, teff, haricot bean, coffee seedling and fruits seedling.

Regarding marketed surplus of households, there was a statistically significant difference between participants and non-participants of the market development interventions of the IPMS project except for teff and poultry commodities at Alaba and coffee commodity at Dale. The estimation result provides an estimate of amount sold as a proportion to what is produced in that particular year, 2009 at individual commodity level. However, considering only amount sold there is a change in Alaba's finding and no change for Dale's case. With regard to the amount/ quantity sold at Alaba, the amount of teff and poultry heads supplied to the market is statistically significant between the two groups of respondents (Appendix XIV) though it was found to be insignificant in considering proportion of sold to what is harvested.

Looking in to individual commodities of intervention at Alaba, participants supplied 10% more of honey to the market over non-participants and this difference was significant at 10% level of significance. Likewise, for teff, the intervention has increased the marketed surplus of participants by 2% to that of non-participants. The difference was insignificant when considering proportion but it is significant for amount sold. Considering haricot bean, participants supplied 30% more to the market than that of non-participants and the difference was found to be significant at 5% level (Table 25).

Correspondingly, at Dale the intervention has resulted in an increase of poultry marketed surplus of participant households by about 21% more to that of non-participants. This difference was significant at 5% probability level. Compared to non-participants, participants of fruits seedling production have supplied 4% of what they have raised and this was found to be significant at 5% level of significance. Participants supplied 17% more of haricot bean as compared to non-participants and the difference was significant at 5% level. Coffee participants have supplied a 1% more of coffee seedlings to the market over non-participants but the difference was not statistically significant between the two groups. The insignificant impact of coffee on marketed surplus of households may be due to, as noted above; its comparative advantage over the other varietal seedling has not been promoted. For this reason farmers hesitate to plant this particular variety seedling (Table 25).

Table 25 Estimates of average treatment effect (ATT) of marketed surplus

Variable	District									
	Alaba					Dale				
	Treated	Controls	Difference	S.E.[a]	T-stat	Treated	Controls	Difference	S.E.[a]	T-stat
Poultry	12	6	6	0.06	1.00	38	17	21	0.09	2.33**
Honey	14	4	10	0.06	1.67*	-	-	-	-	-
Teff	40	38	2	0.19	0.11	-	-	-	-	-
Coffee seedling	-	-	-	-	-	12	11	1	0.09	0.11
Fruits seedling	-	-	-	-	-	4	0	4	0.02	2.00**
Haricot bean	53	23	30	0.11	2.72**	31	14	17	0.08	2.13**

***, ** and* means significant at 1%, 5% and 10% probability levels, respectively.

[a] Boot strapped standard error with 50 replication

The market development interventions of the IPMS project had positive and significant impact on participant households in terms of their market orientation. With respect to proportion of land allocated to the commodities of intervention, as a proxy for market orientation, participants at Alaba have allocated 6% and 10% more of their proportion of land to haricot bean and teff, respectively. Correspondingly at Dale, participants have allocated 18% more of their proportion of land for haricot bean as compared to non-participants. The reason why there was a more than fivefold increase in proportion of land allocation to haricot bean both at Alaba and Dale might be due to the fact that haricot bean has become better rewarding cash crop both in local and export markets. Moreover, formerly farmers used to plant haricot bean by intercropping it with maize with little agronomic practice as a security crop during the time of food shortage. Currently, due to its increased market demand and better return, farmers started to cultivate it as a sole, cash crop and undertaking necessary agronomic practices which contribute to better yield (Table 26).

Pertaining to consideration of market signal in production planning, most participants at both study sites consider market signal to decide on production planning than that of non-participants. The difference was statistically significant at 1% for Alaba and 5% level for Dale site. Therefore, as all the above proxy measures resulted in significant difference between participants and non-participants of the project, the intervention has concomitantly resulted in a considerable impact on participants in terms of their market orientation. This again indicates that participants are more likely to be market oriented than that of non-participants (Table 26).

Table 26 Estimates of average treatment effect (ATT) of market orientation indicators

Variable	District									
	Alaba					Dale				
	Treated	Controls	D/ce	S.E.[a]	T-stat	Treated	Control	D/ce	S.E.[a]	T-stat
Land to										
H. bean*	0.07	0.01	0.06	0.02	3.00**	0.19	0.01	0.18	0.03	6.00***
Teff*	0.11	0.01	0.10	0.03	3.33**	-	-	-	-	-
M. Signal	1.72	1.11	0.61	0.15	4.07***	1.88	1.42	0.46	0.20	2.30**

*Proportion of land allocated to the commodity of intervention and D/ce refers to difference.
*** and ** means significant at 1% and 5% probability levels, respectively.
[a] Boot strapped standard error with 50 replication

4.2.4 The sensitivity of the evaluation results

In this section the issue whether the final evaluation results are sensitive with respect to the choice of the balancing scores is addressed. Matching estimators work under the assumption that a convincing source of exogenous variation of treatment assignment does not exist. Likewise sensitivity analysis was undertaken to detect the identification of conditional independence assumption was satisfactory or affected by the dummy confounder or the estimated ATT is robust to specific failure of the CIA.

Table 27 reveals the sensitivity analysis of the outcome ATT values to the dummy confounder. Regarding input use in haricot bean both at Alaba and Dale, the average treatment effect on the treated of all inputs used except labor and seed rate used at Alaba was found to be insensitive or robust to the dummy confounder. Whereas in case of teff all significant ATT estimates of input use were robust/ not sensitive to the confounder. Looking in to productivity of commodities of intervention, all were robust to the confounder. With respect to net income, both at individual and aggregate level, the CIA remain to be significant/ robust and the results were not sensitive to the confounder both at Alaba and Dale. Pertaining to marketed surplus of households, all the estimates were found to be robust to the dummy cofounder. Moreover the proxies for market orientation were also robust to the CIA identified.

Table 27 Sensitivity analysis of the estimated ATT

Outcome variable		Individual Variables	Percentage change	
			Alaba	Dale
Input use	H. bean	Fertilizer	0.51*	0.11
		Labor	0.32	0.13
		Seed	0.21	0.37*
	Teff	Fertilizer	0.06	-
		Herbicide	0.04	-
		Oxen days	0.04	-
Productivity		Apiculture	0.06	-
		Haricot bean	0.03	0.02
		Teff	0.02	-
Net income		**Total Net Income**	0.11	0.04
		Poultry	0.16*	0.20
		Apiculture	0.09	-
		Teff	0.14	-
		Haricot bean	0.20	0.15
		Fruits seedling	-	0.05
Marketed surplus		Poultry	0.33*	0.16
		Apiculture	0.14	-
		Haricot bean	0.20	-
		Fruits seedling	-	0.14
Market orientation		Land allocated to haricot bean	0.20	0.04
		land allocated to teff	0.22	-
		Market signal	0.11	0.18

* Those outcome variable possessing insignificant project impact (insignificant ATT)

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

This particular study has evaluated the impact of input and output market development interventions of the IPMS project at Alaba and Dale pilot learning woredas of the project in the SNNP region. Mainly the study was focused on examining the impact of the IPMS's market development interventions on input use and productivity, net income, market surplus and market orientation of participant households as compared to non-participant households. The study used cross-sectional data collected from both participant and non-participant sample households and the data were analyzed using PSM method.

In PSM method, the important variable of interest is average treatment effect on the treated (ATT). This is the difference between the mean value of the outcome variable with and without the intervention. Here, one can understand that the '*with'* and '*without'* condition can not be observed from the same household at the same time. There exists a problem of missing or unobserved outcome. The way out here is the use of the counterfactual outcome to get the comparison. The PSM tries to use propensity score of participation which is estimated from the pre-treatment characteristics to compare the difference due to the intervention. After conditioning on pre-treatment characteristics like socio-economic, demographic variables, matching was done to compute the average treatment effect on the treated (ATT) which is the vital variable of interest in impact assessment.

The initial differences between the 50 participant and 50 non-participant sampled households at each study site were conditioned in such a way that 39 participant households were matched with 50 non-participants using kernel matching estimator with no and with 0.1 bandwidth for Alaba and Dale cases, respectively. This makes from 100 sample households of each study site, only 89 households were identified to be considered in the estimation process.

With regard to input use, the intervention has resulted in about 7 kg more of seed per hectare being used by participants of haricot bean commodity of intervention at Alaba and this difference was significant at 10% probability level. In case of labor use, participants used 6 days more at Alaba and 20 days more per hectare at Dale for the cultivation of haricot bean

and this difference was significant at 5 and 10% level, respectively. At Dale, participants used 20 kg more of fertilizer per hectare of land over the non-participants and found to be significant at 10% probability level. In teff commodity of intervention, participants used 27 kg more of fertilizer, 5ml more of herbicide and 3 days more of oxen per hectare over the non-participants and this difference was significant at 5,5 and 10% level, respectively. In case of Apiculture and poultry the input use between the two groups of respondents was found to be positive but insignificant except poultry feed at Dale. The difference was about 6 kg more per hen per year and significant at 5% level. Pertaining to productivity of commodities of intervention participants has got 23 kg more honey per modern or transitional hive; 5 qt more of teff per hectare and 8 qt more of haricot bean per hectare at Alaba. And these differences were significant at 5, 1 and 10% probability levels, respectively. In the same fashion participants at Dale has harvested about 13 qt more of haricot bean and this difference was significant at 1% level.

Looking in to total net income earned, participants has received a total net income of about birr 1,483 at Alaba and birr 2,228 at Dale form the commodities of intervention over the counter parts. This difference was found to be significant at 5 and 1% level, respectively. Participants of Alaba had earned about birr 30 from poultry; 132 from Apiculture; 967 from teff and 331 from haricot bean intervention over the non-participants. On the other hand, compared to non-participants, participants of Dale earned about birr 497 from poultry; 798 from fruit seedling; 575 from coffee seedling and 354 from haricot bean. Individual net incomes were significant except for poultry at Alaba and coffee seedling at Dale.

Regarding Marketed surplus of commodities of intervention, participants were able to offer about 6% more of poultry, 10% more of honey, 2% more of teff and 30% more of haricot bean proportion to their produce to the market than that of non-participants at Alaba. At th same time at Dale, participants supplied about 21% more of poultry, 1% more of coffee seedling, 4% more of fruits seedling and 17% more of haricot bean produce to the market over the comparison groups. Except for the marketed surplus from poultry and teff at Alaba and coffee seedling at Dale marketed surplus of commodities of intervention were found to be significant. Considering market orientation, in contrast to non-participants, participants at Alaba allocated about 6 and 10% more of the proportion of their land to haricot bean and teff,

respectively. While at Dale participants allocated about 18% more of their land owned to haricot bean over the non-participants. With respect to consideration of market signal in production planning, as a proxy for market orientation, about 61% participants at Alaba and 46% at Dale make production decision based on market signal and this was found to be significant at 1 and 5% level of significance, respectively. Therefore, after controlling the pre-treatment differences the PSM, Kernel matching estimator, has resulted in a positive and significant impact of input use, productivity, net income, marketed surplus and market orientation of treated households. These estimates were also found to be robust for bootstrapping and sensitivity analysis (dummy confounder).

5.2 Recommendations

There are policy implications that can emanate from this finding. As the finding of this study reveals a positive and statistically significant impact of the project on participants, an effort of such kind plays a vital role in making smallholder farmers market oriented and makes them better off by making their farming a business enterprise. The increased level of input use (farm inputs and market information and access) by the side of participants made them beneficiaries of the increased productivity and earners of higher net income and marketed surplus thereof. The development of input market of such kind which is participatory-supplied by the private sector, integrated (multifaceted), and sustainable with the provision of market information and new ways of doing can increase the welfare of the communities in the long run and income in the short run.

In addition, it was observed that the interventions that were delivered by the project were not the kind that develop dependency syndrome among the beneficiaries. It was a kind of making beneficiaries self reliant as to from where input is found, as to how to plan farming, to whom to sell and more interestingly as to how to make informed decision regarding output marketing (pricing). Therefore, there has to be such an institution which serve as a bridge among the stakeholders, energizer for the experts of MoA & the farmers' institution (co-operatives) and 'knowledge broker' in the country. Moreover, scaling up of the practice of the project to other places has paramount importance for the development endeavor of the country.

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7. APPENDICES

Appendix I Conversion factor of tropical livestock unit (TLU)

Livestock Category	TLU	Livestock Category	TLU
Ox	1	Horse	1.1
Cow	1	Sheep (adult)	0.13
Woyefen	0.34	Sheep (young)	0.06
Heifer	0.75	Goat (adult)	0.13
Calf	0.25	Goat (young)	0.06
Donkey (adult)	0.7	Hen	0.013
Donkey (young)	0.35		

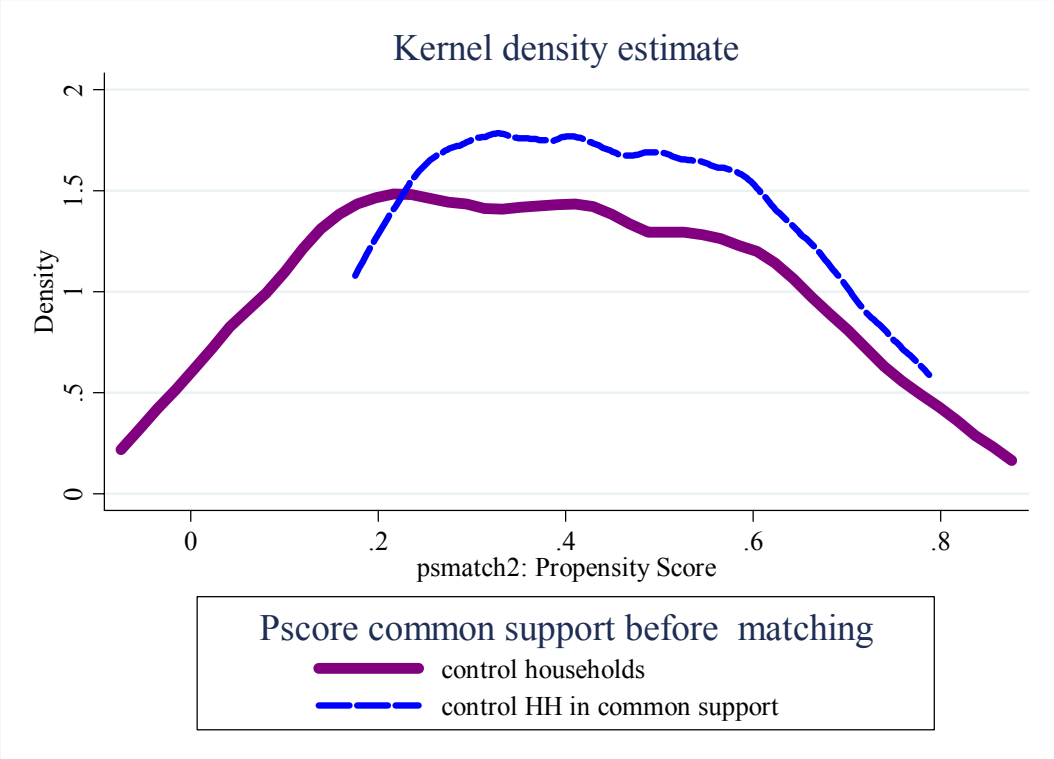
Source: Storck, et al., 1991

Appendix II Conversion factor for adult equivalent (AE)

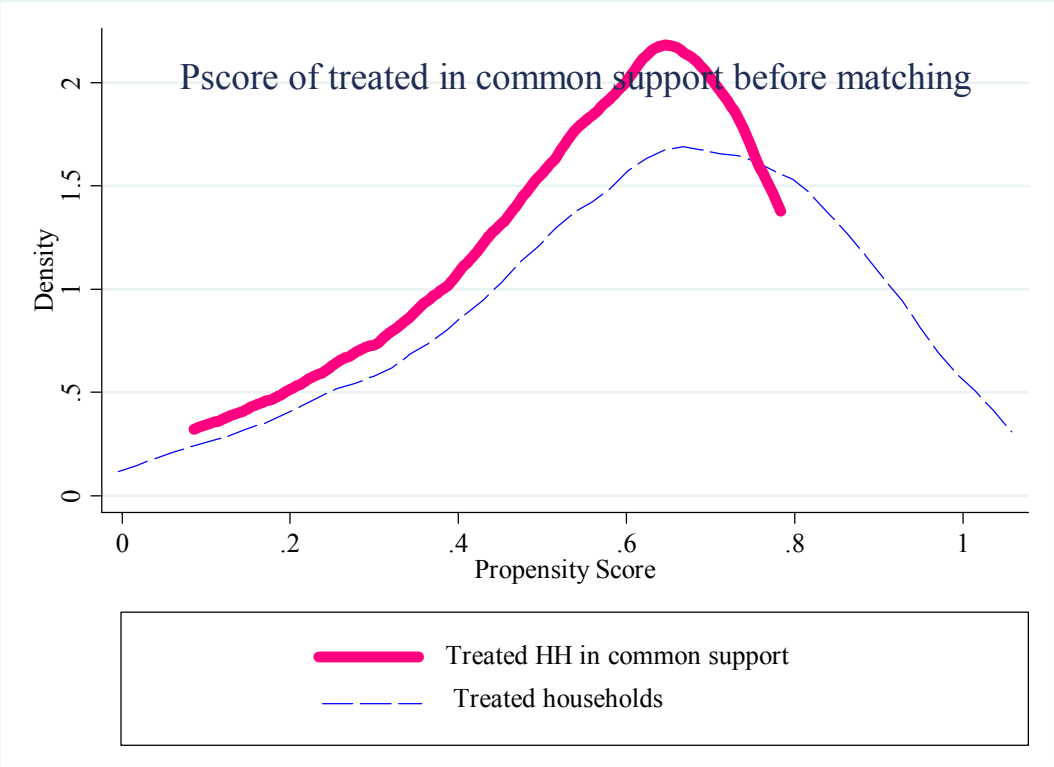
Age group	Male	Female
< 7	0.00	0.00
7-14	0.40	0.40
15- 64	1.00	0.80
>65	0.50	0.50

Source: Storck, et al., 1991

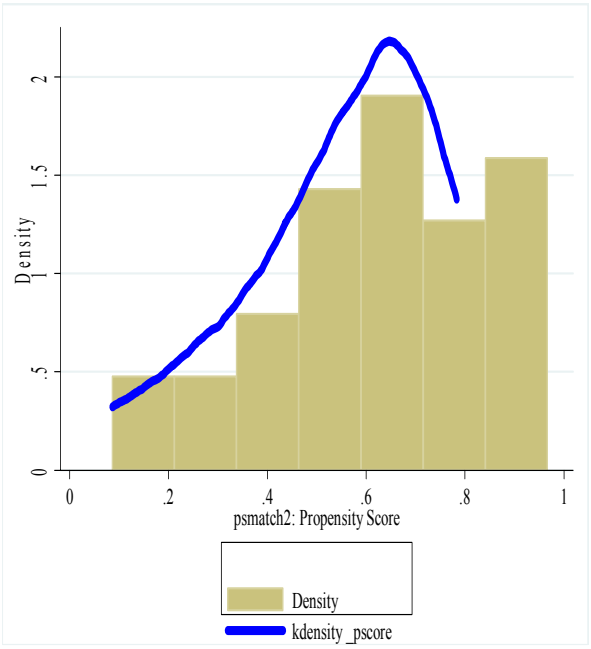
Appendix III Pscore under a common support before matching of Alaba's controls



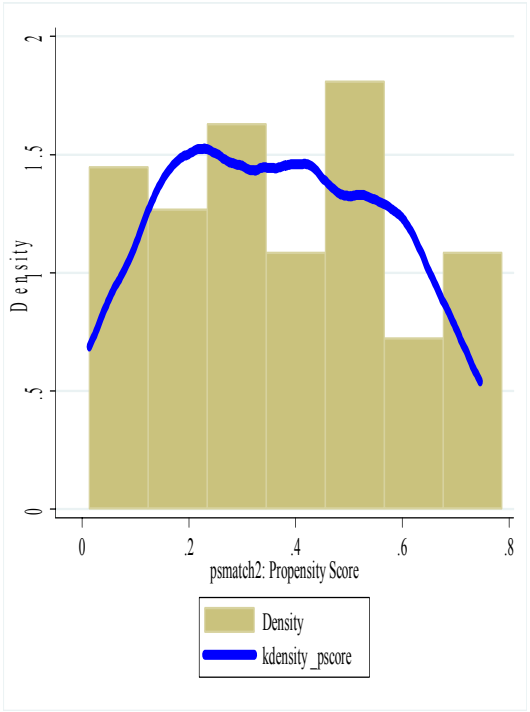
Appendix IV Pscore under a common support before matching of Alaba's treated



Appendix V Alaba's pscore after matching

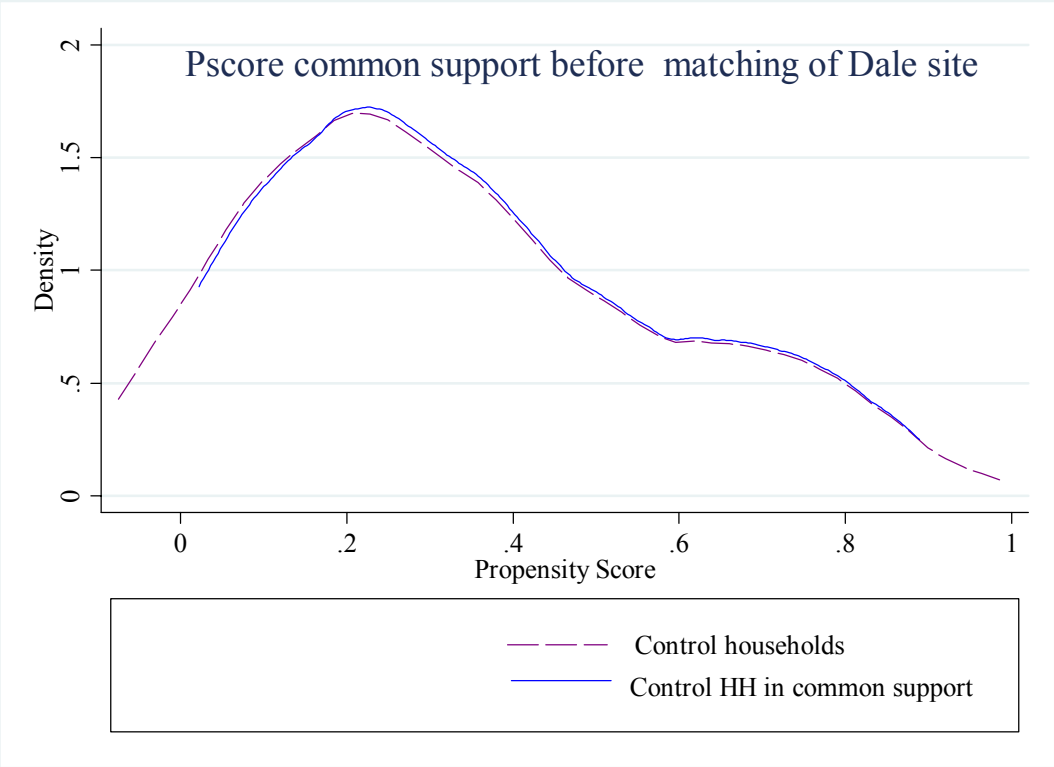


Yes

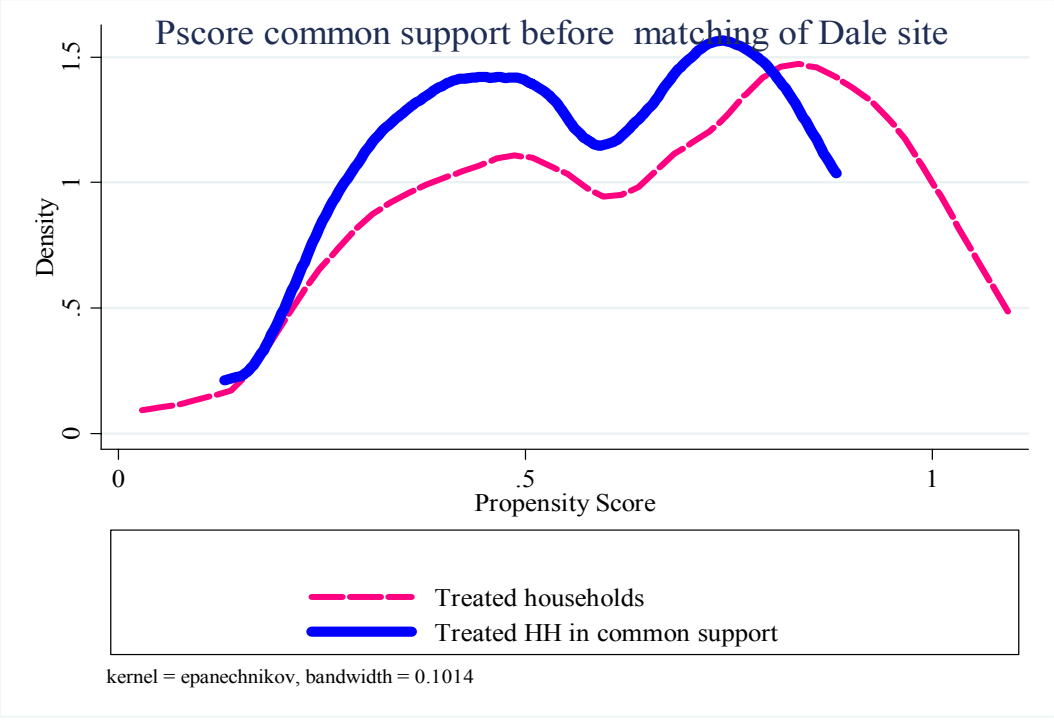


No

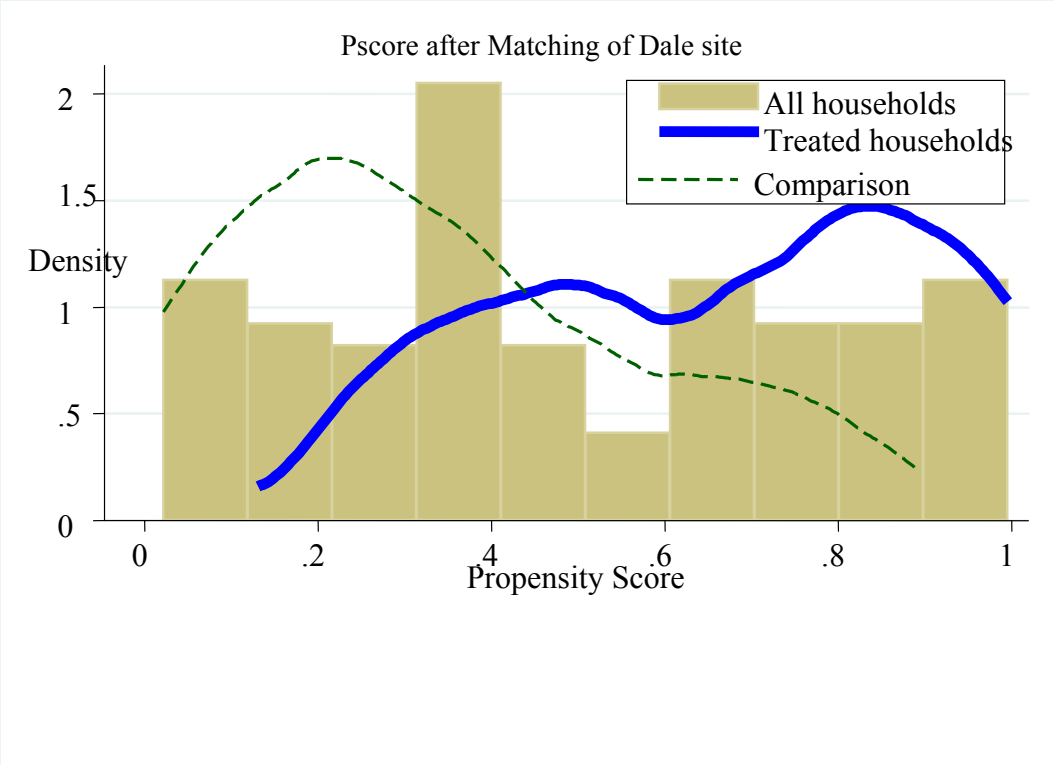
Appendix VI Pscore under common support before matching of controls at Dale



Appendix VII Pscore under common support of Dale's treated respondents



Appendix VIII pscore after matching of Dale' site



Appendix IX Marketed surplus in amount of sold ATT estimation

Variable	District									
	Alaba					Dale				
	Treated	Controls	Difference	S.E.[a]	T-stat	Treated	Controls	Difference	S.E.[a]	T-stat
Poultry	1.31	0.51	0.80	0.45	1.78*	10.95	0.91	10.04	2.55	3.93***
Honey	7.46	1.36	6.09	4.30	1.15	-	-	-	-	-
Teff	1.92	0.72	1.20	0.46	2.58**	-	-	-	-	-
Coffee seedling	-	-	-	-	-	2756.41	926.65	1829.75	1323.93	1.38
Fruits seedling	-	-	-	-	-	67.95	0	67.95	35.16	1.93*
Haricot bean	1.40	0.78	0.62	0.33	1.89*	0.97	0.18	0.79	0.25	3.16***

Note: ***, ** and * means significant at 1%, 5% and 10% probability levels, respectively.

Appendix X Survey Questionnaire

I. HOUSEHOLD CHARACTERSTICS

1. Name of household head, 2. Marital Status? Married=1 Single=2 Divorced=3 Widowed=4
3. Sex? Female=0 Male=1 4. Age? ___(years) 5. Educational status? _____(years) "**0" if illiterate**
6. Family size in age and sex groups

	Children (0-7 yrs)	Children (7-14yrs)	Male (15-64 yrs)	Female (15-64 yrs)	Male (>64 yrs)	Male (>64 yrs)
Total family members						

7.Do you know the interventions of the IPMS project? Yes =1 No =0
8. Did you participate in IPMS market development interventions? Yes =1 No =0
9. *If yes, for how long have you been beneficiary of the project? _____ (years).
10. *In which commodity of intervention did you participate?
1= Apiculture 2= Haricot bean 3= Teff 4= Hot pepper 5= Poultry
11. Total cultivated land in hectares/ in Timad
Owned land _____ Rented in land _____ Rented out land _____
Shared in_____ Shared out_____ Total land size possessed _____
12. Rate of land rental_____ Birr/ Timad
13. How is the trend in your cultivated land after you start involving in IPMS intervention?
Increased=1 decreased= 2 remained the same=3
14. *What is the reason for increasing/decreasing trend in cultivated area_____
15. What type of house do you have? 1. Corrugated iron sheet 2.grass roofed

II. LIVESTOCK PRODUCTION

1. Livestock holding

Livestock type	Cows	Oxen	Heifer	Calves	Y. bulls	Goats	Sheep	poultry	Honey bee
No. of animals									

2. What are the main feed sources in your area? Grazing =1 hay =2 crop straw =3 others =4
3. Do you produce/plant improved forage for your livestock? Yes=1 no=0
4. If yes, what is the size of land allotted for forage last year? _____ha
5. Do you sale improved forage? Yes=1 no=0
6. *Did the IPMS intervention improved feed availability? Yes=1 No=0
7. *If yes, how? _____
8. *What other benefit do you get from IPMS interventions related to feed? _____
9. *Have you brought change in the number of poultry/honey bee kept due to IPMS intervention?
Yes=1 No=0
10. If yes, production in livestock and amount/number sold & income for the years of intervention

Livestock type		Years of intervention							
		2008				2009			
		No. of heads/egg/kg of honey produced	Amt sold	Pric/ head/kg	incom	No. of heads/egg/kg of honey produced	Amt sold	Pric/head/ kg in br	incom e
poultry	heads								
	eggs								
Honey bee	bee colony								
	honey								
	Bee wax								

11. *Specify IPMS support in Livestock production in your a_____
12. *Is there any change in productivity of commodities of intervention by IPMS of livestock?
Yes=1 No =0

13. Did you have beehives in 2000/1? Yes=1 No=0

14. If yes, what was your source, the type and cost of the hive you have?

Type	Source of beehives 1=home made 2= purchase 3= donated from OoARD	quantity	Unit cost or market value (birr/ hive
Traditional			
Transitional			
Modern			

15.Did you produce bee forage? Yes=1 No=0

16.Did you multiply bee colony for sale? Yes=1 No=0

17. Have you purchased any inputs for honey production purpose 2000/1? Yes=1 No=0

18. If yes, would you tell us the following information?

Type of inputs	Does market exist 1=yes 2= no	Quantity	Unit cost	Total cost(value)	Source 1=trader2=other farmer 3=OoARD 4=Cooperatives
Bee colony(no.)					
Bee forage(kg)					
Bee accessories					
Hired Labor					

19. What is the frequency of honey extraction per year? _____

20. Does the yield vary per extraction? Yes =1 No=0

21. If yes, how? Average first round yield_____ second round yield_____

III. CROP PRODUCTION

1. How much '*timad*' is considered as one hectare in your area? _____

2. When did you start farming for your own? _____(Years)

3. *Have you brought about change in land allocated to the commodities of intervention due to IPMS intervention? Yes=1 No=0

4. *If yes, land allocation and commodity of intervention on the farm (in timad)

S. No.	Commodity of intervention	Is there IPMS intervention in the commodity?		Area allocated in *timad*	
		1=Yes 0=No	Since when?	2008	2009

5.*Out of the total land you have, how much did you allocate to the commodity that IPMS has tried to develop through the value chain approach? _____

6. *Specify IPMS support in crop production in your area _____

7. Production, amount sold & income for the years of intervention

Crop type	Year of intervention							
	2008				2009			
	Prodn in qt	Amt sold	Pric/ qt	incom	Prodn in qt	Amt sold	Pric/ qt	incom
Hbean								
Teff								

8. *Is there any change in productivity of commodities of intervention of IPMS? Yes=1No =0

9. *If your answer is decreased what do you think is the reason? _____

10. *If your answer is no change what do you think is the reason? _____

11. How do you take production decisions?

1= traditional way 2= based on market signals 3= others (specify) _____

12. If you take decisions based on market signal, what is your source of information?
1= MOA, 2= IPMS, 3= others (specify) _____
13. What do you think is the advantage of using market signal to take production decision?
14. What problem did you face when you have been using market signal to make production decisions? _____

A. Labor

1. Provide information on utilization of labor for poultry production

S.No	Activities	Days spent per year
1.	Housing	
2.	Feeding	
3.	Watering	
4.	Follow up	
5.	Medication	

2. Provide information on utilization of labor for honey production

S.No.	Activities	Days spent per year
1.	Hive making	
2.	Watering and Feeding	
3.	Regular monitoring	
4.	Swarm control	
5.	Colony transferring	
6.	Honey harvesting	
7.	Honey selling	

3. Provide information on utilization of labor in days spent per year for crop production

S.No.	Crop type	Area	Land preparation to planting	Weed.	Harv.	Tran.	Thresh.	Stor.
1.	H.bean							
2.	Teff							

4. What is average working hours per day in crop production related activities? ___hours
5. What is an average working hour per day in poultry related activities? _____hours
6. What is an average working hours per day in beekeeping related activities? ____hours

B. USE OF OXEN

1. For which activities did you use oxen?
Plowing =1 threshing =2 Others (specify) _____
2. Sources of oxen for plowing?
Own =1 hired/rented = 2 Borrowed = 3 others (specify) _____
3. How much is the cost (rent) of pair of oxen in your area for plowing per day?
a) In cash_____ Birr b) in kind _____
4. Provide information, if oxen were used for crop production

S.No.	Crop type	Area	Oxen-pair days for Plowing	Threshing	
				No. of oxen	No. of days
1.	Haricot bean				
2.	Teff				

5. Sources of oxen for threshing? Own =1 hired/rented =2 borrowed =3 others =4(specify) _____
6. How much is the cost (rental cost) of an ox in your area for threshing per day?
a) In cash_____ Birr b) in kind _____

C. Herbicide

1. Did you use herbicide to control weeds? Yes =1 No =0
2. If yes, provide the following information on the use of herbicides

S. No.	Crop type	Area (timad)	Herbicide	
			2-4-D (lit)	Price per lit
1.	Teff			

D. FERTILIZER USE

1. Do you use fertilizer in your crop fields? Yes =1 No =0
2. If yes, when did you first use fertilizer on your farm? _____ (year)
3. If yes, type and quantity of fertilizer applied

Crop type	Years of intervention					
	2008			2009		
	Area (timad)	Quantity(Kg)		Area timad	Quantity(Kg)	
		Urea	DAP		Urea	DAP
H.bean						
Teff						

4. What is the reason for the above rate of fertilizer?
   Own experience =1 Recommended =2 Others =3(Specify)
5. If recommended, what was your source of information?
   Extension =1 Research =2 NGOs =3 Other farmers =4 Others =5(specify)
6. Is the current recommended fertilizer application profitable for you? Yes =1 No =0
7. If no, which application rates do you suggest? _____Kg/ha
8. How was your fertilizer utilization changed due to IPMS?
   Increased =1 Reduced =2 maintained the same =3 stopped using =4
9. If increased, why? _____
10. If reduced, why? _____
11. Fertilizer procurement (2008/09)

Season	Source*	Distance(Hr)	Cost of fertilizer transport (Br/Qt)
Meher			
Belg			

*MOA=1 Cooperatives=2 NGO=3 Market=4 Local merchants=5 others=6(specify)

12. What was the price of fertilizer in 2008/09 production year?
    a) In **Meher** DAP_____ **Br/Qt**; Urea _____**Br/Qt**
    b) In **Belg** DAP_____ **Br/Qt**; Urea _____**Br/Qt**
13. What constraints do you face on fertilizer use? Inadequate supply =1 High price =2
    Absence of fertilizer Credit =3 Bad weather =4 Not profitable =5 Late delivery =6
    Inappropriate loan repayment time =7 others =8(specify)

E. SEED

1. What is your seed source for the intervention commodities?
   1=MOA 2=Cooperatives 3=Local market 4=other (specify) _____
2. What is the seed rate used for commodities of intervention by IMPS

S. No.	Commodities of intervention	Years of intervention			
		2008		2009	
		Seed Rate used (Kg/ha)	Price/kg	Seed Rate used (Kg/ha)	Price/ kg
1.	H. bean				
2.	Teff				

3. What is your source of improved poultry type? 1=MOA 2=IPMS 3=Cooperatives 4=Local market 5= NGOs 6= Other specify _____
4. Did your use of seed improved change due to IPMS? Yes =1 No =0

IV. INSTITUTIONAL FACTORS

1. Have you received any type of credit last year? Yes=1 No=0
2. What is your source of credit? 1=MOA 2=Cooperatives 3= Microfinance institutions 4=Specify
3. What are the problems in getting credit?
   Few supply =1 Inadequacy of credit =2 Absence of informal sources =3 Unfavorable repayment time=4 High interest rates =5 Restrictive procedures =6 others =7(specify) _____
4. How do you rate the availability and adequacy of credit?1=bad 2= moderate 3=good
5. Did IPMS done any contribution in relation to credit? Yes=1 No=0
6. If yes, what, how, specify? _____
7. Is there Agricultural Development Agent in your area? Yes=1 No=0
8. If yes, do you get services or technical advice from development agents? Yes=1 No=0
9. If yes, frequency of contact? _____ (total number of visits per year)
10. Have you ever attended farmers' training course? Yes =1 No =0
11. If yes, how many days of training? _____
12. What is the **distance in Km** from your home to the development agent's office or residence? _____
13. How many **hours** it requires you to walk from your home to the development agent's office or residence? _____
14. What do you think is the contribution of IPMS for the extension service?
15. Are you a member of any formal organization/association other than PAs? Yes =1 No =0
16. If yes, which one? Cooperatives =1 Women's group =2
    Farmers' group=3 Others =4(specify) _____
17. What services do you get from the formal organization you belong to?
    Loans/credit =1 Seeds =2 Fertilizer =3 Labor =4 Education/information=5 other=6 (specify)
18. Have you ever made contractual agreement so far? Yes=1 No=0
19. If yes, how do you rate the contractual agreements (keeping promises among partners)?
    1=low 2=moderate 3=high
20. Did IPMS made intervention on Cooperatives? Yes=1 No=0
21. If yes, is there any change on cooperatives after IPMS intervention? Yes=1 No=0
22. If yes, how? _____

V. FARM INCOME AND MARKETING

1. Where are your major markets for sale of farm products? _____
2. Distance of the nearest market in kilometers?_____ (in hours of walk _____)
3. Distance of the farthest market in kilometers?_____ (in hours of walk _____)
4. When do you sale most of your products?
   1=Right after harvest 2=Later after harvest 3=Others
5. What is your opinion on the prices of crops that prevailed in 2008/09?
   Good = 1 Fair =2 Bad =3
6. How is the trend of your agricultural (on-farm) income since IPMS's intervention in the PA?
   Increased=1 Decreased=2 Remained unchanged=3
7. What was your total annual income from A) Crop sale _____birr B) Livestock sale ____birr C) Sale of livestock products ____birr D) off-farm activity _____birr E) Others (specify) ____ birr
8. What was your total annual expenditure for the last year?
   A) Labor ____birr B) Purchase of farm tools ___birr C) Purchase of fertilizer ___birr D) Purchase of seed ___birr E) Others (specify___) __birr

9. What are your sources of finance for purchase of agricultural inputs?
   1=Crop sales 2=livestock sales 3=Off-farm activities 4=Credit 5=others
10. Is there any market access change? Yes=1 No=0
11. If yes, how? _____
12. Do you get market information about prices and demand conditions of agricultural **outputs**?
    Yes=1 No=0
13. If yes, indicate the source of information_____
14. Do you get market information about prices and demand conditions of agricultural **inputs**?
    Yes=1 No=0
15. If yes, indicate the source of information_____
16. Do you feel IPMS brought benefit to you in providing market information using bill board and speaker? Yes=1 No=0
17. If yes, in what aspect? _____
18. After IPMS information provision did you get better return/ price? Yes=1 No=0
19. Did IPMS market information help you in reducing transportation costs in relation to **output** markets? Yes=1 No=0
20. If yes, how? _____
21. Did IPMS market information help you in reducing transportation costs in relation to **input** markets? Yes=1 No=0
22. If yes, how? _____
23. Do you know the input supply shop? Yes=1 No=0
24. What benefit do you get from that shop? _____