THE IMPACT OF INPUT AND OUTPUT MARKET DEVELOPMENT INTERVENTION OF THE IPMS PROJECT: THE CASE OF MEISO WOREDA, OROMIYA NATIONAL REGIONAL STATE, 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

TIHITINA ABEBE

June, 2011
Haramaya University

APPROVAL SHEET OF THESIS

SCHOOL OF GRADUATE STUDIES

HARAMAYA UNIVERSITY

As Thesis Research advisor, I hereby certify that I have read and evaluated this thesis prepared, my guidance, by **Tihitina Abebe** entitled "**Impact Assessment of Input and Output Market Development Interventions by IPMS Project: The Case of Mieso Woreda Oromiya National Regional State, Ethiopia**". I recommend that it can be submitted as fulfillment of the Thesis requirement.

Berhanu G/Medhin (PhD)	_____	_____
Major Advisor	Signature	Date
Moti Jaleta(PhD)	_____	_____
Co Advisor	Signature	Date

As member of the Board of Examiners of the M.Sc. Thesis Open Defense Examination, we certify that we have read and evaluated the thesis prepared by Tihitina Abebe. We recommended that the thesis is accepted as fulfilling the Thesis requirement for the Degree of Master of Science in Agriculture (Agricultural economics).

_____	_____	_____
Chair Person	Signature	Date
_____	_____	_____
Internal Examiner	Signature	Date
_____	_____	_____
External Examiner	Signature	Date

DEDICATION

To my family

STATEMENT OF AUTHOR

First, I declare that this thesis is the result of my own work and that all sources or materials used for this thesis have been duly acknowledged. This thesis is submitted in partial fulfillment of the requirements for M.Sc. degree at Haramaya University and to be made available at the university's library under the rules of the library. I confidently declare that this thesis has not been submitted to any other institutions anywhere for the award of any academic degree, diploma, or certificate.

Brief quotations from this thesis are allowable without special permission, provided that accurate acknowledgement of source is made. Requests for permission for extended quotation from or reproduction of this manuscript in whole or in part may be granted by Dean of the school of graduate studies when in his or her judgment the proposed use of the material is in the interests of scholarship. In all other instances, however, permission must be obtained from the author.

Name: **Tihitina Abebe** Signature: ……

Place: **Haramaya University, Haramaya**

Date of Submission: **June, 2011**

BIBLIOGRAPHICAL SKETCH

The author was born on 1986 in Haramaya. She attended her primary education at Haramaya model school and her secondary and preparatory education at SOS Hermann Gmeiner primary and secondary school in Harar.

She joined Haramaya University in 2004/05 and graduated with B.A. degree in Economics in 2008.Then she joined the School of Graduate Studies of Haramaya University, department of agricultural economics in 2008/2009 academic year as a self-sponsored student for pursuing her MSc degree in agricultural economics.

ACKNOWLEDGEMENTS

First of all, I would like to thank my Lord God for giving me the chance to enjoy the fruits of my endeavor and giving me courage and endurance to withstand all the problems and troubles.

Words fail to convey my deepest thanks to my advisor Dr. Berhanu Gebremedhin for his willingness to advice and guide me with understanding throughout the course of the research. It is my sublime privilege to express my deepest sense of gratitude and indebtedness for his scientific guidance and ceaseless support throughout the course of the research work in addition to restructuring and editing the thesis that is obviously tiresome. I also remain thankful to my co-advisor Dr. Moti Jaleta.

My deepest overwhelming acknowledgment goes for my parents who have there for me through everything for their commitments and sacrifices to bring me to this stage. I would also like to convey my thanks to my entire family for their unforgettable encouragement.

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 and DAs of MoARD, the enumerators.

Finally, I would like to send my gratitude to all individuals and institutions for their support and encouragement in the entire work of the research.

.

LIST OF ABBREVIATIONS

ADLI	Agricultural Development Led Industrialization
AI	Artificial Insemination
ATT	Average Treatment Effect
CG	Consultative Group
CIA	Conditional Independence Assumption
CIDA	Canadian International Development Agency
CSA	Central Statistics Authority
DA	Development Agent
DID	Difference in Difference
FGD	Focus Group Discussion
FTC	Farmers Training Center
HH	Household
ILRI	International Livestock Research Institute
IPMS	Improving Productivity through Market Success
M. a. s. l	Meters above sea level
MBPRD	Mieso Woreda Office of Pastoralists and Rural Development
MoARD	Ministry of Agriculture and Rural Development
OCSSCO	Oromia Credit and Saving Share Company
PA	Peasant Association
PASDEP	Plan for Accelerated and Sustained Development to End Poverty
PLW	Pilot Learning *Woredas*
PMG	Producer Marketing Groups
PRA	Participatory Rural Appraisal
PRSP	Poverty Reduction Strategy Program
PSM	Propensity Score Matching
SDPRP	Sustainable Development and Poverty Reduction Program
SPSS	Statistical Package for the Social Sciences
STATA	Data Analysis and Statistical Software
STD	Standard Deviation
TLU	Tropical Livestock Unit
VIF	Variance Inflation Factor

TABLE OF CONTENTS

TABLE OF CONTENTS (*Continued*)

TABLE OF CONTENTS (*Continued*)

LIST OF TABLES

Table **Pages**

LIST OF FIGURES

Figure **Page**

LIST OF TABLES IN THE APPENDIX

Appendix Table **page**

IMPACT ASSESSMENT OF INPUT AND OUTPUT MARKET DEVELOPMENT INTERVENTIONS OF THE IPMS PROJECT: THE CASE OF MIESO WOREDA, OROMIYA NATIONAL REGIONAL STATE, ETHIOPIA

ABSTRACT

Improving Productivity and Market Success of Ethiopian farmers' (IPMS) is a project that is being implemented by ILRI at 10 pilot learning woredas in the country to enhance market oriented production so that the country can overcome the problems of poorly developed agricultural production and marketing. Even though the project has been in place for over five years its impact has not been evaluated. Therefore, this study evaluates the impact of input and output market development interventions of the project on institutional and organizational aspect of markets, input use and productivity, total net income, marketed surplus and market orientation of the participant households. For quantitative analysis both program participant and non participant respondents were drawn and cross-sectional survey data were collected from 180 households in Mieso woreda. A propensity score matching method was applied to assess the impact of the project on outcome variables of the treated households. Results show that the market development interventions have a significant and positive impact on the outcome variables measured using different indicators. The intervention has resulted in positive and significant impact on level of input use for onion and goat production of the treated households. Participants earned more total net income on average from commodities of intervention over non-participants and also found to be more market oriented and supplied more of their produce to market over non-participants. However, some outcome variable indicators such as input use for cattle, net income from goat, land allocated for onion and proportion of goat allocated for fattening by participant households are positive but statistically insignificant. The sensitivity analysis also show that results are not sensitive to unobserved selection bias and were robust to the dummy cofounder. These results reveal that market development interventions of such kind play an important role for the overall transformation and development activities of the country.

Key words: Input and output market development intervention, propensity score matching, Mieso, impact.

1. INTRODUCTION

1.1. Background of the Study

Agriculture is the mainstay of the Ethiopian economy. The agricultural sector accounts for 45 percent of national GDP, 83.9 percent of export earnings and 85 percent of employment opportunity (CIA, 2010). Ethiopia has reasonably good resource potential for agricultural development. Despite agricultural sector's importance in the livelihood of the people and its potential, the sector has still remained at subsistence level due to multifaceted problems (Dercon and Zeitlin, 2009). As a result, Ethiopia is faced with broad, deep and structural poverty problem.

The prevalence of poverty in Ethiopia is associated with slow growth and low productivity of subsistence agriculture. Low productivity in turn is associated among others with very low technical progress. The dependence on rain-fed cultivation practice renders the economy vulnerable to the vagaries of weather conditions (IPMS, 2005).

Like in many developing countries, poverty, food insecurity and poor nutrition were the country's endemic social and economic problems for most of the second half of the 20th century especially among the rural population predominantly dependent on low productive subsistence farming. Consequently, in the first decade of the 21st century they still remain as central policy concern to the Government of Ethiopia. In spite of tremendous efforts, Ethiopia is still among the poorest developing countries with an annual average per capita income of US$317 in 2008 (UNDP, 2010). Furthermore, around 38.7% of the country's populations are below the national poverty line in 2009 (CIA, 2010).

In view of these state of affairs, right from its seizure of power, the current Government of Ethiopia has formulated policies and strategies to guide overall economic development with focus on rural and agricultural development. The fundamental development objective of building a free-market economic system in the country is expected to facilitate economic development, and extricate the country from dependence on food aid and reduce poverty.

These policies and strategies mainly focus on bringing about a structural transformation in agricultural sector and a shift from subsistence production to market-oriented production. They carried important strategic direction in relation to infrastructure, human development, rural development, food security, and capacity-building. They also recommended specialization both at farm and commodity level, a shift to a high-value crops, promotion of niche high-value export crops and a stronger focus on selected high-potential areas. In fact, they also embodied some bold new directions by giving high policy attentions to greater commercialization of agriculture and enhancing private sector development, industry, increased availability and utilization of appropriate technologies, an effective and efficient service delivery system, improving institutional competence and performance, urban development and a scaling-up of efforts to achieve the Millennium Development Goals (MDGs)[1].

The performance of the agricultural sector has been the base for economic growth in Ethiopia. However, Ethiopian agriculture as well as the agricultural marketing has been poorly developed. Nevertheless efficient agricultural marketing system is the main driving force for successful agricultural development and the economy in general. Inefficient performance of the agricultural markets in Ethiopia has been known in various studies as a major hindrance to growth in the agricultural sector and the overall economy. If the marketing system is inefficient, high marketing costs will render products uncompetitive particularly on the international market (MOFED, 2002). Moreover, poorly-functioning credit, input, and product markets may prevent asset-poor farmers from being able to exploit the higher returns to available land and labor that increased agricultural commercialization may provide (Jayne *et al.*, 1994). Thus, improving the efficiency of markets is an important part of the overall development strategy.

In order to attain economic development in Ethiopia the current subsistence oriented agricultural production system needs to be transformed into a market oriented production system. Hence, the government has emphasized the transformation of subsistence

[1] Millennium Development Goals (MDGs) are those goals set to: eradicate poverty and hunger, achieve universal primary education, promote gender equality and empower women, reduce child mortality, improve maternal health, combat HIV/AIDS, malaria and other diseases, ensure environmental sustainability, develop a global partnership for development.

agriculture into market orientation as a basis for long-term development of the agricultural sector. To be competent both at the local and international markets, a focus should be given to farm level production efficiency, product quality, post harvest handling and technologies. As opposed to producing for subsistence, producing primarily for the market (both domestic and export markets), quality and standard of the produce become much more important, since competitiveness depends partly on quality of produce which in turn depends heavily on the use of the right technologies and methods of production. Rapid adjustments in production technologies and timely and effective transmission of market information are vital in altering market conditions and consumer preferences.

Standardization of agricultural products, improving the supply of market information system, expanding and strengthening cooperatives, and strengthening private sector participation are key elements for proper functioning of the agriculture marketing system(MOFED, 2002).

It is with this background that, the Improving Productivity and Market Success (IPMS) project was formulated and has been implemented since 2005. IPMS is donor-supported and implemented by the International Livestock Research Institute (ILRI) on behalf of the Ministry of Agriculture of the Federal Democratic Republic of Ethiopia (MoA). The project follows a value chain development approach, which is made up of several interconnected components that include input supply and services, production, post harvest management and processing, distribution and marketing and consumption (IPMS, 2005). Key to such development is to create the capacity of the rural communities, where farmers produce what they can market rather than trying to sell what they already produce.

The main objective of the project is to contribute to a reduction in poverty of the rural poor through market oriented agricultural development. In attaining this objective, the project supported development and research on innovative technologies, processes and institutional arrangements in the following four focus areas: knowledge management; innovation capacity building of public and private sector partners, farmers and pastoralists; participatory marketable commodity development and development and promotion of recommendations for scaling out (IPMS, 2005).

The project has been implemented in 10 pilot woredas (PLWs) in four major Regional States in the country. In view of helping farmers to improve farm productivity and their market orientation, the project has been assisting the government by accelerating the introduction of technology and institutional innovations, in collaboration with relevant stakeholders so that the technology adoption and application process is enhanced.

However, no study has been conducted in assessing the impact of the interventions of the IPMS project in one of the PLWs, Mieso woreda in Western Hararghe. An assessment of the impact of the market oriented interventions would be useful to draw lesson for scaling out and up of successful interventions. This study is, therefore, aimed at evaluating the impact of the interventions of the IPMS project in Mieso Woreda and aimed at filling the existing knowledge gap.

1.2. Statement of the Problem

Many rural families in Ethiopia suffer from chronic food insecurity and are extremely vulnerable during periodic drought. The methods and techniques of agricultural production and distribution are traditional and result in low productivity (IPMS, 2005). Limited resource ownership, low levels of adoption and use of improved technologies and lack of adequate infrastructure and institutions that support agricultural development are the major factors behind low productivity of small scale agriculture in Ethiopia.

The level and speed of economic development in Ethiopia is heavily influenced by sustained growth in agriculture. Sustained agricultural growth requires increased availability of technologies, farm inputs and services on the one hand and sustained demand for agricultural output on the other. Agricultural marketing is the main driving force for economic development and has a guiding and stimulating impact on production and distribution of agricultural production. However, agricultural markets are inefficient in Ethiopia.

It is increasingly recognized that the commercialization of small-scale farming is closely linked to higher productivity, greater specialization, and higher income (Timmer, 1997). Furthermore, in a world of efficient markets, commercialization leads to the separation of

households' production decisions from their consumption decisions, supporting specialization at household level and diversification at regional or national level. At the macro level, commercialization has also been shown to increase food security and, more generally, to improve allocative efficiency (Timmer, 1997; Fafchamps, 2005).

The IPMS project which aims at contributing to reduction of poverty of the rural poor through market-oriented agricultural development has been implemented in Mieso woreda since 2004. Linking producers to the potential buyers and input suppliers, developing/strengthing producers' cooperatives, establishing alternative input shops, involving private sector in input and output marketing were some of the interventions made in the market development component of the project for the selected market oriented commodities: onion; goat and cattle. However, the impact of these interventions has not been assessed.

Evaluating impact is particularly critical in developing countries where resources are scarce and every dollar spent should aim to maximize its impact on poverty reduction. It has greater importance for the economical allocation of scarce resources in addition to its importance in providing evidence for governments, aid donors and development communities, who are increasingly asking for hard evidence on the impact of public spending projects claiming to reduce poverty.

Hence, this study attempts to provide empirical evidence on the impact of IPMS interventions on institutional and organizational setups of the woreda market, marketed surplus, total household net income, farm intensification and productivity, and households' market orientation behavior for the market oriented commodities of interventions in the Mieso woreda.

1.3. Objectives of the Study

The general objective of the study is to assess the impact of input and output market development interventions by IPMS project on change on institutional and organizational aspect of markets, input intensity and productivity, net income, market surplus and market orientation of households.

The specific objectives are: to:

1. Describe the changes in the organizational and institutional aspects of agricultural markets due to the intervention;
2. Measure the impact of the market interventions on livestock (goat and cattle) and onion intensification and productivity;
3. Measure the impact of the interventions on household net total income from onion and goat and cattle fattening;
4. Measure the impact of the interventions on marketed surplus of onion and fattened goat and cattle; and
5. Measure the impact of the market interventions on market orientation of onion producing and goat and cattle fattening households.

1.4. Significance of the Study

In countries like Ethiopia where investment capital is very limited, knowing the impact of project interventions is critical. Hence, assessing the impact of IPMS towards increased agricultural productivity and market success of Ethiopian farmers would be important to all stakeholders (beneficiaries, MoA and donors and also other rural development actors aiming at formulating and implementing similar projects). These stakeholders need to know the impact in order to draw lesson to improve project design and intervention implementation. Such impact assessment study is especially important for scaling out and up of success stories to achieve greater impact at larger scale. Evidence based project planning and implementation would save scarce funds from being used unwisely

1.5. Scope and Limitations of the Study

The study was undertaken in Mieso woreda of Oromia National Regional State with the main intention of assessing the impact of input and output market development interventions of IPMS on different outcomes of interest. The study was limited to the impact of market development interventions only for onion production and goat and cattle fattening undertaken in the woreda with the support of the project. Hence, confinement to one woreda and focus only on a few commodities may limit the generalization of the

results. However, it is believed that the results would shed a strong clue on the direction of impact of the overall project intervention since the three commodities were the major focus of the interventions. Since Mieso woreda is the only pastoral/agro pastoral woreda of the IPMS PLWs, the study is useful in terms of drawing lessons to similar farming systems in Ethiopia.

1.6 Organization of the thesis

This thesis is organized in five chapters. Chapter one presents the introductory part of the study. The following chapter presents literature review that includes concepts on market, market development, market participation, market orientation and their measurements and linkage of institutions and marketing and impact evaluation methods. Chapter three introduces the methodology which includes description of the program and study area, source and methods data collection and analysis as well. Chapter four describes the results and discussion of the research outcomes and finally chapter five summarizes the findings of the study and draws appropriate conclusions and policy implication.

2. LITERATURE REVIEW

2.1. Definition of Basic Concepts

2.1.1. Market

The word “market” has been defined differently by different scholars over the years. Some of these definitions are as follows. One old definition states that market is another name for demand (McNair and Hansen, 1956). Alternatively, market is defined as a single arrangement in which one thing is exchanged for another (Bain and Howells, 1988). A market is also thought of as a meeting point of buyers and sellers: a place where sellers and buyers meet and exchange takes place: an area for which there is a demand for goods and area for which price determining forces (demand and supply) operate. Moreover, in modern times a market is also defined as an arena for organizing and facilitating business activities and for answering the basic economic questions like how much to produce? What to produce? How to distribute production? (Kohls and Uhl, 1985). As a result, one can understand that the word market has a concept of location, product, time, demand and a group of consumers and suppliers.

2.1.2. Marketing

Another basic concept that is closely related to market is marketing. There is no universally accepted definition of marketing since the usefulness and validity of a definition is associated with its application. For this study, the following definition was used. ‘Marketing is the performance of all business activities involved in the flow of goods and services from the point of initial agricultural production until they are in the hands of ultimate consumers’ (Kohl, 1968 cited in Jone, 1972).

2.1.3. Marketing systems

A marketing system is a collection of actors, channels, intermediaries, business activities, and institutions which facilitate the physical distribution and economic exchange of goods (Kohls and Uhl, 1985). A marketing system can also be regarded as a multi-layered

sequence of physical activities and of transfers of property rights from the farm-gate to the consumer (White, 1995). A channel of distribution may be defined as a path traced in the direct or indirect transfer of the title to a product as it moves from a producer to ultimate consumer or industrial users.

2.1.4. Market development

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).

It can also be said that market is developed, if in addition to the existing markets, new markets are created like niches and linkage to supermarkets which has not been practiced before though marketing practice has been there for long periods, new customers are targeted, different institutions and organizations are involved in every activities in the value chain development approach (Mwape, 2009). In this regard, improving quality and quantity of the existing product, targeted marketing strategies are important components.

Market development may include identifying the products which have potential demand in the domestic as well as international market places, linking potential buyers and sellers, provision of market information which contributes for reduction in marketing costs, establishing primary cooperatives in order to improve their bargaining power and further reduce the transaction costs in the value chain approach (Mwape, 2009).

An important framework for market development is that developed by Ansoff (1957) which classifies market development into market penetration, product development, market development and diversification.

Table 1: Conceptual framework in marketing strategies of market development

	Existing products	**New products**
Existing markets	**Market penetration** Increase sales of products to existing market segments e.g decrease prices, promotion	**Product development** Identify opportunities for new or modified products e.g. product differentiation through new packaging, brands, additional processing, quality improvement
New markets	**Market development** Expanding into new geographical area, selling to new segments of the population, New product dimensions or packaging etc.	**Diversification** Identify opportunities for new products for new clients or markets

Source: Adopted from Ansoff (1957)

According to Ansoff (1957), the main components of market development are: marketing extension and training; market information and intelligence network; grading and standardization at producer's level; improvement in competition and awareness; accessibility of marketing finance and credit; and promoting the product by targeting different customers.

Similarly, Eleni and Goggin (2006), explain that market development requires an integrated rather than piecemeal approach, in which the key market institutions needed, such as market information, grades and standards, contract enforcement, regulation, and trade and producer groups, involvement of different stakeholders are integrated. Moreover, the interaction of these stakeholders and the institutions which are governing them are very important for the best functioning of the activities.

Input and output marketing system play key roles in the adoption of agricultural technologies. If farmers do not have efficient input and output markets, they resist investing in new and more productive technologies (Oechmke *et al.,* 1997). Thus, generally it can be said that, market development increases the competitiveness of selected agricultural sub-sectors that target national, sub-regional and international markets thereby contributing to agricultural growth.

2.1.5. Market participation

William *et al.* (2008) defined market participation in terms of sales as a fraction of total output, for the sum of all agricultural crop production in the household which includes annuals and perennials, locally-processed and industrial crops, fruits and agro-forestry. This sales index would be zero for a household that sells nothing, and could be greater than unity for households that add value to their crop production via further processing and/or storage.

Market participation is both a cause and a consequence of economic development. Markets offer households the opportunity to specialize according to comparative advantage and thereby enjoy welfare gains from trade. Recognition of the potential of markets as engines of economic development and structural transformation gave rise to a market-led paradigm of agricultural development (Reardon and Timmer, 2005).

Improvements in market participation are necessary to link smallholder farmers to markets in order to expand demand for agricultural products as well as set opportunities for income generation (Pingali, 1997). Market-orientation enhances consumers' purchasing power for food, while enabling re-allocation of household incomes by producers to high-value nonfood agribusiness sectors and off-farm enterprises (Davis, 2006). Specific opportunities exist in non-trade distorting measures such as irrigation, intensification, extension and input supply. In addition, niche markets for differentiated products, contracts with village-level institutions (e.g., schools, hotels), and investments in value addition are areas where smallholder farmers would considerably benefit if challenges to their effective participation were addressed (Omiti *et al*., 2007). The rationale for enhancing participation in commercial agriculture also stems from the potential to accelerate attainment of the Millennium Development Goals on food security and poverty reduction through utilization of untapped opportunities in commodity value chains (MOFED, 2006).

2.2. Agricultural Commercialization

In a broad sense, smallholder commercialization could be seen as the strength of the linkage between farm households and markets at a given point in time. This household-to-

market linkage could relate to output or input markets either in selling, buying or both. Alternatively, smallholder commercialization could also be seen as a dynamic process: at what speed the proportion of outputs sold and inputs purchased are changing over time at household level.

In most literature, a farm household is assumed to be commercialized if it is producing a significant amount of cash commodities, allocating a proportion of its resources to marketable commodities, or selling a considerable proportion of its agricultural outputs (Immink and Alarcon, 1993; Strasberg *et al*., 1999). However, the meaning of commercialization goes beyond supplying surplus products to markets (von Braun *et al*., 1994; Pingali 1997). According to these authors, it has to consider both the input and output sides of production, and the decision-making behavior of farm households in production and marketing simultaneously. Moreover, commercialization is not restricted only to cash crops as traditional food crops are also frequently marketed to a considerable extent (von Braun *et al*., 1994; Gabre-Madhin *et al*., 2007). Commodities traditionally considered as food crops may increasingly be marketed during the transformation process as households specialize.

The commonly accepted concept of commercialization is, therefore, that commercialized households are targeting markets in their production decisions, rather than being related simply to the amount of product they would likely sell due to surplus production (Pingali and Rosegrant, 1995). In other words, production decisions of commercialized farmers are based on market signals and comparative advantages, whereas those of subsistence farmers are based on production feasibility and subsistence requirements, and selling only whatever surplus product is left after household consumption requirements are met. (Pingali and Rosegrant, 1995; Berhanu and Dirk, 2009). Depending on the various literatures commercialization can be generalized as households' production decision targeting markets rather than production for subsistence requirements.

2.2.1. Indices in measuring commercialization

The relevance of measuring the level of smallholder commercialization arises from the interest to make comparisons of households according to their degree of commercialization (Randolph, 1992). In addition, it also helps to gauge to what extent a

given farm household is commercialized in its overall production, marketing and consumption decisions, and to analyze the determinants of commercialization. However, there are diverse methods or indicators used for measuring the level of commercialization.

Focusing on commercialization in its static form, various authors have used different yardsticks in measuring the level of agricultural commercialization at household level. Von Braun *et al.,* (1994) specified three types of commercialization indices at household level: output and input side commercialization, commercialization of the rural economy, and degree of a household's integration into the cash economy. For each type, the authors formulated indices measuring the extent of household commercialization. The first index measures proportion of agricultural output sold to the market and input acquired from market to the total value of agricultural production. In the second type, commercialization of the rural economy is defined as the ratio of the value of goods and services acquired through market transactions to total household income. Here, there is an assumption that some transactions may take place in-kind such as payments with food commodities for land use. Thirdly, the degree of household integration to the cash economy is measured as the ratio of the value of goods and services acquired by cash transaction to the total household income.

In measuring household-specific level of commercialization, Govereh *et al*., (1999) and Strasberg *et al*., (1999) used a household commercialization index (HCI), which is a ratio of the gross value of all crop sales per household per year to the gross value of all crop production. This ratio does not incorporate the livestock subsector, which could be more important than crops in some farming systems (Moti *et al*., 2009).

Recently, Gabre-Madhin *et al*., (2007) used four approaches to measure the level of household commercialization: sales-to-output and sales-to-income ratios, net and absolute market positions (either as a net buyer, net seller or autarkic/self-sufficient household), and income diversification or level of specialization in agricultural production.
According to Gabre-Madhin *et al*., (2007), the sales-to-output ratio measures the gross value of all agricultural sales by a household as a percentage of the total gross value of its agricultural production. The total sales-to-income ratio is the ratio of the gross value of total sales to total income from crop production. In this index, income from crop production is assumed as a proxy to total household income, ignoring income from

livestock, and off- farm and non-farm sources. The market position of a household is evaluated using the ratio of volume of sales and volume of purchases to the total volume of stock: the sum of storage from the previous production year and production in the current year. The specialization index tries to capture to what extent farm households are specialized in their production to capture the benefits from comparative advantages: producing what they can efficiently produce and buying what they cannot. This index measures the proportion of the value of purchased agricultural products not produced by households to the gross value of agricultural production.

In addition to the above indices, von Braun *et al.* (1994) have measured commercialization in terms of proportion of land allocated by farmers to commercial crops and in terms of the value of input and output sales and purchases weighted by the value of agricultural production.

In most literature, the issue of commercialization is based on the proportion of resources allocated to either cash or food crops. However, under the existence of favorable market environment and infrastructure, food crops could also have the potential to be commercial crops (Fafchamps, 1992). Moreover, cash crops are not necessarily supplied to the market. Therefore, categorizing crops broadly into food and cash crops to analyze the extent of household commercialization lacks a strong footing and requires looking at the purpose for which a crop is grown rather than looking at the nature/type of crop itself.

Based on this review, it appears that the common approach to measuring the degree of smallholder commercialization is based on the proportion of the value of agricultural produce sold or the value of agricultural inputs bought to the total household agricultural income (Randolph 1992; von Braun *et al*., 1994).

With the aim to identify the position of a farm household in livestock market participation, Asfaw and Jabbar (2008) formulated a gross and net (market) livestock off-take rates at the household level. The gross off-take rate measures the overall rate of inventory changes of livestock in a household. It categorizes births, gifts received, and purchases as incoming animals whereas deaths, sales, gifts, and slaughters are considered as outgoing ones. The gross off-take rate is then defined as the ratio of the difference of the two to the average inventory of a given period (usually one year). The net (market) off-take rate, which is

more relevant in measuring the level of smallholder commercialization, considers only the sales and purchases of livestock per household per a specific period. Net off-take rate is then computed as the ratio of the difference of the two to the average inventory of the period.

2.2.2. Determinants and impact of commercialization

There are a number of determinants in commercialization of smallholder agriculture. These determinants are broadly categorized as external and internal factors. The external ones are factors beyond the smallholder's control like population growth and demographic change, technological change and introduction of new commodities, development of infrastructure and market institutions, development of the non-farm sector and the broader economy, rising labor opportunity costs, macroeconomic, trade and sectoral policies affecting prices and other driving forces (von Braun *et al*., 1994; Pingali and Rosegrant, 1995).

In addition, development of input and output markets, institutions like property rights and land tenure, market regulations, cultural and social factors affecting consumption preferences, production and market opportunities and constraints, agro-climatic conditions, and production and market related risks are other external factors that could affect the commercialization process (Pender *et al*., 2006). On the other hand, factors like smallholder resource endowments including land and other natural capital, labor, physical capital, human capital etc. are household specific and are considered to be internal determinants.

Impacts of commercialization can be categorized into first, second and third orders (Moti *et al*., 2009). The first-order is mainly income and employment effects that are directly reflected in household welfare. The second-order effects include health and nutrition aspects usually contingent on the level of income attained through the existing level of commercialization. The third-order (or usually known as higher order) effects are the macro-economic and environmental effects that go beyond household level.

Agricultural commercialization tends to generate more household income due to its comparative advantages over subsistence production (Kennedy and Cogill 1987; Dorsey

1999). However, unless rural markets are well-integrated and risks are low to influence household decision behavior, the shift from subsistence to commercial production may have an adverse consequence by exposing households to volatile food market prices and food insecurity.

2.3. Market Imperfection and the Role of Institutions

Institutions are defined in many different ways. The most widely quoted definition is the one given by North (1990) which defines institutions as humanly devised, made up of formal constraints (i.e., rules, laws, constitutions), informal constraints (i.e., norms of behavior, conventions and self-imposed codes of conduct) that structure human interactions, and their enforcement characteristics. These constraints and the technology employed determine the transaction and transformation costs that add up to the production and marketing costs.

North (1990), and Dorward *et al*., (2005) define institutions as "rules of the game" that define the incentives and sanctions affecting people's behavior and distinguish institutional arrangement as sets of rules and structures that govern particular contracts, and the context within which the contracts are governed. The World Bank (2002) offers a working definition of market institutions as rules, enforcement mechanisms and organizations that promote market transactions. These definitions indicate that institutions provide multiple functions to markets; they transmit information, mediate transactions, facilitate the transfer and enforcement of property rights and contracts, and manage the degree of competition. Along with these definitions, we define market institutions as rules of the game, enforcement mechanisms and organizations that facilitate market interaction, coordination, contract formation and enforcement.

Market failures are caused by asymmetric information, high transaction costs and imperfectly specified property rights. Where supporting market institutions are lacking, rural markets in areas with low market infrastructure tend to be very thin, imperfect or missing. In the absence of institutions that help to coordinate marketing functions or to link producers to markets, the associated high transportation costs and transaction costs undermine the processes of exchange and result in limited or localized markets with little rural-urban linkages (Kranton, 1996; Eleni, 2001; Chowdhury *et al*., 2005). In such

circumstances, households produce only a limited range of goods and services for their own consumption because social protection for food security is not provided through markets and government interventions (de Janvry *et al*., 1991).

When high transaction costs, asymmetric information and incomplete property rights impede the functioning of markets, market players fail to undertake profitable investments (due to the absence of complementary investments) leading to coordination failures that hinder market functions (Dorward *et al*., 2003, 2005, Poulton *et al*., 2006). Thus, coordination failure along the production-to-consumption value chain may explain constrained agricultural development and the prevalence of a low equilibrium trap, which is a big challenge to policy (Dorward *et al*., 2003). Overcoming the effects of such market imperfections in agricultural input and output markets would therefore require a deliberate attempt to strengthen institutions that promote coordination of market functions, reduce transaction costs and integrate markets to facilitate a continual transition to a higher level equilibrium (World Bank, 2002).

Various private and public sector market-supporting institutions and institutional arrangements have been proposed to bridge market imperfections, reduce transaction costs, enhance opportunities for the poor in markets and to make the market systems more inclusive and integrated (World Bank, 2002). Among the potential market-supporting institutions that can enhance market functions in rural areas are farmer organizations such as Producer Marketing Groups (PMGs). Their potential in this process lies in enabling contractual links to input and output markets; promoting economic coordination in liberalized markets and in leveraging market functions for smallholder farmers. However, their success in this process depends on their ability in conveying market information; coordinating marketing functions; defining and enforcing property rights and contracts; facilitating smallholder competitiveness in markets, and more critically in mobilizing their members to engage in markets. (Rondot and Collion, 1999; Coulter *et al*., 1999; World Bank, 2002)

2.4. Definition, Types and Approaches of Impact Assessment

Impact refers to the broad, long-term economic, social and environmental effects that may be anticipated or unanticipated, and positive or negative, at the level of the individual or the organization. Such effects generally involve changes in both cognition and behavior (Omoto, 2003). Impact evaluations are not simply about measuring whether a given program is having a positive effect on participants.

An impact evaluation also assesses the extent to which a program has caused desired changes in the intended audience. It is concerned with the net impact of an intervention on households and institutions, attributable only and exclusively to that intervention. Thus, impact evaluation consists of assessing outcomes and, thus, the short or medium-term developmental change resulting from an intervention (Baker, 2000).

Impact evaluation is aimed at providing feedback to help improve the design of programs and policies. In addition to providing for improved accountability, impact evaluations are a tool for dynamic learning, allowing policymakers to improve ongoing programs and ultimately better allocate funds across programs. There are other types of program assessments including organizational reviews and process monitoring, but these do not estimate the magnitude of effects with clear causation. Such a causal analysis is essential for understanding the relative role of alternative interventions in reducing poverty.

2.4.1. Types of impact assessment

People level impact refers to the effect of the technology or intervention on the ultimate users or target group for which the technology was developed. Impact begins to occur when there is a behavioral change among the potential users. The people level impact deals with the actual adoption of the intervention output and subsequent effects on economic, socio-cultural, and/or environmental conditions of beneficiaries (Omoto, 2003).

2.4.1.1. Economic impact assessment

Economic impact measures the combined production and income effects associated with a set of research and development activities. The economic impact can be assessed through what is known as an "efficiency analysis" which compares the cost and the benefits of the project in a systematic manner (Anandajayasekeram *et al*., 1997). The economic impact assessment studies range in scope and depth of evaluation from partial impact studies to comprehensive assessment of economic impacts. One popular type of partial impact assessment is adoption studies that look at the effects of new technology such as the spread of modern plant varieties on farm productivity and farmers' welfare. Economic impact assessments of the more comprehensive types look beyond mere yield and crop intensities to the wider economic effects of the adoption of new technology. The literature on economic impact studies also includes a wide range of levels of impact analysis, from aggregate, national level to program and project level.

2.4.1.2. Socio-cultural impact assessment

Socio-cultural impacts assessment (SIA) include the effects of a project on the attitude, beliefs, resource distribution, status of women, income distribution, nutritional implications, institutional implications etc of the community. These can be assessed through socio-economic surveys and careful monitoring. SIA as a process and methodology has the potential to contribute greatly to the planning process of other types of development projects (Burdge and Vanclay, 1996). It can assist in the process of evaluation of alternatives projects/programs, and to help in their understanding and management of the process of social change. Social impacts are important and need to be considered along with the economic and environmental impacts. SIA can enrich the impact analysis as well as provide a clearer identification of issues for project planning and prioritization.

2.4.1.3. Environmental impact assessment

Environmental Impact Assessment (EIA) is defined as the process of identifying, predicting, evaluating and mitigating the biophysical, social, and other relevant effects of

development activities prior and/or subsequent to major decisions being taken and commitments made (IAIA, 1998). Many countries require (EIAs) for major development projects; and, in fact, many countries have formal requirements in law and associated guidelines for carrying out EIAs. The importance of EIA is increasing in agricultural research and development due to the growing concerns of land degradation, deforestation and loss of biodiversity around the world. However, there are few examples of countries and research institutions that have formally assessed the environmental impacts associated with agricultural research and development projects. Environmental costs and benefits are typically not included in conventional economic impact studies. Among other things, there is a clear lack of adequate data on which to base EIA (Alston *et al*., 1998).

2.4.1.4. Institutional impact assessment

Institutional impact consists of changes in organizational structures, methods of conducting scientific research and development activities, and the availability and allocation of research resources (Omoto, 2003). Most of the ongoing research and development impact studies address the people level impact forgetting institutional impacts. Increasing agricultural productivity, whilst strengthening local institutions, has long been an important goal of agricultural research and development activities. Organizations play an important role in meeting this goal by improving technologies and knowledge base of the biological, social, economic and political factors that govern the performance of an agricultural system, and by strengthening local institutions' capacity and performance. Institutional impact assessment involves the evaluation of the performance of organizations in non-technological research activities such as training, networking, development of methodologies, and advisory services in the areas of research and other policies, organization and management (Omoto, 2003). Assessment of the institutional impacts of such activities should therefore be an integral part of the overall impact assessment and research evaluation efforts.

There has been little methodological and practical work in the area of institutional impact assessment of agricultural research and development interventions (Goldsmith, 1993). This includes the impact an agricultural research organization has on capacity building, human resources development, and performance of other institutions. However, recently there has been growing interest to evaluate the institutional impacts. Institutional and

organizational impact is measured in terms of changes in policy, institutional structure, networking, arrangements and achievements in human capacity buildings, human resource development and performance of other institutions (Omoto, 2003).

The concrete results and impacts of institutional development can be difficult to see and may take time to emerge. However, information generated from institutional impact assessment has the great potential to lead to better, more effective actions and institutional performance of development intervention and research system.

Impact assessments can be classified into ex ante impact assessment and ex post impact assessment. Ex ante evaluations are undertaken before the project or program is initiated as an aid in priority setting (Mywish *et al.*, 2003). *Ex ante* impact studies are conducted to estimate the expected returns from current alternative projects/programs. Assessment of future impact includes measures of productivity impacts, distribution of economic benefits, and effects on environmental quality. And *ex post* evaluations are undertaken after diffusion of a research product has been initiated or a certain project or program has been implemented, to assess actual impacts on the ground. However, *ex post* evaluations generate information that is useful for the selection, planning and management of future programs, such as plausible adoption paths. *Ex post* impact assessment develops the confidence of scientists, research managers, and stakeholders and makes the case for enhanced support (Bantilan and Dar, 2001).

The impact assessment process becomes complete when adoption and impact information obtained from *ex post* impact studies is fed back to *ex ante* impact studies and the process continues, as technology development itself is continuous. Such evaluations may provide decision makers with pertinent information but their lack of rigor often undermines their credibility, especially in today's climate of accountability (Mywish *et al.*, 2003).

2.4.2. Impact assessment approaches

In order to determine the effects of the intervention, it is necessary to identify what would have happened without the intervention. What would have been the welfare levels of particular communities, groups, households and individuals without the intervention? Evaluation involves an analysis of cause and effect in order to identify impacts that can be

traced back to interventions (Ezemenari *et al.*, 1999). These questions cannot, however, be simply measured by the impact of a project. There may be other factors or events that are correlated with the impact but are not caused by the project. To ensure methodological rigor, an impact evaluation must estimate the counterfactual, that is, what would have happened had the project never taken place or what otherwise would have been true. However, the two situations cannot be observed for the same individual. In other words, only the factual situation can be observed. Thus, the fundamental problem in any social program evaluation is the missing data problem (Bryson *et al*., 2002; Ravallion, 2005).

To determine the counterfactual, it is necessary to net out the effect of the interventions from other factors—a somewhat complex task. This is accomplished through the use of comparison or control groups (those who do not participate in a program or receive benefits), which are subsequently compared with the treatment group (individuals who do receive the intervention). Determining the counterfactual is at the core of evaluation design and a key to identifying what would have occurred in the absence of the intervention (Ezemenari *et al*., 1999). However, this is difficult to achieve for two reasons. First, beneficiaries of the intervention may be selected on the basis of certain characteristics (purposive targeting). If these characteristics are observed then a comparison group with the same characteristics can be selected. But if they are unobserved then in principle only a randomized approach can eliminate selection bias. Second, the comparison group may be contaminated either by spillover effects from the intervention or a similar intervention being undertaken in the comparison area by another agency.

If these differences that could arise from the non-random placement of the program and/or from the voluntary nature of participation in program (self-selection) are not properly accounted for, comparison of outcomes between program participants and non-participants is likely to yield biased estimates of program impact (Gilligan *et al.,* 2008).

In theory, evaluators could follow three main methods in establishing control and treatment groups: randomization/pure experimental design; non-experimental design and quasi-experimental design. In practice, in the social sciences, the choice of a particular approach depends, among other things, on data availability, cost, and ethics to experiment

(Yibeltal, 2008). In what follows, there are brief descriptions of the main impact evaluation methods mentioned above.

2.4.2.1. Experimental method

Experimental designs, also known as randomization, are generally considered the most robust of the evaluation methodologies. By randomly allocating the intervention among eligible beneficiaries, the assignment process itself creates comparable treatment and control groups that are statistically equivalent to one another, given appropriate sample sizes (Baker, 2000). According to Ezemenari *et al*., (1999), a random assignment of individuals to treatment and non-treatment groups ensures that on average any differences in conditions of the two groups after the intervention can be attributed to the intervention.

Random assignment ensures the two groups are statistically similar (drawn from same distribution) in both observable and unobservable characteristics, thus avoiding program placement and self-selection biases (Bernard *et al.*, 2010). If implemented appropriately, this design ensures that potential confounders are balanced across program (intervention) and control units and therefore any differences in the conditions between the two can be attributed to the program.

The main advantage of a randomized experiment is its ability to avoid problem of selection bias, which arises when participation in the program by individuals is related to their unobservable or unmeasured characteristics (like motivation and confidence), which in turn determine the program outcome and its simplicity in interpreting results.

While experimental designs are considered the optimum approach to estimating project impact, in practice there are several problems. Baker (2000) summarizes the potential problems associated with this approach in the following six categories. First, randomization may be unethical owing to the denial of benefits or services to otherwise eligible members of the population for the purposes of the study. Second, it can be politically difficult to provide an intervention to one group and not another. Third, the scope of the program may mean that there are no non treatment groups such as with a project or policy change that is broad in scope. Fourth, individuals in control groups may

change certain identifying characteristics during the experiment that could invalidate or contaminate the results. Fifth, it may be difficult to ensure that assignment is truly random. And finally, experimental designs can be expensive and time consuming in certain situations, particularly in the collection of new data. Obviously, randomization must take place before the program begins.

2.4.2.2. Quasi-experimental method

Quasi-experimental design involves matching program participants with a comparable group of individuals who did not participate in the program. This simulates randomization but need not take place prior to the intervention (Kerr *et al*., 2000). Quasi-experimental (non-random) methods 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 matching methods, double difference methods, instrumental variables methods, and reflexive comparisons.

When these techniques are used, the treatment and comparison groups are usually selected after the intervention by using nonrandom methods. Therefore, statistical controls must be applied to address differences between the treatment and comparison groups and sophisticated matching techniques must be used to construct a comparison group that is as similar as possible to the treatment group (Gilligan *et al.*, 2008). In some cases a comparison group is also chosen before the treatment, though the selection is not randomized.

A quasi-experimental method is the only alternative when neither a baseline survey nor randomizations are feasible options (Jalan and Ravallion, 2003). The main benefit of quasi-experimental designs is that they can draw on existing data sources and are thus often quicker and cheaper to implement, and they can be performed after a program has been implemented, given sufficient existing data. The principal disadvantages of quasi-experimental techniques are that (a) the reliability of the results is often reduced as the methodology is less robust statistically; (b) the methods can be statistically complex; and (c) there is a problem of selection bias.

There are two types of bias: those due to differences in observables or something in the data, and those due to differences in unobservable (not in the data), often called selection bias (Baker, 2000). An observable bias could include the selection criteria through which an individual is targeted, such as geographic location, school attendance, or participation in the labor market. Unobservable that may bias program outcomes could include individual ability, willingness to work, family connections, and a subjective (often politically driven) process of selecting individuals for a program. Both types of biases can yield inaccurate results, including under- and overestimates of actual program impacts, negative impacts when actual program impacts are positive (and vice versa), and statistically insignificant impacts when actual program impacts are significant and vice versa.

In generating a comparison group rather than randomly assigning one, many factors can affect the reliability of results. Statistical complexity requires considerable expertise in the design of the evaluation and in analysis and interpretation of the results. This may not always be possible, particularly in some developing country circumstances. Distilling the effect of intervention *per se* from those factors that affect individuals in examining outcome response of an intervention involved is the central methodological challenge in non-experimental evaluation method (Foster, 2003). There are different econometric approaches that have been used to avoid or reduce this problem.

Double difference or difference-in-differences (DID) methods, in which one compares a treatment and comparison group (first difference) before and after a program (second difference). Comparators should be dropped when propensity scores are used and if they have scores outside the range observed for the treatment group. In this case potential participants are identified and data are collected from them. However, only a random sub-sample of these individuals is actually allowed to participate in a certain project. The identified participants who do not actually participate in the project form the counterfactual (Jalan and Ravallion, 1999; Baker, 2000).

This method can be used to reduce the potential selection bias (when unobservable individual characteristics are assumed to be time invariant) and the impact of other factors exogenous to the program on observable characteristics. It accomplishes this by looking at

the difference in outcome of participants relative to the difference in outcome of non participants. Equivalently, it looks at the difference in indicators for the two groups at the end of the program relative to the difference in indicators at the beginning.

Instrumental variables or statistical control: It is one of the econometric techniques that can be used to compare program participants and non-participants correcting for selection bias. In this method one uses one or more variables that matter to participation but not to outcomes given participation. This identifies the exogenous variation in impact 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).

Reflexive comparisons: It is another type of quasi-experimental design in which a baseline survey of participants is done before the intervention and a follow-up survey, is done after. The baseline provides the comparison group, and impact is measured by the change in impact indicators before and after the intervention (Baker, 2000). Thus, program participants are compared to themselves before and after the intervention and function as both treatment and comparison group. This type of design is particularly useful in evaluations of full-coverage interventions such as nationwide policies and programs in which the entire population participates and there is no scope for a control group.

Unless they are carefully done, reflexive comparisons may not be able to distinguish between the program and other external effects, thus compromising the reliability of results.

Propensity Score Matching: Along with randomization, matching is one of the oldest and widely-used methods of evaluation. It is based on the intuitively attractive idea of contrasting the outcomes of program participants with the outcomes of "comparable" nonparticipants. Differences in the outcomes between the two groups are attributed to the program. This method is very appealing to evaluators with time constraints and working without the benefit of baseline data given that it can be used with a single cross-section of data (Ravallion, 2005). The idea is to find a comparison group that looks like the treatment group in all respects except one: the comparison group did not get the program. However, the problem in practice is always how to define "looks like". There are potentially many

characteristics one might look for to match on, and it was not clear whether a match has to be "identical" in all these characteristics, and (if not) how each characteristic should be weighted.

The method of Propensity-Score Matching (PSM) devised by Rosenbaum and Rubin (1983) can justifiably claim to be the solution to this problem, and thus to be the observational analog of a randomized experiment. The method balances the observed covariates between the treatment group and a control group (sometimes called "comparison group" for non-random evaluations) based on similarity of their predicted probabilities of receiving the treatment (called their "propensity scores"). The difference between PSM and a pure experiment is that the latter also assures that the treatment and comparison groups are identical in terms of the distribution of all observed or unobserved characteristics. Hence, there are always concerns about remaining selection bias in PSM estimates.

Thus, PSM essentially assumes away the problem of endogenous placement, leaving only the need to balance the conditional probability, i.e., the propensity score. An implication of this difference is that (unlike a social experiment) the impact estimates obtained by PSM must always depend on the variables used for matching and hence the quantity and quality of available data.

In PSM, one confines attention to the region of common support (overlap of the propensity score distributions in the treated and untreated samples). Non-participants with a score lower than any participant are excluded (Ravallion, 2005). With this method meaningful counterfactual (control) group is selected among a large group of nonparticipants, which is identical to the participating group to match the characteristics of the project population (causality of potential outcomes) as closely as possible (Bryson *et al.*, 2002; Caliendo and Kopeinig, 2008). It matches control groups to treatment groups on the basis of observed characteristics or by a propensity (to participate) score; the closer this score, the better the match. A good control group is from the same economic environment and is asked the same questions by similar interviewers as the treatment group. By contrast, the regression methods commonly found in the literature use the full sample. The simulations in Rubin and Thomas (2000) indicate that impact estimates based on full (unmatched) samples are

generally more biased, and less robust to miss-specification of the regression function, than those based on matched samples.

In the standard regression method one looks for predictors of outcomes, and preference is given to variables that one can argue to be exogenous to outcomes. In PSM one is looking instead for covariates of participation. It is clearly important that these include those variables that also matter to outcomes. However, variables with seemingly weak predictive ability for outcomes can still help reduce bias in estimating causal effects using PSM (Rubin and Thomas, 2000).

Matching the treated and the control subjects becomes difficult when there is a multidimensional vector of characteristics (Rosenbaum and Rubin, 1983). The PSM solves this type of problem by summarizing the pre-treatment characteristics of each subject into a single index variable, and then using the propensity score (PS) to match similar individuals. This constitutes the probability of assignment to treatment conditional on pre-treatment variables (Rosenbaum and Rubin, 1983).

Matching estimates are more reliable if: participants and controls have the same distribution of unobserved characteristics; they have the same distribution of observed characteristics; the same questionnaire is administered to both groups; and treated and control households are from the same economic environment. In the absence of these features, the difference between the mean impact of the participants and the matched non-participants is biased estimate of the mean impact of the project (Jalan and Ravallion, 1999).

However, there are potentially problematic assumptions and implementation challenges to PSM. PSM is non-parametric: we do not make any functional form assumptions regarding the average differences in the outcome. Although the first stage involves specification choices - e.g., functional form like logit and probit, empirical analyses tend to find impact estimates that are reasonably robust to different functional forms. In addition, if unobservable characteristics also affect the outcomes, PSM approach is unable to address this bias (Ravallion, 2005). Moreover, PSM requires large amounts of data both on the universe of variables that could potentially confound the relationship between outcome

and intervention, and on large numbers of observations to maximize efficiency (Bernard *et al.*, 2010). And also, related to the previous point one can never be entirely sure that he/she has actually included all relevant covariates in the first stage of the matching model and effectively satisfied the conditional independence assumption (CIA).

Despite its limitations, PSM is applied in this study since it is the best method to impact evaluators with time constraint and working in the absence of baseline data in that it can be applied with a single cross-section data.

2.5. Empirical studies

There is lack of available information on effect of market development intervention studies, therefore only application of the model used by different researcher will be discussed.

Studies on the applications of propensity score matching method

Here are some of the recent studies that applied PSM in program evaluation.

Gilligan and Hoddinott (2006) have used a PSM technique in their study on "Is there Persistence in the Impact of Emergency Food Aid? Evidence on Consumption, Food Security, and Assets in Rural Ethiopia" Esquivel and Pineda (2006) employed the PSM method in their study of the role of international remittance on poverty in Mexico using food-based, capabilities-based and assets-based outcome indicators.

Mendola (2007) also applied a PSM technique to evaluate the impact of agricultural technology on household poverty in rural Bangladesh. The study found that the adoption of high yield variety of rice has a positive impact on farm household wellbeing. Allowing for interactions between agricultural technology and other determinants of income, the study quantifies the positive impact of technology adoption on resource-poor farmers, in terms of rise of income and poverty reduction. Furthermore, potential gains from agricultural technology are lower for near-landless and higher for small and medium-scale farmers. This might evidenced by those directly achieving production enhancements in

small and medium farms may have an important causal impact in terms of household wellbeing. On the other hand, technology adoption seems to increase income of poorer near-landless but it hardly helps them to come out of the poverty line, unless other equity-enhancing policy measures are undertaken.

Jalan and Ravallion (2003) have applied a PSM technique in their study on the benefit incidence of an antipoverty program in Argentina. Hope (in press) has conducted a study to evaluate social impacts of watershed development in India. The study was intended to estimate changes in gross agricultural returns from two crops and access to domestic water in rural villages following the introduction of watershed development project. The author adopted a PSM method to analyze the impact of the program on farmers' income and domestic water collection time.

In assessing the impact of the Productive Safety Net Program (PSNP) in Ethiopia on livestock and tree holdings of rural households, Andersson *et al.* (2009), have applied PSM model.

They found that there was no indication that participation in PSNP leads households to disinvest in livestock or trees. In fact, the number of trees increased for households that participated in the program. It could be the case that participation in PSNP (where tree planting and subsequent forest management work on public lands are usual activities) leads to households becoming more skilled in forestry, and that they switch to increased forest planting as a result.

In analyzing the impact of social protection on food security and coping mechanisms in Ethiopia's productive safety nets program, Gilligan *et al.* (2008), used PSM methods and they found that participation in the public works component of the PSNP (defined as receipt of at least 100 Birr) in payments over the first five months has modest effects. It improves food security by 0.40 months and increases growth in livestock holdings by 0.28 Tropical Livestock Units (TLU). It leads to an increase of 4.4 percentage points in the likelihood that a household is forced to make a distress asset sale.

Yebeltal (2008) applied the model to assess the impact of Integrated Food Security Program in Ibant district of Amahara region. The study found that the program has increased participating households' calorie intake by 30% (i.e., 698 calories) compared to that of nonparticipating households.

3. RESEARCH METHODOLOGY

3.1. Description of the Project

Aiming at contributing to a reduction in poverty of rural poor through market oriented agricultural development, the International Livestock Research Institution and the Ministry of Agricultural initiated the project "Improving Productivity and Market Success of Ethiopian farmers in June 2004 with the financial assistance from the Canadian International Development Agency (CIDA) to be implemented in the four major regional states Tigray, Oromiya, Amhara and SNNP in 10 Pilot Learning *Woredas* (PLW). Mieso district is one of the 10 sites selected for the project implementation.

The project adopted a participatory market oriented commodity value chain approach which is based on innovation systems and value chain concepts. Crucial elements in the approach are the value chain instead of a production focus, linking and capacitating of value chain partners and the assessment, synthesis and sharing of knowledge among the partners, participatory commodity development. The project introduced this approach with the objective of testing/adopting the approach so that the respective PLW best practice can be scaled up/out nationwide.

In Mieso woreda, the integrated market oriented commodities are onion, goat and cattle. The selection of the commodities was based on the development priorities expressed by communities as well as the MoA. Local consultation with experts and administrators and non random placement were used to select households to participate in the project. *Kebeles* were identified based on criteria like accessibility to road and availability of agricultural extension services and willingness of the farmers to participate and the opportunity and potential of the *kebele* for the specific commodity of intervention. Households who have been participating in different project's component since 2006/07 were considered as participants.

The major objective of the project is to contribute to improved agricultural productivity and production through market-oriented agricultural development, as a means for achieving improved and sustained livelihoods for the rural population. Other specific

objectives include: agricultural knowledge management system in the MoA that will enable institutions, farmers and pastoralists to adopt appropriate technologies from research and development institutions; building and strengthening existing public agricultural institutional capacity and foster institutional learning and change so that new collaborative arrangements across sectors and levels are developed to better support the dissemination, use and impact of market oriented agricultural technologies and information; increasing capacity of farmers, pastoralists, community-based organizations, and private organizations to improve market oriented agricultural productivity and production, and to improve and sustain livelihoods; based on action oriented research generate gender sensitive policy and strategy recommendations on marketing, technology transfer, input and credit innovations for market oriented priority key crops, livestock and livestock products (IPMS, 2005).

The project's role in the PLW is to facilitate access to agricultural innovations to better serve farmers and communities (IPMS, 2007) At the PLW level, the program was implemented by existing public and private institutions, including extension/advisory services, agricultural input/service suppliers, credit institutions, cooperatives and private traders. An important aspect of the project was providing these institutions with new ideas and best practices from CGIAR centers and other institutions outside of Ethiopia in addition to the existing institutions in the country.

In addition, emphasis has been put on strengthening or developing farmer-based seed and seedling supply system (linked to a cooperative and/or private sector outlet), private/cooperative bull stations and AI services, private/cooperative rural shops for the supply of veterinary drugs, farm equipment/implements and fertilizers and other innovative arrangements. And also focus on grouping individual farmers to increase their negotiating power, agro-processing possibilities, and access to market information thereby increasing their potential for earning high income. The project also assists in improving product quality, storage and processing. Linking of producer groups and small scale local traders with wholesale, agro-processing and export marketing parties through various forums has been part of the strategy (IPMS, 2007).

3.2. Description of Study Area

Mieso is located 300 km east of Addis Ababa at about 200 km east of the Oromiya Regional State capital of Nazareth. It is located west of the Somali region, south of the Afar region and is one of the woredas in Oromiya where pastoral/agro-pastoral farming system prevails.

Geographically, the woreda is located between 40^0 9"30.1' W and 40^0 56"44' E; and: 9^0 19"52'N and 8^0 48"12 N. Altitudinally, the woreda ranges from 1107 to 3106 meters above sea level (m a s l), but most of the woreda is found at about 1700 m a s l. The woreda is surrounded by a chain of mountains in nearly all directions. The highest mountain is Asebot, which is located north east of Mieso town (MBPRD, 2009). The total land area of the woreda is 196,026 ha of which 22,487ha (~12%) are considered suitable for agriculture. This shows that the area is much of a range land where livestock rearing is a major activity.

Two major farming systems are identified in the woreda. These are crop/livestock farming system and Pastoral/agro-pastoral system. In the crop/livestock farming system the total cultivated land (annual and perennial) is estimated at 21,877 ha. The total area under this farming system is about 145,864 ha. The average land holding (cultivable land) in this farming system is 1.2 ha per household. However, the proportion of total land to total rural households in this farming system is, 1.5 ha. Sesame and haricot bean are the major marketable crop commodities, while ground nut is a potential marketable crop. In addition, *cha't* a kind of plant that is chewed as a stimulant is widely grown in the area. Among the livestock types, cattle and goats are the most dominant livestock types in this farming system. In the pastoral/agro-pastoral farming system the total cultivated land (annual and perennial) is estimated at 5635 ha, while the total area is 58,625 ha. The average land holding (cultivable land/household) in this farming system is 1.5 ha per household. However, the proportion of total land to total rural households in this farming system is about 16 ha. There are no marketable crop commodities because the main livelihood of these pastoralists depends on livestock production. Therefore, Cattle and goats are the major livestock species dominantly marketed in this farming system.

The woreda has markets namely Meiso, Asebot, Bordede and Kora. And there are two market days in the woreda: the Monday and Tuesday markets. The major animals sold in the woreda are cattle, goat, sheep and camel. Sorghum, maize, sesame, haricot bean, chickpea and *teff* are the principal crops grown in the area.

According to the recent woreda population report, the total population of the woreda in 2007 was 143,228. The total number of agricultural households is 22,012, while the urban households were 6,785. The town dwellers are scattered in four small towns including the woreda town. Of the total rural households, 80% are male headed. In 2007, the total rural population was 115,568, out of which, 58,612 were male and 56,958 (49%) were females (CSA, 2008). The woreda has a total of 37 Peasant Associations and 4 Town Dwellers Associations.

Rainfall is a major limiting factor for agricultural production in the area. Agro ecologically, the woreda is classified as Kolla (lowland). Based on the digital data, mean annual temperature is around 21^0C, while average annual rainfall is between 635 and 945 mms. The area receives a bimodal rainfall where the small rains are between March and April while the main rains are between July and September (under normal conditions). The major soils of the woreda are Vertic Cambisol (orthic and ferralic), Haplic Luvisol (Orthic) and Eutric Cambisol (Orthic), accounting for 50%, 16% and 11%, respectively. Use of commercial fertilizer is not common in the area. There is hardly any fertilizer distribution in the woreda. Annual fertilizer use in the woreda is extremely low. The vegetation is predominantly acacia and there is good underneath grass cover (IPMS, 2005).

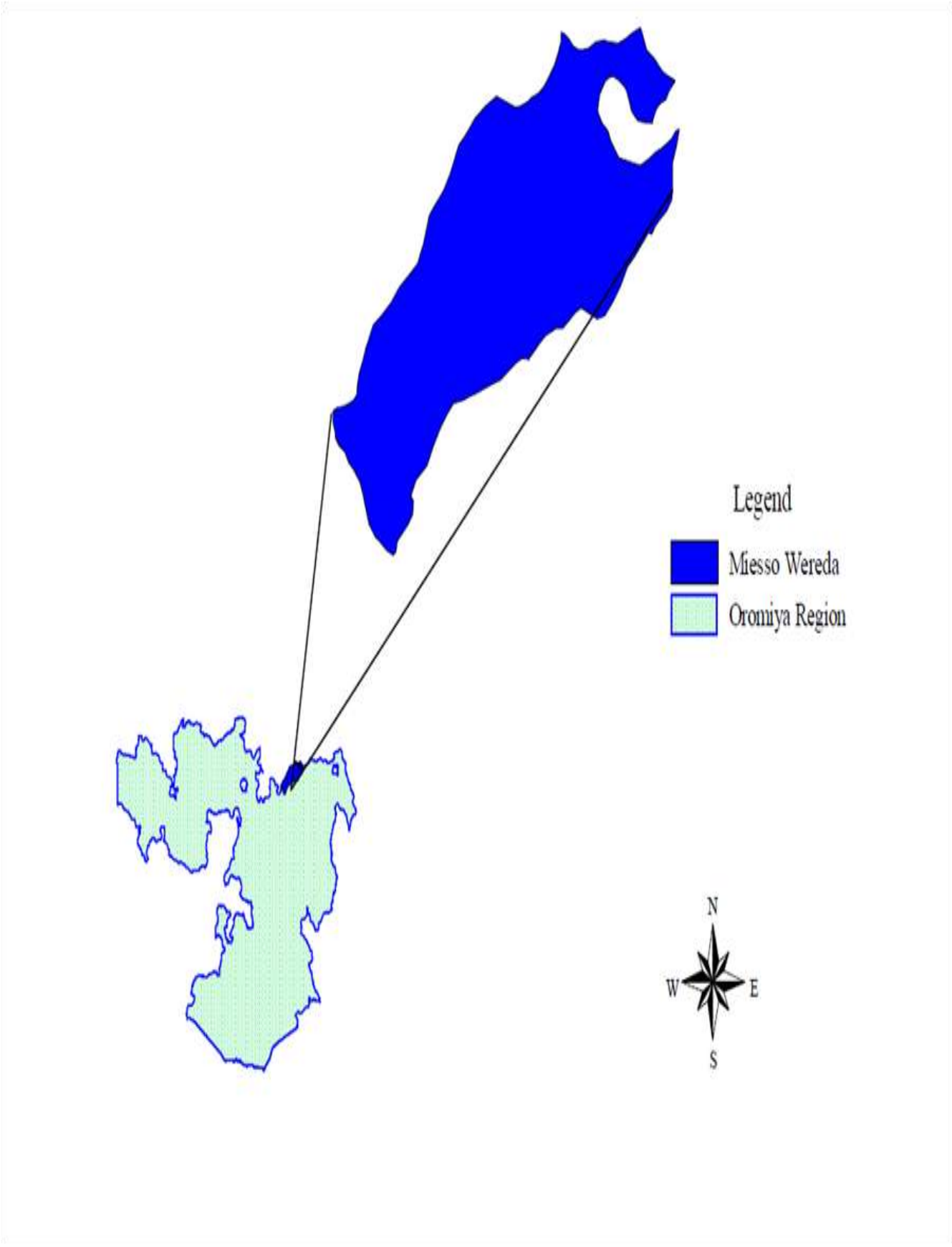


Figure 1: Location of the study area

3.3. Sources and Methods of Data Collection

Both qualitative and quantitative data from primary and secondary data sources were collected for this study. The primary data were collected from randomly selected farm households using pre-tested questionnaire. Secondary data, published and unpublished, pertinent to the research, were collected from Mieso PLW records and the Mieso Office of Pastoralist and Rural Development and various relevant publications and reports.

Structured questionnaire were administered to 180 sampled households. Enumerators who have experience in socioeconomic survey were employed after training on basic interview techniques and survey questionnaire administration. The survey was conducted between April-May 2009.

Sampled households were asked to answer a series of questions included in the survey questionnaire. The survey questionnaire was prepared to bring out information on a variety of topics including resource endowment of households, access to markets, agricultural and extension services and demographic characteristics of the respondents both before intervention of the project and at the time of the survey.

In addition to formal survey, data were collected through focus group discussions. Moreover, interviews were held with development agents, key informants and experts who work in close collaboration with the IPMS project. This information has been valuable in providing insights into beneficiaries' perspective and value of the project to beneficiaries and also the process that may have affected outcomes, and a deeper interpretation of results observed in quantitative analysis.

3.4. Sampling Procedures

A multistage random sampling technique was used to select PAs and draw sample farm households. In the first stage, 15 PAs were purposively identified based on the existence of IPMS project interventions for long time and the existence of commodity of interest. At the second stage, 9 PAs were randomly selected. Finally, from the selected PAs households were stratified into participant and non-participant. This was done by

preparing a separate list of project participants and non-participants in collaboration with Mieso Office of Pastoralist and Rural Development and IPMS. A farmer who has been involved in the intervention made by IPMS was considered as project participant. Then, a total sample size of 180 households constituting 90 participants and 90 non-participants are randomly selected.

Table 2: Distribution of sample households by type of participation in the IPMS project PAs

Sample *kebeles*	Participants		Non participants		Total HHs
	Total	Sample	Total	Sample	
Hunde Misoma	117	21	653	11	32
Oda Roba	38	7	768	13	20
Oda Keneni	66	12	458	8	20
Tokuma	72	13	744	13	26
Harmero Deyima	53	10	682	11	21
Hargetti	42	8	506	8	16
Adelle	34	6	549	9	15
Kenteri	30	6	418	7	13
Welda Jejeba	38	7	602	10	17
Total	490	90	5380	90	180

Source: Own survey, 2010

3.5. Methods of Data Analysis

In this study, qualitative analysis, descriptive statistics and econometric model were employed to analyze the data.

3.5.1. Qualitative analysis

To achieve the first objective *i.e.* describing the change in the organizational and institutional aspects of agricultural markets due to IPMS intervention, relevant piece of

information was obtained from focus group discussion (FGD), interview with experts in different organizations and from secondary sources.

3.5.2. Descriptive statistics

Descriptive statistics are important tools to present research results clearly and concisely. They help one to have a clear picture of the characteristics of sample units. By applying descriptive statistics such as mean, standard deviation, percentages, frequency, charts, graphs and inferential statistics such as Chi square test (for categorical variables) and t-test (for continuous variables) one can compare and contrast the two groups of sample respondents with respect to some socio-economic, institutional and other characteristics so as to draw some important conclusions. The statistical package SPSS version 16 was used to compute these statistical tests.

3.5.3. Propensity score matching (PSM) method

In impact assessment, the major objective is to measure the difference in outcomes between units with and without treatment. However, one cannot observe, both outcomes from a single unit at the same time. Due to this fact, having a control group with similar features to the participant units is essential.

An alternative to econometric regression is statistical matching method. With this method meaningful counterfactual (control) group will be selected among a large group of non-participants, which is identical to the participating group (Bryson *et al*., 2002; Caliendo and Kopeinig, 2005) to match the characteristics of the project population (causality of potential outcomes) as closely as possible. It matches control groups with treatment groups on the basis of observed characteristics or by a propensity (to participate) score; the closer this score, the better the match. A good control group is from the same economic environment and is asked the same questions by similar interviewers as the treatment group.

To evaluate the impact of market development made by IPMS on different impact variables, PSM quasi- experimental method was used. Rosenbaum and Rubin (1983) were

the first to develop the PSM statistical tool. The technique has attracted attention of social program evaluators for the last fifteen years (Dehejia and Wahba, 1999; Jalan and Ravallion, 2003). The present study also uses a PSM technique to address its main objectives. The PSM technique enables us to extract from the sample of non-participating households a set of matching households that look like the participating households in all relevant pre-intervention characteristics. In other words, PSM matches each participant household with a non-participant household that has (almost) the same likelihood of participating into the program.

PSM is preferred to the traditional regression method in several ways. For instance, PSM compares outcome for observations, who share similar observable characteristics. Moreover, PSM only compares households that lie in the common support and excluded others from the analysis. Unlike econometric regression methods, PSM compares only comparable observations and does not rely on parametric assumptions to identify the impacts of projects and it does not impose a functional form and also highlights common support region of covariates which could usually identify individuals in one group that are a poor match to anyone in the other group(s). One then might exclude those individuals from the analysis (Diaz and Hunda, 2006).

Despite its benefits PSM has, some limitations. One of its principal weaknesses is that, it requires large sample, group overlap must be substantial and hidden bias may remain because matching only controls for observed variables (to the extent that they are perfectly measured (Guo *et al.*, 2006; Diaz and Hunda, 2006). The central methodological challenge in employing PSM method is that examining impact response of an intervention involves distilling the effect of intervention *per se* from that of the factors that affect individuals (Foster, 2003).

The impact of marketing intervention of the IPMS project on households can be measured using the change in intensification, change in the number of animal sold, change in income, attitudinal change towards fattening, change in business development service, change in market orientation of farmers, change in awareness of farmers about the importance of market information service with the program and without the program. However, households participating in the program cannot be simultaneously observed in two states. Hence, this study applies a propensity score matching technique, which is a

widely applied impact evaluation method in the absence of baseline survey data for impact evaluation. Impact is evaluated for livestock intensification and productivity, net total income, marketed surplus and market orientation of households for the three commodities of intervention.

3.5.2.1. Mathematical specifications of PSM method

According to Caliendo and Kopeinig (2005), there are steps in implementing PSM. These are estimation of the propensity scores, choosing a matching algorithm, checking on common support condition and testing the matching quality.

The first step in PSM method is to estimate the propensity scores. As described by Rosenbaum and Rubin (1983), matching can be performed conditioning on P(X) alone rather than on X, where P(X) = Prob (D=1|X) is the probability of participating in the program conditional on X. The same authors indicate that if outcomes without the intervention are independent of participation given X, then they are also independent of participation given P(X). This reduces a multidimensional matching problem to a single dimensional problem.

In this study, qualitative response model was employed to estimate propensity scores using a composite of pre-intervention characteristics of the sampled households and matching was then performed using propensity scores of each observation. Thus, for comparative computational simplicity logit model will be used to estimate propensity scores and then the log odds-ratio $\log\left(\frac{p}{1-p}\right)$ is computed for each observation in the control and comparison samples using households pre-intervention characteristics and matching is then performed using propensity scores of each observable characteristics, which must be unaffected by the intervention, or which are taken as the explanatory variables. The coefficients are used to calculate a propensity score, and participants are matched with non-participants based on having similar propensity scores. The difference in the mean outcome from the two groups is taken as project impact.

In estimating the logit model, the dependent variable is participation in market development intervention of IPMS, which takes the value 1 if a household participated in the specific market related intervention activities and 0 otherwise. The mathematical formulation of logit model is as follows:

$$p_i = \frac{e^{z_i}}{1+e^{z_i}} \quad (1)$$

Where, p_i is the probability of participation in market development intervention of IPMS,

$$z_i = a_0 + \sum a_i x_i + U_i \quad (2)$$

Where,
i = 1, 2, 3, - --, n
a_0 = intercept
a_i =regression coefficients to be estimated
U_i = a disturbance term, and
x_i =pre-intervention characteristics.

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

$$1 - p_i = \frac{1}{1+e^{z_i}} \quad (3)$$

Then the odds ratio can be written as:

$$\frac{p_i}{1-p_i} = \frac{1+e^{z_i}}{1+e^{-z_i}} = e^{z_i} \quad (4)$$

Now $\frac{p_i}{1-p_i}$ is simply the odds ratio in favor of participating in market development interventions. It is the ratio of the probability that the household would participate in the market development interventions to the probability that he/she would not participate in the intervention. Finally, by taking the natural log of equation (4) the log of odds ratio can be written as:

$$L_i = Ln\left(\frac{P_i}{1-p_i}\right) = Ln\left(e^{\beta_0+\sum_{j=1}^{n}\beta_j X_{ji}}\right) = Z_i = \beta_0 + \sum_{j=1}^{n}\beta_j X_{ji} \quad (5)$$

Where, L_i is log of the odds ratio in favor of participation in the market development, which is not only linear in X_{ji} but also linear in the parameters.

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

The effect of household's participation in the markets developed by IPMS intervention on a given outcome[2] (Y) is specified as:

$$\tau_i = Y_i(D_i = 1) - Y_i(D_i = 0) \quad (6)$$

Where τ_i is treatment effect (effect due to participation in livestock marketing intervention), 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 notice 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, either $Y_i(D_i = 1)$ or $Y_i(D_i = 0)$. 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:

$$\tau_{ATT} = E\left(\tau \middle| D = 1\right) = E[Y(1) \middle| D = 1] - E[Y(0) \middle| D = 1] \quad (7)$$

[2] Outcome in our case could be intensity of input use, level of productivity attained, household income, etc.

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

In our particular case, variables that determine household's decision to participate in the markets developed by 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 $E[Y(0)|D=0]$ from both sides of equation 7, one can get the following specification for ATT.

$$E[Y(1)|D=1]-E[Y(0)\mid D=0]=\tau_{ATT}+E[Y(0)|D=1]-E[Y(0)|D=0] \quad (8)$$

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.

A. Conditional Independence Assumption:

The Conditional Independence Assumption is given as

$$Y_0 Y_1 \perp D/X, \forall X, \quad (9)$$

Where ⊥ indicates independence

X -is a set of observable characteristics

Y_0-Non-participants and

Y_1-Participants

Given a set of observable covariates (X) which are not affected by treatment (in 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 (X) 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 (Bryson *et al*., 2002; Caliendo and Kopeinig, 2008). Hence, after adjusting for observable differences, the mean of the potential outcome is the same for D = 1 and D = 0 and$E(Y_0 /D = 1, X) = E(Y_0/D = 0, X)$.

Instead of conditioning on$X$, Rosenbaum and Rubin (1983), suggest conditioning on a propensity score (propensity score matching). The propensity score is defined as the probability of participation for household i given a set X which is household's characteristics$P(X) = pr(D = 1/X)$. Propensity scores are derived from discrete choice models, and are then used to construct the comparison groups. Matching the probability of participation, given covariates solves the problem of selection bias using PSM (Liebenehm *et al.,* 2009). The distribution of observables X is the same for both participants and non-participants given that the propensity score is balancing score (Liebenehm *et al.,* 2009). If outcomes without the intervention are independent of participation given$X$, then they are also independent of participation given $P(X)$. This reduces a multidimensional matching problem to a single dimensional problem. Due to this, differences between the two groups are reduced to only the attribute of treatment assignment, and unbiased impact estimate can be produced (Rosenbaum and Rubin, 1983).

B. Common support

Imposing a common support condition ensures that any combination of characteristics observed in the treatment group can also be observed among the control group (Bryson *et al*., 2002). The common support region is the area which contains the minimum and maximum propensity scores of treatment and control group households, respectively. It requires deleting of all observations whose propensity scores is smaller than the minimum and larger than the maximum of treatment and control, respectively (Caliendo and Kopeinig, 2005).

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

$0 < P(D = 1 | X) < 1$

This assumption improves the quality of the matches as it excludes the tails of the distribution of $p(X)$, though this is done at the cost that sample may be considerably reduced. Yet, nonparametric matching methods can only be meaningfully applied over regions of overlapping support. No matches can be formed to estimate the parameters when there is no overlap between the treatment and comparison groups. This assumption ensures that persons with the same X values have a positive probability of being both participants and non-participants.

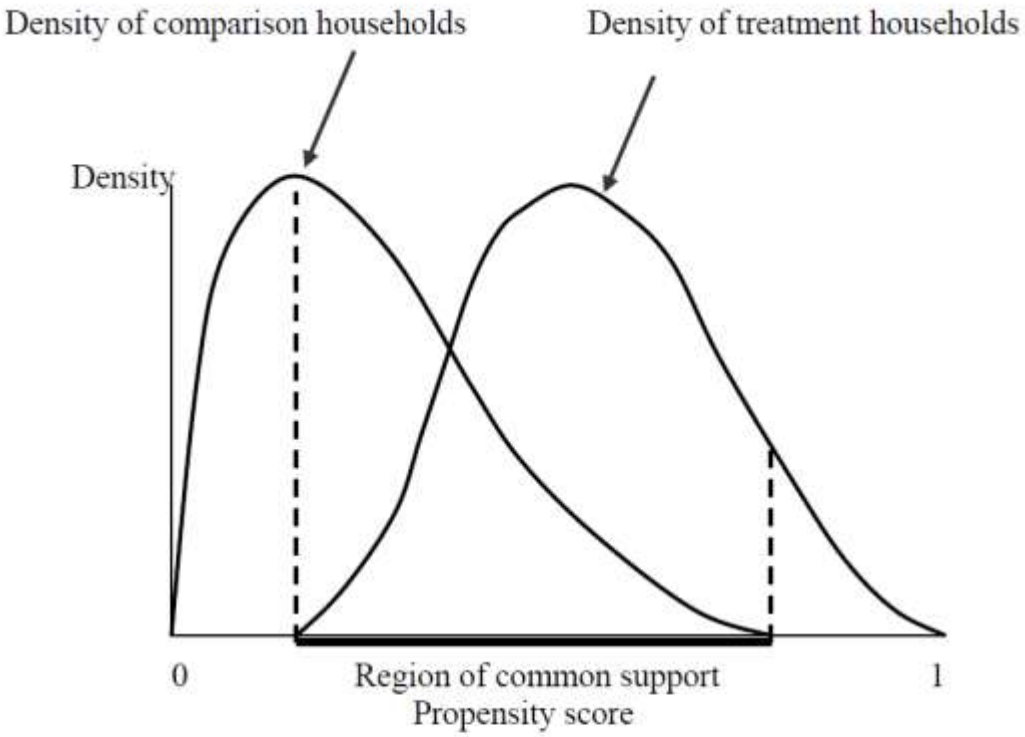


Figure 2. Region of common support condition

Source: Ravallion, 2005

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

$$\tau_{ATT} = E[Y_1 - Y_0/D = 0, P(x)] = E[Y_1/D = 1, p(x)] - E[Y_0/D = 0, p(x)] \quad (10)$$

Where P(X) is the propensity score computed on the covariates X. Equation (10) shows that the PSM estimator is the mean difference in outcomes over the common support, appropriately weighted by the propensity score distribution of participants.

3.5.2.2. Matching algorithms

After estimation of the propensity scores, seeking an appropriate matching estimator is the major task. Estimation of the propensity score *per se* is not enough to estimate the ATT of interest. This is due to the fact that propensity score is a continuous variable and the probability of observing two units with exactly the same propensity score is, in principle, zero. There are a number of matching methods that differ from each other with respect to the weights they attribute to the selected controls when estimating the counterfactual outcome of the treated and the way they select the control units that are matched to the

treated. However, they all provide consistent estimates of the ATT under the CIA and the overlap condition (Caliendo and Kopeinig, 2008). The most commonly used matching estimators are discussed below.

- Nearest neighbors matching
- Radius matching
- Kernel matching
- Caliper matching
- Local linear regression matching
- Spline matching
- Mahalanobis matching

These estimators are used to find one or more comparable untreated individual to each treated individual. The most commonly applied matching estimators are Nearest Neighbor matching, caliper and kernel matching, which are discussed below.

Nearest Neighbor (NN) matching: It is the most straightforward matching estimator. In NN matching, an individual from a comparison group is chosen as a matching partner for a treated individual that is closest in terms of propensity score (Caliendo and Kopeinig, 2008). NN matching can be done with or without replacement options. In the case of the NN matching with replacement, a comparison individual can be matched to more than one treatment individuals, which would result in increased quality of matches and decreased precision of estimates. On the other hand, in the case of NN matching without replacement, a comparison individual can be used only once. Matching without replacement increases bias but it could improve the precision of the estimates. In cases where the treatment and comparison units are very different, finding a satisfactory match by matching without replacement can be very problematic (Dehejia and Wahba, 2002). It means that by matching without replacement, when there are few comparison units similar to the treated units, one may be forced to match treated units to comparison units that are quite different in terms of the estimated propensity score.

Caliper matching: The above discussion reveals that NN matching faces the risk of bad matches, if the closest neighbor is far away. To overcome this problem researchers use the second alternative matching algorism called caliper matching. Caliper matching means that an individual from the comparison group is chosen as a matching partner for a treated individual that lies within a given caliper (propensity score range) and is closest in terms of propensity score (Caliendo and Kopeinig, 2008). If the dimension of the neighborhood is set to be very small, it is possible that some treated units are not matched because the neighborhood does not contain a control unit. One problem in caliper matching is that it is difficult to know *a priori* what choice for the tolerance level is reasonable (Smith and Todd, 2005).

Kernel matching: This is another matching method whereby all treated units are matched with a weighted average of all controls with weights which are inversely proportional to the distance between the propensity scores of treated and controls (Becker and Ichino, 2002).

Kernel weights the contribution of each comparison group member so that more importance is attached to those comparators providing a better match. The difference from caliper matching, however, is that those who are included are weighted according to their proximity with respect to the propensity score. The most common approach is to use the normal distribution (with a mean of zero) as a kernel, where the weight attached to a particular comparator is proportional to the frequency of the distribution for the difference in scores observed (Bryson *et al*., 2002).

According to Caliendo and Kopeinig (2008), a drawback of this method is that possibly bad matches are used as the estimator includes comparator observations for all treatment observation. Hence, the proper imposition of the common support condition is of major importance for kernel matching method. A practical objection to its use is that it will often not be obvious how to set the tolerance. However, according to Mendola (2007), kernel matching with 0.25 band width is most commonly used.

However, the most important question in using PSM is on how and which method to select these estimators. Clearly, as (Bryson *et al*., 2002), reported there is no single answer to this question. The choice of a given matching estimator depends on the nature of the

available dataset. In other words, it should be clear that there is no winner for all situations and that the choice of a matching estimator crucially depends on the situation at hand. The choice of a specific method depends on the data in question, and in particular on the degree of overlap between the treatment and comparison groups in terms of the propensity score. When there is substantial overlap in the distribution of the propensity score between the comparison and treatment groups, most of the matching algorithms will yield similar results (Dehejia and Wahba, 2002).

3.5.2.4. Testing the matching quality

One important concern that should be taken care of while doing PSM is balancing test. The matching quality depends on the ability of the matching procedure to balance the relevant covariates. While differences in covariates are expected before matching, these should be avoided after matching. The primary purpose of the PSM is that it serves as a balancing method for covariates between the two groups. Consequently, the idea behind balancing tests is to check whether the propensity score is adequately balanced. In other words, a balancing test seeks to examine if at each value of the propensity score, a given characteristic has the same distribution for the treatment and comparison groups. The basic idea of all approaches is to compare the situation before and after matching and check if there remain any differences after conditioning on the propensity score (Caliendo and Kopeinig, 2008). The propensity scores themselves serve only as devices to balance the observed distribution of covariates between the treated and comparison groups. The success of propensity score estimation is therefore assessed by the resultant balance rather than by the fit of the models used to create the estimated propensity scores (Lee, 2006).

There are different approaches in applying covariate balancing (i.e., the equality of the means on the scores and all the covariates) between treated and non-treated individuals. Among different procedures the most commonly applied ones are described below.

Standard bias

One suitable indicator to assess the distance in marginal distributions of the X variables is the standardized bias (SB) suggested by Rosenbaum and Rubin (1983). For each covariate

X it is defined as the difference of sample means in the treated and matched control subsamples as a percentage of the square root of the average of sample variances in both groups. It is used to quantify the bias between treated and control groups. For each variable and propensity score, the standardized bias is computed before and after matching as:

$$\mathbf{SB_{before}(X) = 100.\frac{\bar{X}_1 - \bar{X}_0}{\sqrt{0.5.(v_1(X) + v_0(X)}}} \quad (11)$$

Where $\bar{X}_1$ and $\bar{X}_0$are the sample means for the treatment and control groups, and ($v_1(X)$ and $v_0(X)$are the corresponding variance (Caliendo and Kopeining, 2008).
The standardized bias after matching is given by:

$$SB_{after} = 100.\frac{\overline{X_{1M}} - \overline{X_{0M}}}{\sqrt{0.5.(V_{1M}(X) + V_{0M}(X))}} \quad (12)$$

Where$X_{1M}(V_{1M})$ and $X_{0M}(V_{0M})$ are the corresponding values for the matched samples. This is a common approach used in many evaluation studies (e.g. by Lechner, 2002; Sianesi, 2004; and Caliendo *et al*, 2005). One possible problem with the standardized bias approach is that one does not have a clear indication for the success of the matching procedure, even though in most empirical studies a bias reduction below 3% or 5% is seen as sufficient.
The bias reduction (BR) can be computed as:

$$BR = 100(1 - \frac{B(X)_{after}}{B(X)_{before}}) \quad (13)$$

One possible problem with the SB approach is that one does not have a clear indication for the success of the matching procedure.

T-test

A two-sample *t*-test is used to check if there are significant differences in covariate means for both groups (Rosenbaum and Rubin, 1983). Before matching differences are expected, but after matching the covariates should be balanced in both groups and hence no significant differences should be found. The *t*-test might be preferred if the evaluator is concerned with the statistical significance of the results. The shortcoming here is that the bias reduction before and after matching is not clearly visible.

Joint significance and Pseudo-R^2

Sianesi (2004) suggests re-estimating the propensity score on the matched sample, i.e. only on participants and matched nonparticipants, and comparing the pseudo-R^2 before and after matching. The pseudo-R^2 indicates how well the regressors X explain the participation probability. After matching, there should be no systematic differences in the distribution of covariates between both groups and therefore the pseudo-R^2 should be fairly low.

Furthermore, one can also perform a likelihood ratio test on the joint significance of all covariates in the probit or logit model. The test should not be rejected before, and should be rejected after matching. In our case, in order to test the matching quality of matching estimators the combinations of the above procedures were applied.

3.5.2.5. Estimation of standard error

Testing the statistical significance of treatment effects and computing their standard errors is not a straightforward thing to do. The problem is that the estimated variance of the treatment effect should also include the variance due to the estimation of the propensity score, the imputation of the common support, and possibly also the order in which treated individuals are matched. These estimation steps add variation beyond the normal sampling variation (Heckman *et al.,* 1998). For example, in the case of NN matching with one nearest neighbor, treating the matched observations as given understate the standard errors.

Bootstrapping: Standard errors in psmatch2 are invalid, since they do not take into account the estimation uncertainty involved in the probit/logit regressions (pscore). One way to deal with this problem is to use bootstrapping as suggested by Lechner (2002). This method is a popular way to estimate standard errors in case analytical estimates are biased or unavailable.

Recently it has been widely applied in most of economic literatures in impact estimation procedures. Each bootstrap draw includes the re-estimation of the results, including the first steps of the estimation (propensity score, common support, etc). Bootstrap standard errors attempt to incorporate all sources of error that could influence the estimates.

Abadie and Imbens (2006), argue that using the bootstrap after nearest neighbor matching, does not yield valid estimates. In other words, bootstrapping estimate of standard errors is invalid for nearest neighbor matching selection. Thus, calculating analytical standard error is applicable here. Bootstrapping standard errors for kernel matching estimators is not subject to this criticism because the number of observations used in the match increases with the sample size.

The distribution of these means approximate the sampling distribution and thus the standard error of the population mean. Clearly, one practical problem arises because bootstrapping is very time-consuming, computationally expensive and might therefore not be feasible in some cases (Caliendo and Kopeinig, 2008).

3.5.2.6. Sensitivity analysis

Recently checking the sensitivity of the estimated results becomes an increasingly important topic in the applied evaluation literatures (Caliendo and Kopeining, 2008). Matching method is based on the conditional independence or unconfoundedness assumption, which states that the evaluator, should observe all variables simultaneously influencing the participation decision and outcome variables simultaneously. This assumption is intrinsically non-testable because the data are uninformative about the distribution of the untreated outcome for treated units and *vice versa* (Becker and Caliendo, 2007). As outlined in equation (5) the estimation of treatment effects with

matching estimators is based on the unconfoundedness or selection on observables assumption. However, if there are unobserved variables which affect assignment into treatment and the outcome variable simultaneously, a 'hidden bias' might arise (Rosenbaum, 2002). In other word, if treatment and outcomes are also influenced by unobservable characteristics, then CIA fails and the estimation of ATTs is biased. The size of the bias depends on the strength of the correlation between the unobservable factors, on the one hand, and treatment and outcomes, on the other.

It should be clear that matching estimators are not robust against this 'hidden biases. Different researchers have become increasingly aware that it is important to test the robustness of results to departures from the identifying assumption. Since it is not possible to estimate the magnitude of selection bias with non-experimental data, the problem can be addressed by sensitivity analysis.

Rosenbaum (2002) proposes using Rosenbaum bounding approach in order to check the sensitivity of the estimated ATT with respect to deviation from the CIA. The basic question to be answered here is whether inference about treatment effects may be altered by unobserved factors. In other words, one wants to determine how strongly an unmeasured variable must influence the selection process in order to undermine the implications of matching analysis.

Eventually, using predicted probabilities of participation in the program (i.e. propensity score) match pairs are constructed using alternative methods of matching estimators. Then the impact estimation is the difference between simple mean of outcome variable of interest for participant and non participant households.

The difference in the involvement in market development interventions by IPMS project between treatment and matched control households is then computed. The ATT is obtained by averaging these differences in market development outcomes (Y_i) across the *k* matched pairs of households as follows:

$$ATT = \frac{1}{K}\sum_{i=1}^{K}\left[Y_i^{i\in D=1} - Y_i^{i\in D=0}\right] \quad (17)$$

A positive (negative) value of ATT suggests that households who have participated in market development interventions have higher (lower) outcome variable Y_i than non-participants.

3.6. Variable Choice and Definitions

3.6.1. Choice and definition of explanatory variables

A review of relevant literature shows that attention should be given regarding the inclusion (or exclusion) of covariates in the propensity score model. The matching strategy builds on the CIA, requiring that the outcome variable(s) must be independent of treatment conditional on the propensity score. Hence, implementing matching requires choosing a set of variables *X* that credibly satisfy this condition. Heckman *et al,* (1997) show that omitting important variables can seriously increase bias in resulting estimates. Only variables that influence simultaneously the participation decision and the outcome variable should be included. Hence, economic theory, a sound knowledge of previous research and also information about the institutional settings should guide the researcher in building up the model (Sianesi, 2004; Smith and Todd, 2005a). It should also be clear that only those variables that are unaffected by participation (or the anticipation of it) should be included in the model. To ensure this, variables should either be fixed over time or measured before participation. In the latter case, it must be guaranteed that the variable has not been influenced by the anticipation of participation. Heckman *et al,* (1999) also point out, that the data for participants and non-participants should stem from the same sources (e.g. the same questionnaire). The better and more informative the data are, the easier it is to credibly justify the CIA and the matching procedure.

In our particular case, variables that determine households' decision to participate in the market developing interventions by the IPMS project could also affect the outcome variable mentioned above. Here, pre-intervention characteristics, which bring variation in outcomes of interest among program participants and non-participant, were used. In other words, variables which are not affected by participation in the program or not or those explanatory variables which are fixed throughout are used as explanatory variables.

There are no general rules for which variables to include in the model (Anderson *et al.*, 2009). However, the evaluator is guided by economic theory and empirical studies to know which observables (explanatory variables) affect both participation and the outcomes of interest (Bryson *et al.*, 2002). Accordingly, different socioeconomic, demographic, institutional and location factors were identified below.

Table 3: Type, definitions and measurement of variables

Dependent variables	**Type and definition**	**Measurement**
Treatment	Dummy, participation in market development of IPMS project	1 if yes, 0 otherwise
Covariates		
AgeHH	Continuous, age of head of household	In year
SexHH	Dummy, sex of household head	1if male, 0 otherwise
EduHH	Dummy, education of household head	1 if literate, 0 illiterate
NoHHmem	Continuous, number of household members	Number
FrmYrs	Continuous, farming experience of household head	In years
AmtLown	Continuous, size of land owned	In hectare
MoVuequ	Continuous, monetary value of farm equipment	In birr
TLU	Continuous, livestock holding size	Tropical livestock unit
Dstmkt	Continuous, distance to the nearest market	In kilometers
DisDa	Continuous, distance to house of DA	In kilometers

Source: own definition

3.6.2. Choice, measurement and indicators of the outcome variables

The first step in impact analysis is to select appropriate impact indicators. In this study different indicators were used to assess the impact of IPMS project intervention on participant households' intensification, productivity, household net income, market surplus and market orientation behavior**.** As mentioned above, impact is assessed for three commodities of intervention by IPMS project which are onion, goat and cattle fattening. Accordingly, these impact indicator variables are discussed below**.**

Intensification: This is one of the outcome variables and is measured by the quantity of inputs used for the market oriented commodities of interventions. There are various inputs

type (pesticide, fertilizer and improved seed measured in kilogram per hectare and value of input used for goat and cattle fattening measured in birr) supplied and sold by the private traders to the participant households which they used for the production, maintenance and management of intervention commodities. In addition to this, extra labor is required in addition to the family labor during planting, weeding and harvesting of onion. Thus, intensity of labor use is measured using number of days used for all activities of onion, goat and cattle fattening.

Productivity: As input use is increasing the productivity of the commodity usually increases. For food crops especially, and other commodities the effect of an increment in input use is immediately reflected in improvement in the productivity. To analyze the effect of market development intervention on the productivity of onion we used total yield per hectare as indicator of productivity.

Marketed surplus: It is the quantity of produce left out after meeting the household's consumption and utilization requirements (in-kind payments and other obligations such as gifts, donation, charity, *etc)*. This marketable surplus shows the quantity available for sale in the market. It is expected that market interventions for each commodities of interventions improves the amount of product taken to the market. The effect of market development interventions on marketed surplus is measured as the proportion onion produce that is marketed. However, for the goat and cattle fattening intervention, the proportion of goat and cattle fattened that are taken to the market or sold from the total goat and cattle (kept from own stock or purchased) for fattening purposes was considered as indicators of marketed surplus.

Household net income: It is one of the outcome variables as a result of the household's participation in specific market development intervention and is measured in Birr. Household's net income is calculated as the difference between the incomes generated from sale and cost incurred for production and marketing of the commodities of intervention.

Market orientation behavior: It is the other outcome variable which is used to determine whether the household is market oriented or not due to participation in the market development interventions by the project.

Different researchers have used different market orientation indicators or measurements which are not uniform. According to Bernard *et al.* (2010), farmers' involvement in producing cash crops such as coffee, fruits, or *khat* rather than staple crops such as cereals may by itself reflect the commercial orientation of the household.

On the other hand, Berhanu and Dirk (2008), used the proportion of households producing market oriented crop and the proportion of land allocated to them as indicators of level of market orientation in their study of market orientation of smallholders in selected grains in Ethiopia.

In this study the proportion of land used for onion production was used as market orientation indicator. Similarly, number of goats and cattle kept for fattening either from their own stock or purchase are used as an indicator of market orientation for goat and cattle fattening activities.

Before proceeding to estimate the logit model, different tests were undertaken. One of the tests is checking the existence of multicollinearity among explanatory variables. The presence of multicollinearity among the variables seriously affects the parameter estimates of any regression model. The Variance Inflation Factor (VIF) technique was employed to detect the problem of multicollinearity among the continuous variables (Gujarati, 2004). VIF can be defined as;

$$VIF(X_i) = \frac{1}{1 - R_i^2}$$

Where R_i^2 is the squared multiple correlation coefficient between X_i and other explanatory variables. The larger the value of VIF, the more troublesome the problem of multicollinearity is. As a rule of thumb if a VIF of a variable exceeeds10, the variable is said to be highly collinear.

Similarly, for dummy variables contingency coefficients test were employed using the following formula

$$C = \sqrt{\frac{\chi^2}{n + \chi^2}}$$

Where C is contingency coefficient, χ^2 is the chi-square value and n=total sample size. For dummy variables if the value of contingency coefficients is greater than 0.75 the variable is said to be collinear.

Hetroscedasticity exists when the variances of all observations are not the same, leading to consistent but inefficient parameter estimates. More importantly, the biases in estimated standard errors may lead to invalid inferences (White, 1980). Hetroscedasticity was detected by using Breusch-Pagen test (hettest) in STATA.

Finally, to estimate the impact of market development interventions on the outcomes STATA version 10.0 computing software using the propensity scores matching algorithm (psmatch2) developed by Leuven and Sianesi (2003) was used.

4. RESULT AND DISCUSSION

In this chapter the results of descriptive statistics and econometric model are presented and discussed. Under descriptive statistics important pre-treatment household characteristics are presented with appropriate statistical tools like mean, standard deviation and percentages. Subsequently, the second section deals with description of the institutional and organizational change of agricultural marketing in the district. Finally, the impact of IPMS project using propensity score matching (PSM) model is presented.

4.1. Description of Sample Households' Characteristics

A combination of different descriptive statistics was performed on the sample households' data to inform the subsequent empirical data analysis. To describe the sample households included in this study both continuous and discrete variables were used. The analysis here was performed based on pre- intervention characteristics of both program participants and non-participants.

Table 4 summarizes household and socio-economic characteristics of sample participants and non-participants households from Mieso district. Accordingly, the two groups were found to be significantly different with respect to size of land holding, total household members (family size), value of farming equipments, relative distance to nearest market and distance to extension agent's office which were statistically significant at 1, 10, 10, 1 and 1% probability levels, respectively. In contrast to non-participants, participants have larger size of land holding, smaller number of household members and value of farming equipments and situated at a relatively nearer distance to market place and agricultural extension agent's home.

Table 4: Descriptive statistics of sample household characteristics (Continuous variables)

Pre-intervention variables	Total Sample (N=180)		Participants (N=90)		Nonparticipants N(90)		Difference in means		t- value
	Mean	STD	Mean	STD	Mean	STD	Mean	STD^D	
AgeHH	38.66	8.62	38.34	7.91	38.98	9.30	-0.63	1.27	-0.492
NoHHmem	6.17	1.68	5.80	1.47	6.53	1.81	-0.73	0.25	-2.987***
FrmYrs	19.26	8.52	19.17	8.28	19.34	8.81	-0.18	1.27	-0.140
AmtLown	2.09	0.74	2.16	0.78	2.02	0.68	0.14	0.11	1.267*
MoVuequ	652.07	334.39	518.47	295.39	785.68	318.64	-267.21	45.80	-5.834*
TLU	6.78	3.76	6.63	46759.00	6.93	2.55	-0.30	0.56	-0.539
Dstmkt	4.29	2.99	3.72	2.54	4.86	3.29	-1.14	0.44	-2.609***
DisDa	1.80	1.46	1.38	1.22	2.22	1.56	-0.84	0.21	-4.026***

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

Source: Own survey result, 2010

STD^D for mean difference= $\sqrt{\frac{STD_1^2}{N_1} + \frac{STD_2^2}{N_2}}$

Table 5 shows the education level and sex of farmers in the study area. Sample respondents were composed of both male and female household heads. Among the total sample households, the majority (86.1 %) were headed by male while only 13.9% were female headed. With regard to education level of household head most (88.9%) of the sample households were found to be literate (Table 5).

Table 5: Descriptive statistics of sample households (Dummy variables)

Pre-intervention Variables	Category	Participant (N=90)		Nonparticipant (N=90)		Total		χ^2
		N	%	N	%	N	%	
SexHH	Male	82	91.1	73	81.1	155	86.1	3.763
	Female	8	8.9	17	18.9	25	13.9	
EduHH	Literate	85	94.4	75	83.3	160	88.9	5.625
	Illiterate	5	5.6	15	16.7	20	11.1	

Source: Own survey data, 2010

4.2. Institutional and Organizational Changes of Agricultural Markets in the Woreda

As a result of the intervention made by IPMS project in Mieso woreda different changes were observed in organizational and institutional aspects of agricultural market for the commodities of intervention. To achieve these changes many individuals and different organizations came together and played their part in the value chain approach of the project.

4.2.1. Credit facility

Credit is widely regarded as an important instrument for improving the present and long-term economic welfare of households. Access to credit can increase the risk-bearing capacity of households, motivating them to invest in more uncertain but higher return activities, such as production of onion and fattening.

Table 6: Access to formal credit

Credit service	Participants		Non-participants		Total	
	N	%	N	%	N	%
Received	21	23.3	15	17	36	20
Did not receive	69	76.7	75	83	144	80

Source: Own survey data, 2010

Regarding credit facilities, about 22% of the sample respondents reported that they received formal credit in 2008/2009 production season. Furthermore, about 23% of participants received credit as compared to nonparticipants, which are about 20%. The main reason cited by 66 and 63 percents of participants and non-participants respectively, was unavailability and inadequacy of credit as the main problem in getting credit (Table 7). According to Table 7, the second reason for not taking credit as reported by 13% of the respondents was that there was no need for credit.

Table 7: Reason for not taking credit

Reason for not taking credit	Type of participation			
	Nonparticipants		Participant	
	N	%	N	%
No need for credit	7	9.3	12	17.4
No credit available	50	66.6	44	63.8
Lack of collateral and no credit available	2	2.7	1	1.4
Lack of collateral	9	12	5	7.2
High interest rate	2	2.7	1	1.4
Fear to repay and high interest rate	4	5.3	0	0
Fear to repay	1	1.4	6	8.7

Source: Own survey data, 2010

The main source of credit for participants is Oromiya Credit and Saving Share Company (OCSSCO) integrated with IPMS and Microfinance institutions which accounts for 6 and 11, respectively from total of 21 receivers. Mieso which had not benefited from the credit scheme for so long was issued funds channeled through the OCSSCO from the

neighboring Asebe Tefari branch for fattening. And the rest is provided by banks and the government.

According to Table 8, non-participant households who receive credit about 26%, 33% and 20% reported to accessed loan from microfinance institution, government and Banks, respectively. Microfinance institutions dominantly provided cash credit. On the other hand, about 52% participants received input credit from IPMS project indirectly. Project participants indicated that the IPMS project has contributed much in providing input credit in kind mostly for fattening purpose. 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.

Table 8: Sources of credit

Source of credit	Types of participation			
	Participants		Non-participants	
	N	%	N	%
Banks	2	9.5	3	20
Microfinance Institutions	6	28.6	4	26.7
OCSSCO integrated with IPMS	11	52.4	3	20
Government	2	9.5	5	33.3
Total	21	100	15	100

Source: Own survey data, 2010.

4.2.2. Agricultural extension service

Agricultural extension offices provided services that are alleged to be important sources of information about new and improved agricultural technologies. According to Table 9, from total sample respondents 87% reported that they have contact with agricultural extension agents in 2008/9 production season and get technical advice from them. 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. It has also been providing the FTCs with necessary equipments like television, computers, chairs, tables and CDs to facilitate the farmers

training program. Moreover, the project is involved in strengthening the linkages among the institutions which are believed to work together: research institutions, extension and farmers. Besides, the project introduces new ways of agricultural practices and technologies to the woreda.

Table 9: Extension service

Received extension service	Participants		Non-participants		Total	
	N	%	N	%	N	%
Received	85	94.4	71	78.9	156	86.7
Did not receive	5	5.6	19	21.1	24	13.3

Source: Own survey data, 2010.

4.2.3. Farmers organization and linkage to different value chain actors

As it can be seen from Table 10, about 74% of the respondents were not members to any formal organizations. About 89% of participants and 59% of non-participants are found to be members of one or more formal organizations. The IPMS project has been playing a role in initiating organization of farmers in to cooperatives based on the commodities of intervention. Linkages are made between different value chain actors including linkages with research, private companies for either the supply of inputs and/or the marketing of products. The project facilitated consolidation of these 3 women marketing groups in collective input output marketing and there has been on-going quest for linkage with the export abattoirs. The project also assisted linkage between a milk processor at Awash and 30 women. Milk market monitoring was undertaken in Messo, Asebot, Bordode, Asebe Teferi and Awash towns (Husemendhera, Torebeyo, Gorbo). As part of value addition, milk quality tests (Lactometer and Alcohol Tests) were introduced in Buri and Godachele PA involving 45 women and 5 men. The project initiated the establishment of 2 cattle fattening market groups and linked farmers with commercial feed supplement dealers, and vet drug shops at Nazareth. Facilitated the establishment of one MUM supplier in Bordode and Asebot town and trained additional paravets in 3 PAs. These indicate that the project has brought about organizational and institutional changes in input marketing.

Table 10: Membership to formal organization

Membership to formal organization	Participants		Non-participants		Total	
	N	%	N	%	N	%
Member of formal organization	80	88.9	53	58.9	133	73.9
Not member of formal organization	10	11.1	37	41.1	47	26.1

Source: Own survey data, 2010

4.2.4. Market information service

Information about current market related issue is very much in hand to producers, traders and consumers since it reduces transaction costs, business risks associated with uncertainty and it enables market participants to make accurate decisions.

The project's intervention has included market information delivery system through posting weekly market price on billboard in a place of convenience. Thus about 92% of respondents know and get market information on input and output price using the bill board directly and indirectly. However, about 42% of participants and 41% of non-participants reported to get additional price information from the market and friends, neighbors and relatives.

About 29% of respondents of those who have access to the bill board information, reported that IPMS has brought benefit to them in providing market information and enabling them to reduce transaction costs. In addition, respondents described livestock fair events are a reliable source of market information and new practices and technologies.

4.3. Empirical Results

Before embarking to econometric estimation the existence of multicollinearity among explanatory variables were assessed using different methods. Variance inflation factor (VIF) was used to test the presence of strong multicollinearity problem among all the explanatory variables hypothesized. In addition, multicollinearity between discrete variables was checked using contingency coefficients (CC). Based on the result of VIF, the data has no serious multicollinearity problem (see Appendix 1). Similarly, the

contingency coefficients calculated for the dummy variables showed a weak degree of association among the variables considered as a result no explanatory variable was dropped (see Appendix 2). Likewise, hetroscedasticity was tested using Breusch-Pagen test. This test resulted in the rejection of the existence of hetroscedasticity hypothesis as (p=0.294) and there was no need to make the standard error robust. Therefore, all the hypothesized continuous and dummy variables were included in the model for further analysis.

4.3.1. Propensity scores

Logistic regression model was used to estimate propensity score of participants and non-participant households. The first stage in the propensity score matching is to model the probability of participating in the IPMS project. With that purpose, the study included variables that influence the likelihood of participating in the IPMS project. The rationale behind this is that, if a variable influences participation but not the outcome, there is no need to control for differences with respect to this variable in the treatment versus the control groups. Likewise, if the variable influences the outcome but not the treatment likelihood, there is no need to control for that variable since the outcome will not significantly differ in the treatment versus the control groups. Variables that affect neither treatment nor the outcome are also clearly unimportant. Therefore, only those variables that influence both the treatment and the outcome are needed for the matching and are included in the logit model from which the propensity score is derived.

Table 11 shows the estimation results of the logit model. It reports the estimated coefficients, Z-value, standard error, and some goodness of fit measures for the model.

The estimated coefficient results indicate that probability of participation is significantly influenced by five explanatory variables. This includes access to market, distance to agricultural extension agent office, number of family member, size of land and farm asset holding. Access to markets and office of agricultural extension agent are found to have strong and positive relationship with household participation in the project. Both of these variables are significant at 1% of probability level. This means that households who lives nearer to market and office of agricultural extension agents are more likely to included in the project than those who live far from market and extension office. Likewise, households

who have more number of family members are less likely to participate in the project than households with less family members. In contrary, size of own land has a strong and positive effect on household project participation. In addition, household's farm asset holding has a strong and negative effect on household participation.

The estimated model appears to execute well for the intended matching exercise. The pseudo-R^2 value is 0.35 (Table 11). The pseudo-R^2 indicates how well the covariates explain the participation probability. A low pseudo R^2 value means that participant households do not have much distinct characteristics overall and *per se* finding a good match between participants and non-participant households becomes easier. After matching there should be no systematic differences in the distribution of covariates between both groups and therefore, the pseudo-R^2 should be fairly low (Caliendo and Kopeining, 2005).

Table 11: Logit results household program participation

Variable	Coefficients	Standard Error	Z-values
ageHH	0.009	0.048	0.19
SexHH	0.395	0.644	0.61
EduHH	0.600	0.640	0.94
NoHHmem	-0.463***	0.131	-3.53
FrmYrs	0.062	0.050	1.25
AmtLown	0.792 **	0.302	2.62
TLU	-0.028	0.049	-0.58
MoVuequ	-0.004***	0.001	-5.20
Dstmkt	-0.204***	0.073	-2.81
DisDa	-0.612***	0.150	-4.07
_cons	3.257	1.568	2.08
N	180		
LR chi2(10)	87.00		
Prob > chi2	0.0000		
Log likelihood	-81.268		
Pseudo R^2	0.349		

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

On the basis of this participation model, we then computed the distribution of the propensity score for each household included in the treated and control groups to identify the existence of a common support. Figure 3 portrays the distribution of the household with respect to the estimated propensity scores. Most of the treatment households are found in the right side and partly in the middle. On the other hand, most of control households are found in the left side of the distribution. In generally the graph shows that there is wide area in which the propensity score of participants is similar to those of non-participants.

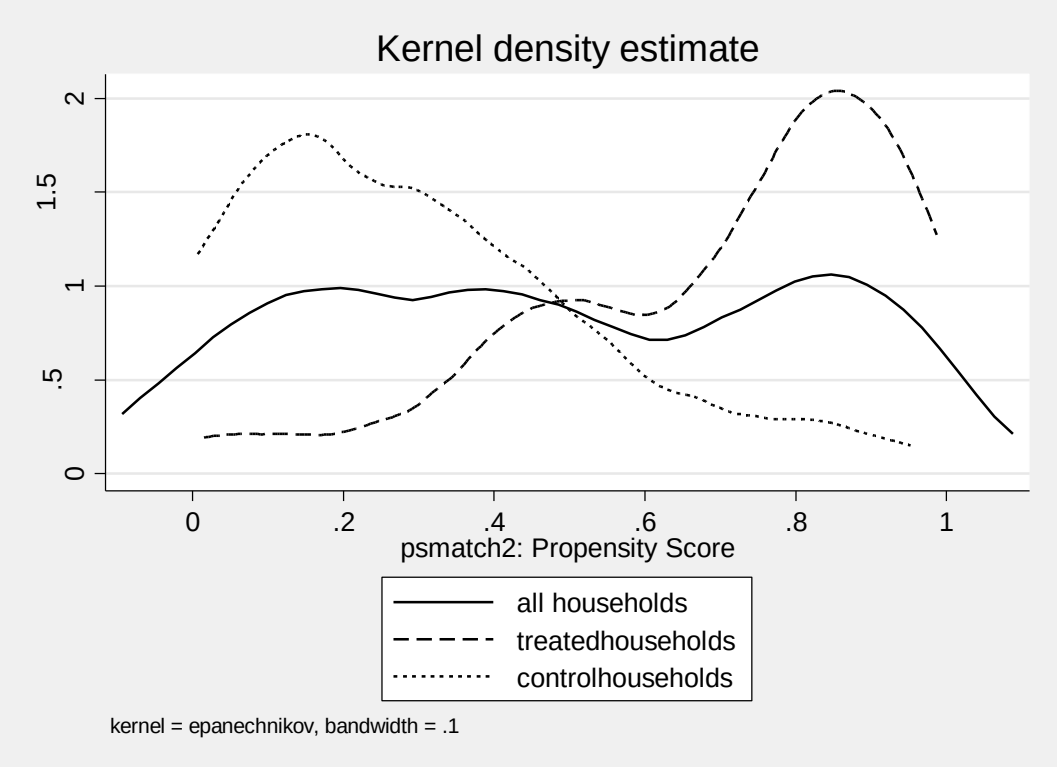


Figure 3: Kernel density of propensity score distribution

4.3.2. Matching participant and comparison households

Before one launches the matching task there are four main tasks to should accomplish. The first is the estimation of predicted values of project participation (propensity scores) for all participant and non-participant households as shown in Table 12.

Secondly, a common support condition should be imposed on the propensity score distributions of the households with and without the project.

Third, discard observations whose predicted propensity scores fall outside the range of the common support region. And at last sensitivity analysis should be done in order to check the robustness of the estimation (whether the hidden bias affects the estimated ATT or not).

As shown in Table 12, the estimated propensity scores vary between 0.013 and 0.98 (mean=0.50) for participant households and between 0.0051 and 0.95 (mean=0.48) for non participants (control) households. Thus, the common support assumption is satisfied in the region of [0.013-0.95] with the mean of 0.48. This means that households with estimated propensity scores less than 0.013 and greater than 0.95 are not included in the matching exercise. As a result of this restriction, 10 households (4 treated and 6 control households) were discarded.

Table 12: Distribution of estimated propensity scores

Group	Obs	Mean	Std. Dev	Minimum	Maximum
Total households	180	0.5	0.32	0.005	0.98
Treatment households	90	0.71	0.24	0.013	0.98
Control households	90	0.29	0.23	0.005	0.95

Source: Own survey result

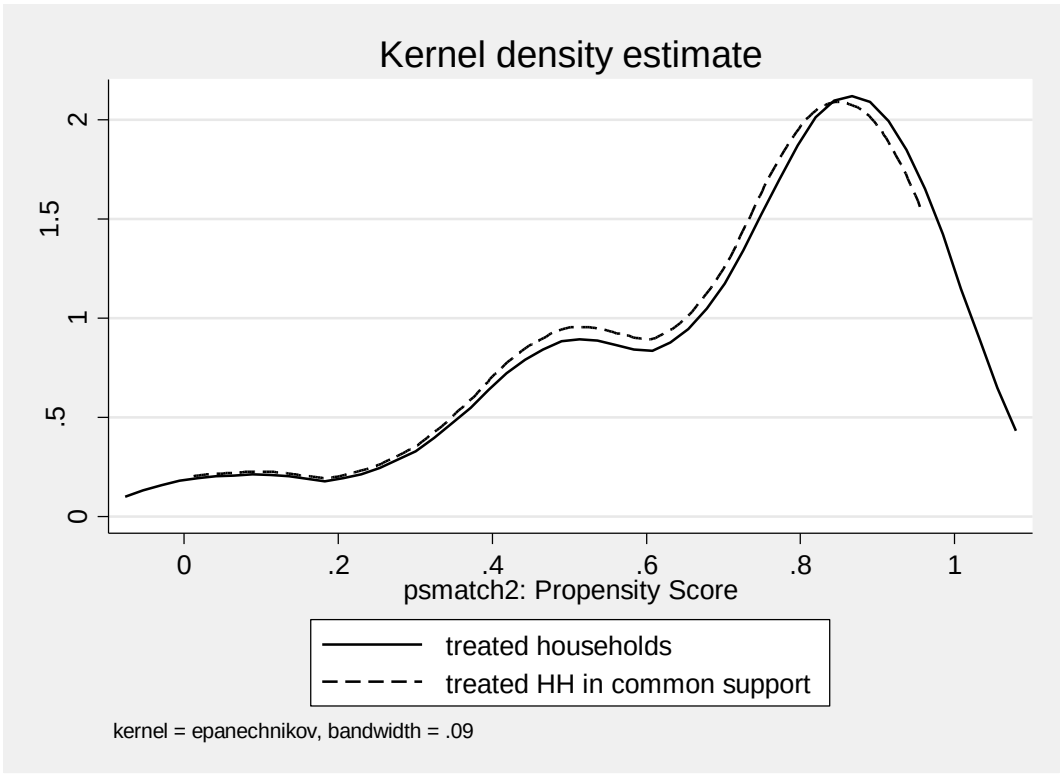


Figure 4: Kernel density of propensity scores of participant households

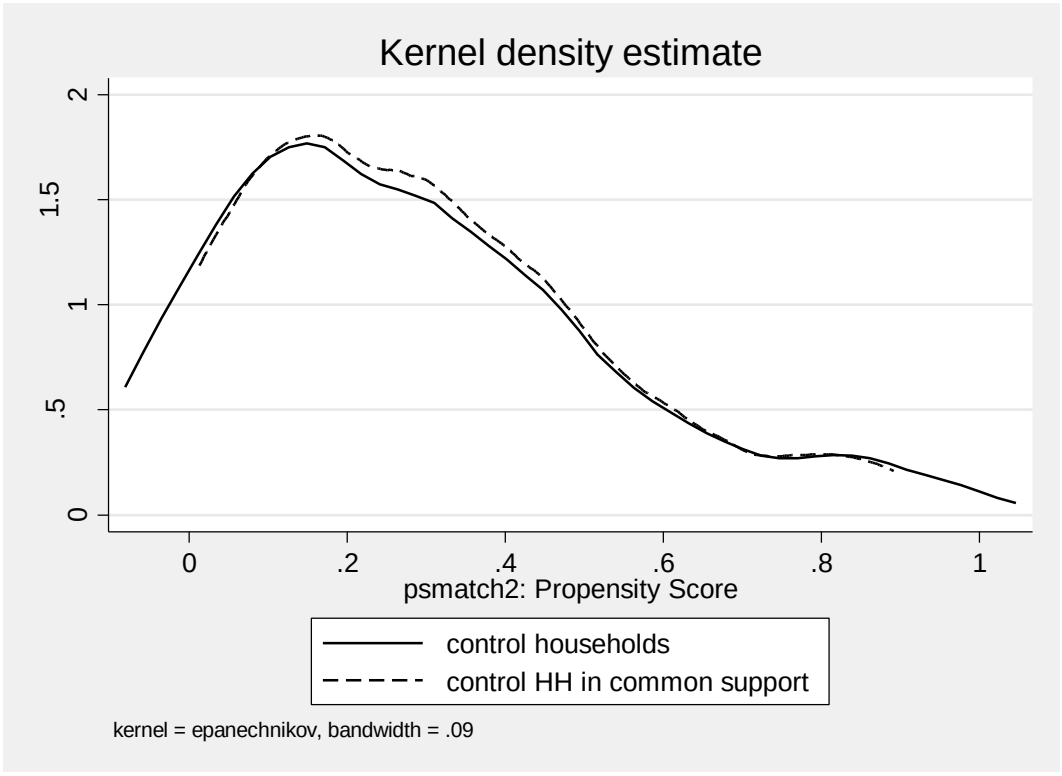


Figure 5: Kernel density of propensity scores of non participant households

Figures 4 and 5 depict the distribution of estimated propensity scores, with and without the imposition of the common support condition, for participant and non-participant households, respectively. Most of the participant households have propensity score around 0.8 while majority of the non-participant households have propensity score less than 0.4.

4.3.3. Choice of matching algorithm

Different matching estimators were tried in matching the treatment and control households in the common support region. Different criteria such as equal means test referred to as the balancing test, pseudo-R^2 and matched sample size were used as a guide to make the final choice of a matching estimator. Particularly a matching estimator that results in insignificant mean differences between the two groups that bears low pseudo R^2 value and also which results in large sample size is preferable.

Table 13 depicts the estimated results of tests of matching quality based on the above mentioned performance criteria. After looking the results, it has been found that kernel matching with a band width of 0.25 is the best estimator for the data at hand. As such, in what follows estimation results and discussion are the direct outcomes of the kernel matching algorithm based on a band width of 0.25.

Table 13: Performance of matching estimators

Matching estimator	**Performance criteria**		
	Balancing test*	Pseudo-R^2	Matched sample size
NN			
1 neighbor	5	0.389	170
2 neighbor	8	0.189	95
3 neighbor	4	0.5	170
4 neighbor	4	0.356	170
Caliper			
0.01	8	0.170	95
0.25	6	0.198	170
0.5	10	0.034	170
Kernel			
With no band width	8	0.339	160
band width 0.1	8	0.348	170
band width 0.25	10	0.030	170
band width 0.5	9	0.139	141

Source: Own calculation result

*Number of explanatory variables with no statistically significant mean differences between the matched groups of participant and non-participant households.

4.3.4. Testing the balance of propensity score and covariates

After choosing the best performing matching algorithm the next job is to check the balancing of propensity score and covariates using the selected matching algorithm which is kernel matching. The main purpose of the estimation of propensity score is to balance the distributions of relevant variables in both treatment and control groups but not to obtain a precise prediction of selection into treatment.

Table 14 shows the balancing tests of the covariates using the matching estimators. Moreover, Table 14 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. Education, farming experience monetary value of farming assets, distance to market and distance to agricultural extension office 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 14: Balancing test of each covariates using t-test

Variables	Before matching (180)			After matching (170)		
	Treatment (90)	Control (90)	T-value	Treatment (84)	Control (86)	T-value
AgeHH	36.711	38.056	-1.20	36.076	37.176	0.10
SexHH	0.9111	0.8556	1.16	0.8987	0.8888	-0.04
EduHH	0.9444	0.8333	2.4**	0.9367	0.8865	-0.36
NoHHmem	6.0889	5.8556	1.00	6.05	6.1337	-0.11
FrmYrs	16.889	19.178	-2.02**	16.633	17.541	0.17
AmtLown	2.1556	2.0169	1.27	2.0538	2.0629	-0.23
TLU	6.6251	6.9278	-0.54	6.4855	6.457	0.05
MoVuequ	518.47	785.68	-5.83***	528.13	647.27	-0.13
Dstmkt	3.7178	4.8611	-2.61***	3.862	4.0331	0.13
DisDa	1.3772	2.2183	-4.03***	1.4741	1.7475	0.17

The low pseudo-R^2 and the insignificant likelihood ratio tests support the hypothesis that both groups have the same distribution in covariates X after matching. These results clearly show that the matching procedure is able to balance the characteristics in the treated and matched comparison groups. These results were used to evaluate the effect of the IPMS project among groups of households having similar observed characteristics. This allowed us to compare observed outcomes for participants with those of a comparison group sharing a common support.

Table 15: Chi-square test for the joint significance of variables

Sample	Pseudo R^2	LR chi^2	$p>chi^2$
Unmatched	0.292	72.86	0.000
Matched	0.009	2.03	0.998

All of the above tests suggest that the matching algorithm we have chosen is relatively the best for the data at hand. Therefore, we can proceed to estimate ATT for households.

4.3.5. Estimating Treatment Effect on Treated

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

4.3.5.1. Estimates of average treatment effect (ATT) of input use

A closer look at the level of input use in case of onion revealed that there was a statistically significant difference between participants and non-participants of the project in terms of the level of fertilizer and improved seed use. With respect to fertilizer and improved seed rate used the result shows that participants have used about 51kg more of fertilizer and 4kg more of improved seed per hectare than non-participants and this difference was significant at 1% and 5% level respectively. The average treatment effect of the intervention on input use for goat and cattle are also shown in Table 16. With regard to the value of input use intensity for goat participants spent about 49 birr more than non-participants and the difference was statistically significant at 1% probability level. Though

there was a significant difference between the two groups before matching, after matching their difference with regard to input use for cattle was found to be insignificant.

Table 16: Estimation of ATT of IPMS program on input intensity

Commodity of intervention	Variable	Treated	Control	Difference	SE[b]	t-value
Onion	Pesticide (kg/ha)	7.818	2.868	4.951	3.730	1.33
	Fertilizer (kg/ha)	52.575	1.450	51.124	14.968	3.42***
	Improved seed (kg/ha)	5.849	1.235	4.614	1.799	2.56**
	Value of labor use (days/ha)	10.699	5.223	5.477	4.215	1.29
Goat	Value of goat input use(birr)	62.128	13.267	48.861	15.735	3.105***
Cattle	Value of cattle input use(birr)	147.526	58.119	89.407	55.51	1.448

*** and ** significant at 1% and 5% probability levels

[b] Boot strapped standard error with 100 replications

4.3.5.2. Estimates of average treatment effect (ATT) of productivity of onion

Table 17 presents the change in the productivity of onion. As compared to the non-participants, participants have harvested about 30 Qt more of onion per hectare of land. In this respect, the difference between participants and non-participants is significant at 5% probability level.

Table 17: Estimation of ATT of IPMS program on productivity of onion

Variable	Treated	Control	Difference	S.E[b]	t- value
Productivity of onion (kg/ha)	53.434	22.929	30.504	14.009	2.177**

** Significant at 5% probability levels

[b] Boot strapped standard error with 100 replications

4.3.5.3. Estimates of average treatment effect (ATT) of net income

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. Participants on average earned about birr 4515 more from the commodities of intervention over non-participants and this was statistically significant at 10% level of significance.

Table 18 also shows mean differences in terms of net income from individual commodities of intervention. Accordingly, participants got a net income about birr 1330 from onion which was statistically significant at 1% significance level.

Participants earned about birr 288 from goat over non-participants although it is insignificant after bootstrapping the standard error. While, participants of cattle fattening intervention fetch a net income of about birr 995 over non-participants and this was found to be significant at 1% level of significance.

Table 18: Estimation of ATT of IPMS program on net income

Variable	Treated	Control	Difference	SE[b]	t-value
Net income from onion	4572.632	3241.696	1330.935	129.167	10.304***
Net income from goat	846.154	557.312	288.842	257.883	1.12
Net income from cattle	4746.327	3751.747	994.579	243.195	4.09***
Total net income[T]	11579.484	7063.740	4515.745	619.164	1.73*

*** and * significant at 1% and 10% probability levels

[b] Boot strapped standard error with 100 replications

[T] Total Net income is the sum of net income from onion, goat and cattle fattening.

4.3.5.4. Estimates of average treatment effect (ATT) of marketed surplus

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 for all three commodities of intervention. The estimation result provides an

estimate of amount sold as a proportion to what is produced at individual commodity level.

Looking into individual commodities of intervention participants supplied about 68% more of onion to the market over non-participants which is statistically significant at 5% probability level. Similarly, for goat the intervention has increased the marketed surplus of participants by about 20% to that of non-participants and this difference was significant at 5% level of significance. In addition, compared to non-participants, participants of cattle fattening have supplied around 25% of what they fattened which was found to be significant at 10% level of significance.

Table 19: Estimation of ATT of IPMS program on marketed surplus

Variable	Treated	Control	Difference	S.E[b]	t- value
Onion	0.690	0.006	0.685	0.235	2.915**
Goat	0.715	0.498	0.217	0.085	2.553**
Cattle	0.717	0.472	0.244	0.128	1.906*

** and * significant at 5% and 10% probability level.

[b] Boot strapped standard error with 100 replications

4.3.5.5. Estimates of average treatment effect (ATT) of market orientation indicators

Table 20 illustrates, with respect to proportion of land allocated to the onion commodities of intervention, as a proxy for market orientation, the effect of the project on the proportion of households' allocation of land for onion commodity do not yield significant difference between participants and non-participants. In other words, our impact estimation does not show significant difference between the two groups. Similarly, our result of measuring the market orientation for goat fattening does not show an effect significantly different from zero. On the other hand, participants have allocated 86% more of cattle for fattening as compared to non-participants. And this difference is statistically significant at 5% probability level.

Pertaining to consideration of market signal in production and fattening plan, most participants consider market signal to decide on production and fattening planning than that of nonparticipants. The difference was statistically significant at 5% level.

Table 20: Estimation of ATT of IPMS program on market orientation

Variables	Treated	Control	Difference	S.E[b]	t- value
Land allocated for onion (%)	0.133	0.075	0.058	0.052	1.12
Goat allocated for fattening (no.)	4.039	2.089	1.950	1.359	1.43
Cattle allocate for fattening (no.)	2.289	1.426	0.863	0.385	2.24**
Market signal[a]	0.632	0.203	0.428	0.205	2.088**

** significant at 5% probability level.

[a] Consideration of market signal in production decision

[b] Boot strapped standard error with 100 replications

4.2.4. The sensitivity of the evaluation results

In this section we address the issue whether the final evaluation results are sensitive with respect to the choice of the balancing scores. 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 21 reveals the sensitivity analysis of the outcome ATT values to the dummy confounder. Regarding input use in onion the average treatment effect on the treated of both fertilizer and improved seed rate used were found to be insensitive or robust to the dummy confounder. Whereas in case of goat value of input used was robust/ not sensitive to the confounder. Looking into productivity of onion, it was found to be robust to the confounder. With respect to net income, net income from onion and cattle and also the aggregate level, the CIA remain to be significant/ robust and the results were not sensitive to the confounder. Pertaining to marketed surplus of households, all the estimates were found to be robust to the dummy cofounder. Moreover, the proxies for market orientation for cattle and market signal were also robust to the CIA identified.

Table 21: Sensitivity analysis of the estimated ATT

Outcome variable		Individual variables	Percentage change
Input use	Onion	Fertilizer	0.08
		Improved seed	0.04
	Goat	Monetary value of input used	0.06
Productivity		Onion	0.2
Net income		Total net income	0.03
		Onion	0.18
		Cattle	0.55
Market surplus		Onion	0.01
		Goat	0.02
		Cattle	0.48
Market orientation		Cattle allocate for fattening	0.21
		Market signal	0.18

5. CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusions

This study has evaluated the impact of input and output market development interventions of the IPMS project at Mieso pilot learning *woreda* of the project in the Oromiya region. Generally the study has focused on examining the impact of the IPMS's market development interventions on input use and productivity, net income, marketed surplus and market orientation of participant households as compared to non-participant households.

Cross-sectional data collected from both participant and non-participant sample households were used and analyzed using PSM method. The primary data for the study was collected from 180 households from both participant and non-participant households in Mieso *woreda* using a structured questionnaire.

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. In studies like this the main research question is what would have happened to an outcome of interest had the program not been in place. To answer this question observing outcomes with-and-without the program for the same household is required. But, it is obvious that the '*with'* and '*without'* condition cannot be observed from the same household at the same time. There exists a problem of missing or unobserved outcome. Here one can use the counterfactual outcome to get the comparison.

In non experimental design, simple with-and-without comparison of means for program and non-program households would lead to biased estimates, since the program placement creates selection effect as opposed to randomized experimental design, where the impact of a program can be estimated by a simple difference in means between treatment and control outcomes.

Hence, the study applied a propensity score matching technique which has become the most widely applied non-experimental tool for impact evaluation of social programs. 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.

Participation in the project is significantly influenced by the combination of five explanatory variables. Households who lives nearer to market and office of agricultural extension agents are more likely to included in the project than those who live far from market and extension office. Likewise, households who have more number of family members are less likely to participate in the project than households with less family members. In contrary, those who have larger size of land and smaller farm asset are more likely to be participant in the project.

After controlling for these confounding factors, the original 90 participant and 90 non-participant sampled households were conditioned in such a way that 84 participant households were matched with 86 non-participants using kernel matching estimator with 0.25 bandwidth. As a result, only 170 sample households were identified to be considered in the estimation process after discarding households whose pscore value is out of the common support region.

With regard to input use, the intervention has resulted in about 51 kg more of fertilizer per hectare being used by participants of onion commodity of intervention which was significant at 1% probability level. In case of improved seed use, participants used 4kg of improved seed per hectare over non-participants which was significant at 5% level. In case of goat fattening participants spent 49 birr more than non-participants for the purchase of input for goat fattening.

Concerning to productivity of onion participants has got 30qt more onion per. This difference was significant at 5% probability level. Looking into total net income earned, participants has received a total net income of about birr 4151 over non-participants that was found to be significant at 10% level of probability. Participants had earned about birr 1330 from onion and birr 995 from cattle which were significant at 1%.

The project has resulted in statistically significant market surplus which is the proportion of produce sold for participants. Participants sold about 68% more of onion and fattened goat about 20% and cattle about 25% to the market over non-participants.

Looking into market orientation, about 42% of participants make production and fattening decision by considering market signals which was found to be significant at 5%. Moreover participants allocated about 86% more of cattle for fattening. In contrary, there was no significant difference in land allocated for onion production and goat fattening between treated and control households.

As the result of the intervention made by the project various institutional and organizational changes has been witnessed. These include better access to credit and market information. The establishment or strengthening of farmers' organization which improves access to better markets, facilitating linkages with potential traders and input supply are some of important changes that were observed.

These estimates were found to be robust for bootstrapping and sensitivity analysis (dummy confounder).

5.2. Recommendations

Depending on the findings of this study, the following policy implication can be forwarded.

The empirical results reveal that the project has a positive and statistically significant impact on participants which makes similar intervention very important in guiding more farmers to be market-oriented and earn higher incomes.

More emphasis should be give to market oriented goat production, tighter linkage with traders and potential exporters and better negotiating skill by the side of farmers so that they can benefit more from the current favorable market condition because of the growing involvement of goat meat export abattoirs.

As it can be seen from the results participants are more productive, supplied more of their produce to the market and earned higher net income as a result of increased level of input use. This calls for an advanced effort to develop the input market in particular the provision of reliable and timely market information, the involvement of the private sector in input supply.

Farmers reported that most of their onion produce was sold right after harvest due to shortage of storage facilities which resulted in unfair price. The establishment and/or support farmers to build their own storage facilities are vital.

Generally cattle production system is characterized by low input system and mainly traditional. Cattle production is also characterized by lack of improved breeding bulls, insufficient credit service and veterinary support. These requires for the provision of improved vet and credit services and training farmers/pastoralists to maintain the best type and adequate number of livestock for breeding and fattening or there is a need to ease the way farmers get improved/hybrid goat and cattle for fattening.

In addition, most of farmers reported that they didn't receive credit mainly due to the absence or inadequacy of credit service and also they were obliged to repay in short period of time. This requires for the facilitation of credit service in a more convenient way and modifying the loan repayment period so that farmers can maximize the return to loans.

Moreover, scaling up of the practice of the project to other places has paramount importance for the development endeavor of the country.

6. REFERENCES

Abadie, A. and G.W. Imbens, 2006. Large Sample Properties of Matching Estimators for Average Treatment Effects. *Econometrica*, 74:235- 67.

Alston, J.M., M.C. Marra, P.G. Pardey, and T.J. Wyatt. 1998. *Research returns redux: A meta-analysis of the returns to agricultural R&D.* EPTD Discussion Paper No, 38. Washington, D.C.: International Food Policy Research Institute.

Anandajayasekeram, P., J. F. Oehmke and W.A. Master, 1997. Agricultural Technology Development and Transfer in Africa Impacts Achieved and Lessons Learned. USAID, Office of Sustainable Development, Bureau for Africa, SD Publication Series, Technical Paper No. 77, Washington, D. C.

Andersson, C., Alemu Mekonen and S. Stage, 2009. Impacts of the productive safety net program in Ethiopia on livestock and tree holdings of rural households. Discussion Paper Series. Environment for Development (EfD) Initiative. EfD DP 09-05.

Ansoff, I. H., 1957. Strategies for diversification, *Harvard Business Review*, 35(2):113 124.

Asfaw Negassa, and M. Jabbar, 2008. *Livestock ownership, commercial off-take rates and their determinants in Ethiopia.* Research Report 9. ILRI (International Livestock Research Institute), Nairobi, Kenya. 52 pp.

Bain, K., and P. Howells, 1988. Understanding Markets: An Introduction and Practice of Marketing. Harvester Wheat sheaf, London.

Baker, J.L., 2000. Evaluating the impact of development projects on poverty: A handbook for Practitioners. Washington D.C. World Bank.

Bantilan, M.C.S., and W.D. Dar, 2001. Impact assessment linked with research priority setting: experience at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). Pages 57–59 (Annex) *in* The future of impact assessment in the CGIAR: needs, constraints and options. Proceedings of a workshop organized by the Standing Panel on Impact Assessment of the Technical Advisory Committee, 3–5 May 2000, FAO, Rome, Italy.

Becker, S. O., and A. Ichino, 2002. Estimation of average treatment effects based on Propensity Scores: *The Stata Journal*, 2(4): 1-19.

Becker, S.O., and M. Caliendo, 2007. Sensitivity Analysis for Average Treatment Effects. *The Stata Journal*, 7(1): 71–83.

Berhanu G/M., H. Dirk and Samson J, 2007. Heading towards commercialization? The case of live animal marketing in Ethiopia. Working paper no.5

Berhanu Gebremedhin and H. Dirk, 2008. Market orientation of smallholders in selected grains in Ethiopia: Implications for enhancing commercial transformation of subsistence agriculture. IPMS (Improving Productivity and Market Success) of Ethiopian Farmers Project Working Paper 11. ILRI (International Livestock Research Institute), Nairobi, Kenya. 44 pp.

Berhanu Gebremedhin and H. Dirk, 2009. Staple food crops turning into commercial crops: Case studies of *Teff*, Wheat and Rice in Ethiopia. Revision submitted to the Ethiopian Journal of Economics. International Livestock Research Institute (ILRI). Addis Ababa, Ethiopia.

Berhanu Gebremedhin, Hoekstra D and Azage Tegegne. 2006. *Commercialization of Ethiopian agriculture: Extension service from input supplier to knowledge broker and facilitator.* IPMS (Improving Productivity and Market Success) of Ethiopian Farmers Project Working Paper 1. ILRI (International Livestock Research Institute), Nairobi, Kenya. 36 pp.

Bernard T, Eleni Gabre-Madhin and Tafesse AS. 2007. *Smallholders' commercialization through cooperatives: A diagnostic for Ethiopia.* IFPRI Discussion Paper 722. IFPRI (International Food Policy Research Institute), Washington, DC, USA.

Bernard,T., D.J. Spileman, Alemayehu Seyoum and Eleni Gabre-Madhin, 2010. Cooperatives for staple crop marketing: evidence from Ethiopia. IFPRI research monograph; 164.

Bryson, A., R. Dorsett and S. Purdon, 2002. The Use of Propensity Score Matching in the Evaluation of Labour Market Policies, Working Paper No. 4, Department for Work and Pensions.

Burdge., R.J. and F. Vanclay, 1996. "Social Impact Assessment: A contribution to the state of the art series", *Impact Assessment,* 14: 59-86.

Caliendo, M., R. Hujer, and S. Thomsen (2005): \The Employment Effects of Job Creation Schemes in Germany - A Micro econometric Evaluation," Discussion Paper No. 1512, IZA, Bonn.

Caliendo, M., and S. Kopeinig, 2005. Some Practical Guidance for the Implementation of Propensity Score Matching, Discussion Paper No. 1588, University of Cologne.

Caliendo, M., and S. Kopeinig, 2008. Some practical guidance for the implementation of propensity score matching. IZA Discussion Paper No. 1588, University of Cologne.

Chamberlain, J., J. Pender and B. Yu. 2006. *Development domains for Ethiopia: Capturing the geographical context of smallholder development options.* ESSP Working Paper. Washington, D.C.: International Food Policy Research Institute.

Chapman, A., 2009. Market development process. www.businessballs.com(Accessed on September 1, 2010).

Chowdhury, S., Asfaw Negessa and M. Torero, 2005. Market institutions: Enhancing the value of rural-urban links. FCND Discussion Paper 195/MTID Discussion Paper 89. Washington DC: International Food Policy Research Institute.

CIA (Central Intelligence Agency), 2010. US Central Intelligence Agency: world fact book. (Accessed on January 11, 2011).

Collion, M-H., and P. Rondot, eds, 1998. *Background discussion and recommendations. Agricultural producer organizations, their contribution to rural capacity building and poverty reduction.* Washington, D.C.: The World Bank.

Coulter, J., J. Millns, A. Tallontire and R. Stringfellow, 1999. Marrying farmer cooperation and contract farming for agricultural service provision in liberalizing economies in sub- Saharan Africa. ODI Natural Resources Perspectives, No. 48, London: Overseas Development Institute.

CSA (Central Statistics Agency), 2008. Summary and statistical report of population and housing census, Addis Ababa, Ethiopia

Davis, J.R., 2006. How can the poor benefit from the growing markets for high value agricultural products? Research Report, Natural Resources Institute, Kent, UK.

De Janvry, A., M. Fafchamps and E. Sadoulet, 1991. Peasant household behavior with missing markets: Some paradoxes explained. *Economic Journal,* 101:1400-1417.

Dehejia, R. H. and S. Wahba, 2002. Propensity Score Matching Methods for Non-Experimental Causal Studies: The Review of Economics and Statistics, Vol. 84, No.1, pp. 151–161.

Dehejia, Rajeev, and S. Wahba, 1999. "Causal Effects in Nonexperimental Studies: Reevaluating the Evaluation of Training Programs," Journal of the American Statistical Association, 94, 1053-1062.

Delgado C, M. Rosegrant, H. Steinfeld, S. ehui and C. Courbois, 1999. Livestock to 2020: the next food revolution. Discussion paper 28.

Dercon, S. and A. Zeitlin, 2009. Rethinking agriculture and growth in Ethiopia: A conceptual discussion. Paper prepared as part of a study on agriculture and growth in Ethiopia.

Diaz, J. J., and S. Handa, 2006: An Assessment of Propensity Score Matching as a Non Experimental Impact Estimator: Evidence from Mexicos Progresa Program," forthcoming, Journal of Human Resources.

Dorsey B., 1999. Agricultural intensification, diversification and commercial production among smallholder coffee growers in Central Kenya. *Economic Geography* 75(2):178 195.

Dorward, A., J. Kydd, J. Morrison and C. Poulton, 2005. Institutions, markets and economic development: Linking development policy to theory and praxis. *Development and Change,* 36(1): 1-25.

Dorward, A., N. Poole, J. Morrison, J. Kydd and I. Uray, 2003. Markets, institutions and technology: Missing links in livelihoods analysis. *Development Policy Review,* 21(3): 319- 332.

Eleni, G. E., and I. Goggin, 2006. Does Ethiopia need a commodity exchange? An integrated approach to market development. Paper presented at the Ethiopian Strategy Support Program 2006 Policy Conference, Addis Ababa.

Eleni, G., 2001.Market Institutions, Transaction costs, and Social capital in the Ethiopian Grain Market.International Food Research Policy Institute (IFPRI) research report No. 124. Ethiopia: 5-55

Ezemenari, K., A. Rudqvist and K. Subbarao, 1999. Impact Evaluation: A Note on Concepts and Methods, Poverty Reduction and Economic Management Network, World Bank.

Fafchamps M. 1992. Cash crop production, food price volatility, and rural market integration in the third world. *American Journal of Agricultural Economics* 74(l):90–99.

Fafchamps, M., 2005. Market institutions in Sub-Saharan Africa. Cambridge, Mass, U.S.A.: MIT Press.

Foster, E., 2003. Propensity score matching. An illustrative analysis of dose response. Lippincott Williams & Wilkins, Inc. *Journal of Medical Care*, 41(10):1183-1192.

Gabre-Madhin EZ, Alemu Dawit and Samson Dejene. 2007. From farmer to market: Smallholder commercialization of food crops in Ethiopia. Draft ESSP Working Paper (Unpublished).

Gilligan, D., J. Hoddinott and Alemayehu Seyoum, 2008. The Impact of Ethiopia's Productive Safety Net Programme and its linkages. IFPRI Discussion Paper 00839.

Goldsmith, A., 1993. "Institutional development in national agricultural research: Issues for impact assessment" *Public Administration and Development*, 13(3): 195-204.

Govereh, J., T.S. Jayne and J. Nyoro, 1999. Smallholder commercialization, interlinked markets and food crop productivity: Cross-country evidence in eastern and southern Africa

Gujarati, D.N., 2004. Essentials of Econometrics. 4th edition. Mc-Graw-Hill Companies

Guo, S., R.P. Barth and C. Gibbons, 2006. Propensity score matching strategies for evaluation substance abuse services for child welfare clients. *Children and Youth Serv. Rev.* 28, 357-383.

Heckman, J., H. Ichimura, J. Smith, and P. Todd, 1998. Characterizing selection bias using experimental data. *Econometrica*, 66: 1017–1098.

Heckman, J., L. Robert and J. Smith, 1999, "The Economics and Econometrics of Active Labor Market Programs," *Handbook of Labor Economics, Volume 3*, Ashenfelter, A. and D. Card, eds., Amsterdam: Elsevier Science.

Heckman, J.J., H. Ichimura and P. Todd, 1997. Matching as an econometric evaluation estimator: evidence from evaluating a job training programme, *The Review of Economic Studies*, 64:605-654.

http://ideas.repec.org/c/boc/bocode/s432001.html.Accessed on April, 2010

Hujer, R., M. Caliendo and S.L. Thomson, 2004. New evidence on the effects of job creation schemes in Germany. A matching approach with threefold heterogeneity. *Res. Econ.* 58(4), 257–302.

IAIA., 1998. *Principles of Environmental Impact Assessment: Best Practice.* International Association for Impact Assessment. URL: ttp://iaia.ext.nodak.edu/iaia/principles/

Immink, MDC and J.A. Alarcon, 1993. Household income, food availability, and commercial crop production by smallholder farmers in the western highlands of Guatemala. *Economic Development and Cultural Change* 41(2):319–342.

IPMS (Improving Productivity and Market Success) of Ethiopian Farmers, 2005. Project implementation plan. www.ipms-ethiopia.org. (Accessed on August 30, 2010).

IPMS (Improving Productivity and Market Success) of Ethiopian Farmers, 2007. Mieso Pilot Learning Woreda. Diagnosis and program design. www.ipms-ethiopia.org. (Accessed on August 30, 2010).

Jalan, J., and M. Ravallion, 1999. Income gains to the poor from workfare:Estimates for Argentina's Trabajar Program. Indian Statistical Institute and World Bank. Policy Research Working Paper 2149. Washington, DC.

Jalan, J., and M. Ravallion, 2003. Estimating the benefit incidence of an antipoverty program by propensity-score matching. *Journal of Business and Economics Statistics,* 21(1):19-30

Jayne T. S., 1994. Do high food marketing costs constrain cash crop production? Evidence from Zimbabwe. *Economic Development and Cultural Change* 42(2):387–402.

Jones, S., 1996. Food markets in developing countries: what do we know? Working Paper, No 8. Oxford: Food Studies Group.

Jones, W.O., 1972. Marketing Staple Food Crops in Tropical Africa. Cornell University Press. Ithaca

Kennedy, E., and B. Cogill, 1987. Income and nutritional effects of the commercialization of agriculture in southwestern Kenya. Research Report No. 63. IFPRI (International Food Policy Research Institute), Washington, DC, USA.

Kerr, J., Pangare, G., Pangare, V. L. and George, P. J. 2000. An Evaluation of Dry land Watershed Management Projects in India: Environment and Production Technology Division, International Food Policy Research Institute, Washington, U.S.A.

Kohls, R. L., and J. N. Uhl, 1985. Marketing of agricultural products. 6th-edition. Macmillan publishing company, New York.

Kranton, R.E., 1996. Reciprocal exchange: A self-sustaining system. *American Economic Review,* 86(4): 830-851.

Lechner, M., 2002. Program Heterogeneity and Propensity Score Matching: An Application to the Evaluation of Active Labor Market Policies. *The Review of Economics and Statistics*, 84(2): 205-220.

Lee, W. S., 2006. Propensity Score Matching and Variations on the Balancing Test: Melbourne Institute of Applied Economic and Social Research, the University of Melbourn

Leuven, E. and B. Sianesi, 2003. PSMATCH2: Stata module to perform full Mahalanobis and propensity score matching, common support graphing and covariate imbalance testing.

Liebenehm, S., H. Affognon and H. Waibel, 2009. Impact assessment of agricultural research in West Africa: An application of the propensity score matching methodology. Paper presented at the International Association of Agricultural Economics Conference, Beijing, China.

MBPRD, 2008. Meiso office of Pastoralists and Rural development Annual Report. Meiso Wereda

MBPRD, 2009. Meiso office of Pastoralists and Rural development Annual Report. Meiso Wereda

McNair, M. P., and H. L. Hansen, 1956. Reading in Marketing, Second Edition. McGraw-Hill Book Company, Inc. New York.

Mendola, M., 2007. Agricultural technology adoption and poverty reduction: A propensity score matching analysis for rural Bangladesh. *Journal of Food Policy,* 32(3):372-393.

MoFED (Ministry of Finance and Economic Development), 2002. Ethiopia: Sustainable Development and Poverty Reduction Program. Federal Democratic Republic of Ethiopia (FDRE), Addis Ababa.

MoFED (Ministry of Finance and Economic Development), 2006. Building on progress: A Plan for Accelerated and Sustained Development to End Poverty (PASDEP). Addis Ababa, Ethiopia.

Moti Jaleta, Berhanu Gebremedhin and H. Dirk, 2009. Smallholder commercialization: Processes, determinants and impact. Discussion Paper No. 18. Improving Productivity and Market Success (IPMS) of Ethiopian Farmers Project, ILRI (International Livestock Research Institute), Nairobi, Kenya. 55 pp.

Mwape, F., 2009. Paper presented at the opening speech of Towards Priority Actions for Market Development for African Farmers, ILRI Conference, Nairobi, Kenya

Mywish, M., B. Derek and A. Jock, 2003. Ex-post evaluation of economic impacts of agricultural research program. A tour of good practice. May 3-5, Rome

North, D.C., 1990. Institutions, institutional change and economic performance. Cambridge: Cambridge University Press.

Omiti. J., O. David, N. Ellen and N. Timothy, 2007. Strategies to Promote Market-Oriented Smallholder Agriculture in Developing Countries: A Case of Kenya. Ministry of Agriculture, Ministry of Livestock and Fisheries Development, Ministry of Cooperative Development and Marketing, Nairobi, Kenya.

Oehmke, J.F., Anandajayasekeram, P., Masters, W.A., 1997. Agricultural Technology Development and Transfer in Africa Impacts Achieved and Lessons Learned. USAID, Office of Sustainable Development, Bureau for Africa, SD Publication Series, Technical Paper No. 77, Washington, D. C.

Omoto, W., 2003. Impact assessment of urban agriculture research and development in Nairobi, Kenya.

Pender, J. S., Ehui and F. Place, 2006. Conceptual framework and hypothesis. In: Pender J, Place F and Ehui S (eds), *Strategies for sustainable land management in the East African highlands.* IFPRI (International Food Policy Research Institute), Washington, DC, USA.

Pingali, P., 1997. From subsistence to commercial production systems: The transformation of Asian agriculture. *American Journal of Agricultural Economics,* 79(2): 628–634.

Pingali, P., and M. Rosegrant, 1995. Agricultural commercialization and diversification: Processes and policies. *Food Policy,* 20(3): 171–185.

Pingali, P., and T.P. Schultz (Eds). Handbook of Agricultural Economics Volume 3. Agricultural Development: Farmers, Farm Production and Farm Markets. Amsterdam: Elsevier.

Poulton C, Kydd J and Dorward A. 2006. Overcoming market constraints on pro-poor agricultural growth in sub-Saharan Africa. Development Policy Review 24(3): 243-277.

Randolph, T. F., 1992. The impact of agricultural commercialization on child nutrition. A case study of smallholder households in Malawi. PhD dissertation. Cornell University, Ithaca, New York, USA.

Ravallion, M., 2005. Evaluating anti-poverty programs: Policy research working paper 3625, World Bank, Washington D.C.

Reardon, T., and C.P. Timmer, 2005. Transformation of Markets for Agricultural Output in Developing Countries Since 1950: How Has Thinking Changed? In R.E. Evenson, P.

Rondot P and Collion M. 1999. Agricultural producer organizations: Their contribution to rural capacity building and poverty reduction. Summary of a workshop, June 28-30, Washington DC. Rural Development Department, World Bank.

Rosembaum, P.R., and D.B. Rubin, 1983. The Central Role of the Propensity Score in Observational Studies for Causal effects, Biometrika, Vol.70, No.1, pp. 41–55.

Rosenbaum, P. R., 2002. Observational Studies. 2nd ed. New York: Springer

Rosenbaum, P. R., and D.B. Rubin, 1985.Constructing a control group using multivariate matched sampling methods that incorporate the propensity score. *The American Statistician,* 39(1): 35-39

Rubin, D. B., and N. Thomas, 2000. "Combining Propensity Score Matching with Additional Adjustments for Prognostic Covariates." *Journal of the American Statistical Association 95:* 573-85.

Scarborough, V., and J. Kydd, 1992. Economic analysis of agricultural markets: a manual, Natural Resources Institute.

Sianesi, B., 2004. An evaluation of the active labor market programs in Sweden. *The Review of Economics and Statistics*, 186(1):133-155.

Smith, J., and P. Todd, 2005a, "Does Matching Overcome LaLonde's Critique of NX Estimators?" *Journal of Econometrics*, 125(1-2): 305-353.

Smith, J., and P. Todd, 2005b, "Rejoinder," *Journal of Econometrics*, 125(1-2): 365-375.

Strasberg, P.J., T.S. Jayne, T. Yamano, J., Nyoro, D. Karanja and J. Strauss, 1999. Effects of agricultural commercialization on food cop input use and productivity in Kenya. MSU International Department of Agricultural Economics Development, Department of Economics. Working paper no. 71.

Tanguy, B., Eleni G. and Alemayehu S., 2007. Smallholders' Commercialization through Cooperatives: A Diagnostic for Ethiopia. IFPRI Discussion Paper 00722

Thornton, PK., R.L. Kruska, N. Henninger, P.M.Kristjanson, R.S. Reid, F. Atieno, A.N. Odero and T. Ndegwa, 2002. Mapping poverty andlivestock in the developing world. ILRI (International Livestock Research Institute), Nairobi, Kenya. 124pp

Timmer, C. P., 1997. Farmers and markets: The political economy of new paradigms. *American Journal of Agricultural Economics,* 79(2):621–627.

UNDP (United Nations Development Program) 2010, Human Development Report: 20th Anniversary Edition, UNDP New York.

Von Braun, J., H. Bouis and E. Kennedy, 1994. Conceptual framework. In: Von Braun J and Kennedy E. (eds.). Agricultural commercialization, economic development and nutrition. John Hopkins University Press, Baltimore, USA

White, H., 1980. A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity. *Econometrica*, 48: 817-838.

White, T. A., and C.F. Runge, 1995. The emergence and evolution of collective action: Lessons from watershed management in Haiti. World Development 23(10): 1683-1698.

William, A.R., William, R. A ,Masters and G. E. Shively, 2008. Linkages between market participation and productivity: results from a multi-country farm household sample**.** Prepared for presentation at the American Agricultural Economics Association Annual Meeting, Orlando, FL, July 27-29, 2008

World Bank., 2002. World development report 2002: Building institutions for markets. New York: Oxford University Press.

World Bank., 2007. Ethiopia: Accelerating equitable growth: Country Economic Memorandum, Part II: Thematic chapters. ReportN0.38662-ET.Washington, DC: World Bank. World Bank/Poverty reduction and Economic management Unit, Africa Region.

Yibeltal Fentie, 2008. The Impact of Ibnat-Belessa integrated food security program on household food poverty. An M.Sc. Thesis Presented to School of Graduate Studies of Haramaya University. 94p.

7. APPENDICES

Appendix 1: Multicollinearity test for continuous explanatory variables

Variable	VIF	1/VIF
FrmYrs	4.7	0.212629
ageHH	4.62	0.216403
MoVuequ	1.21	0.826611
AmtLown	1.19	0.839887
EduHH	1.1	0.911897
NoHHmem	1.09	0.914086
SexHH	1.08	0.92783
DisDa	1.06	0.944674
TLU	1.05	0.951962
Dstmkt	1.02	0.981044
Mean	VIF	1.81

Appendix 2: Contingency coefficient for discrete variables

Variable	Value of C
SexHH	0.086
EduHH	0.174

Appendix 3: Conversion factor used to calculate TLU

Livestock category	TLU
Calf	0.34
Heifer	0.75
Cow and Ox	1.0
Horse	1.1
Donkey	0.7
Sheep and Goat (adult)	0.13
Chicken	0.013

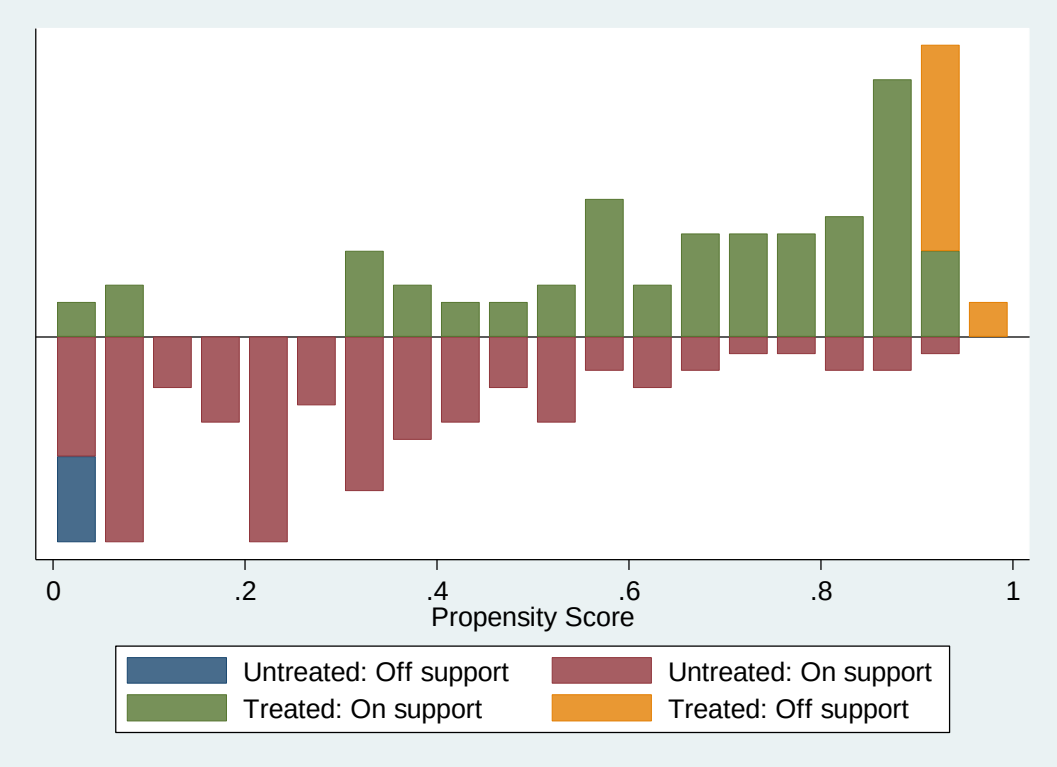
Source: Storck *et al.,* 1991

Appendix 4: Conversion factor for adult equivalent (AE)

Age group	Male	Female
<7	0.00	0.00
7-14	0.04	0.40
15-64	1.00	1.00
>65	0.50	0.50

Source: Storck, et al., 1991

Appendix 5: Histogram of Pscore with common (off) support regions



School of Graduate Studies

Department of Agricultural Economics

The Impact of Input and Output Market Development Interventions of the IPMS Project: The Case of Meiso Woreda, Oromiya, Ethiopia

Questionnaire for individual household

Rigion: Oromia

Zone:

District:

Date of interview_____

Name of Peasant Association_____

Name of interviewee_____

Questionnaire no._____

I. HOUSEHOLD CHARACTERSTICS

1.1. Name of household head,

1.2. Marital Status?

Married=1 Single=2 Divorced=3 Widowed=4

1.3. Sex of respondent?

Female=0 Male=1

1.4. Age of respondent? ___ (years)

1.5. Educational status? _____ (years) **"1" if literate and** "**0" if illiterate**

1.6. Religion of respondent?

Orthodox=1 Muslim=2 Protestant=3 others (specify) _____

1.7. Family size in age and sex groups

Table 1

S/N	Name of household member	Sex 1-male 2-female	Age	R/ship to head(a)	Education level(b)	Major occupation (c)

Codes a: *Husband=1Wife=2 Son=3 Daughter=4 Other (specify)=5_____*

Codes b: *No formal education=1 Adult education=2 Primary education=3 Secondary education=4 High school=5 Preparatory education=6 Certificate=7 Diploma=8 Degree=9*

Codes c: *Farming=1 Livestock raring=2 Herding=3 Household work=4 Marketing=5 Sell of fuel wood and charcoal=6 Petty trading=7 Schooling=8 Unemployed=9 Others=10 _____*

1.8. Do you know the interventions of the IPMS project?

Yes =1 No =0

1.9. Did you participate in IPMS market development interventions?

Yes =1 No =0

1.10. If yes, for how long have you been beneficiary of the project? _____ (years)

1.11. In which commodity of intervention did you participate?

1= Onion 2= Goat fattening 3= Cattle fattening

1.12. Total cultivated land in hectares

Owned land _____ Rented in land _____ Rented out land _____

Shared in_____ Shared out_____ Total land size possessed _____

1.13. Rate of land rental_____ Birr/ ha

1.14. What type of house do you have?

1=Corrugated iron sheet 2=Grass roofed 3=Kulu tora 4=Mud house

II. LIVESTOCK PRODUCTION

2.1. Livestock holding

Table 2

Livestock types	Ox	Bull	Barren cow	Milking cow	Heifers	Sheep	Goat	poultry	Donkey	Camel
Number (in head)										

2.2.What are the main sources of feed in your area?

Grazing =1 hay =2 crop straw =3 others =4

2.3.Do you produce/plant improved forage for your livestock?

Yes=1 No=0

2.4. If yes, what is the size of land allotted for forage last years?

3. Table 3

Type of forage	Mode of production 1= rain fed 2= irrigated	Size of land allotted	Remark
Alfafa			
Elephant plant			

2.5. Do you sale improved forage?

Yes=1 No=0

2.6. Did the IPMS intervention improved feed availability?

Yes=1 No=0

2.7. If yes, how? _____

2.8. What other benefit do you get from IPMS interventions related to feed?

_____

2.9. Have you brought change in the number of goat and cattle kept due to IPMS intervention?

Yes=1 No=0

2.10. If yes, production in livestock and amount/number sold & income for the years of intervention

Table 4

Livestock types	Years of intervention							
	2008				2009			
	No. of heads	Amt sold	Price/head	income	No. of heads	Amt sold	Price/head	income
Goat								
Cattle								

2.11. Specify IPMS support in Livestock production in your area

_____

2.12. Have you participated in any of the local level livestock fair events in the past years?

Yes=1 No=0

2.13. If yes, what have you gained from participating in these fair events?

_____

2.14. Is there any change in productivity of livestock due to intervention by IPMS?

Yes=1 No =0

2.15. Did you have any goats and cattle meant for fattening in 2000/1?

Yes=1 No=0

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

Table 5

Types of livestock	Source of animal 1= own flock 2=purchase	Quantity	Unit cost or market value (birr/head)	Remark
Goat				
Cattle				

2.17. Which types of shoat are more fattened?

Ram=1 Ewe=2 Keb (goromiti)=3 Wetete (Korbeessa)=4

2.18. How long it takes to finish fattening?

Goat _____

Cattle _____

2.19. Have you purchased any inputs for livestock fattening purpose 2000/1?

Yes=1 No=0

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

Table 6

Type of inputs	Does market exist 1=Yes 2=No	Quantity	Unit cost	Total cost	Source 1=traders 2=other farmers 3=OoPDR 4=cooperatives
Improved cow and bull					
Semen(lt.)					
Vet. Service					
Goat and cattle forage					
Forage seed					
Nougcake (kg)					
MUB (kg)					
Hired labor					

2.21. How often do you take fattened animals to market? _____

2.22. Is there any difference in the quality of animals after you started working with IPMS?

Yes=1 No=0

2.23. If yes, how do you express the difference?

Poor=1 Good=2 Very good=3 Excellent=4

III. ONION PRODUCTION

3.1.Do you produce onion?

Yes=1 No=0

3.2. When did you start producing onion for your own? _____ (Years)

3.3. Have you ever participated in any intervention provided by IPMS in relation to onion?

Yes=1 No=0

3.4. Have you brought about change in land allocated to the commodities of intervention due to IPMS intervention?

Yes=1 No=0

3.5. If yes, land allocation for commodity of intervention on the farm (ha)

Table 7

Commodity type	Started to participate since (year)	Area allocated (ha)		Remark
		2008	2009	
Onion				

3.6. 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? _____

3.7. Specify IPMS support in onion production in your area _____

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

Table 8

Commodity type	Years of intervention								Remark
	2008				2009				
	Prod(qt)	Amt. sold	Price/qt	income	Prod(qt)	Amt. sold	Price/qt	income	
Onion									

3.9. Have you sold any onion seed and seedling?

Yes=1 No=0

Table 9

Commodity type	Years of intervention								Remark
	2008				2009				
	Prod(qt)	Amt. sold	Price/qt	income	Prod(qt)	Amt. sold	Price/qt	income	
Seed									
Seedling									

3.9. Is there any change in productivity of commodities of intervention of IPMS?

Yes=1No =0

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

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

3.12. How do you take production decisions?

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

3.13. If you take decisions based on market signal, what is your source of information?

1= MOA, 2= IPMS, 3= others (specify) _____

3.14. What do you think is the advantage of using market signal to take production decision?

3.15. 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 in days spent per year for onion production

Table 10

Commodity type	Source of labor 1=family 2=hired 3=labor exchange, guza	Area (ha)	Land preparation to planting	Weed.	Harv	Trans.	Storing	Marketing	Wage rate if hired (birr/person/day)
Onion									

2. Provide information on utilization of labor for goat and cattle production

Table 11

Commodity type	Activities	Source of labor 1=family2=hired 3=labor exchange, guza	Days spent per year	Current wage rate if hired(birr/person/day)
Goat	Housing			
	Feeding			
	Watering			
	Follow up and monitoring			
	Medication			
	Marketing			
Cattle	Housing			
	Feeding			
	Watering			
	Follow up and monitoring			
	Medication			
	Marketing			

4. What is average working hours per day in onion production related activities? ___hours

B. USE OF OXEN

1. For which activities did you use oxen?

Plowing =1 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 onion production

Table 12

Commodity type	Area	Oxen-pair days for plowing	Remark
Onion			

C. PESTICIDE

1. Did you use pesticide for onion production?

Yes =1 No =0

2. If yes, provide the following information on the use of pesticide

Table 13

Commodity type	Area	pesticide(kg)	Unit cost	Total cost	Source 1=traders 2=other farmers 3= OoPRD 4=cooperatives
Onion					

D. FERTILIZER USE

1. Do you use fertilizer in your onion 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

Table 14

Commodity type	Years of intervention							
	2008				2009			
	Area (ha)	Quantity(kg)		Cost/kg	Area (ha)	Quantity(kg)		Cost/kg
		Urea	DAP			Urea	DAP	
Onion								

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. 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. IMPROVED SEED

1. What is your source of improved seed for onion?

1=MOA 2=Cooperatives 3=Local market 4=other (specify) _____

2. What is the improved seed rate used for commodities of intervention by IMPS

Table 15

Commodity type	Years of intervention			
	2008		2009	
	Seed used (kg/ha)	Price/kg	Seed used (kg/ha)	Price/kg
Onion				

3. Did your use of seed improved change due to IPMS? Yes =1 No =0

4. INSTITUTIONAL FACTORS

A. Credit Service

4.1. Have you received any type of credit last year?

Yes=1 No=0

4.2. What is your source of credit?

1=Banks 2=Cooperatives 3=Microfinance institutions 4=OCSSCO integrated with IPMS 5= Other (Specify) _____

4.3. How much was it? _____what was the interest rate? _____

4.4. For what purpose you obtained the credit?

1. Seed purchase 2. Fertilizer purchase 3. Chemical/drug purchase
4. Animals purchase 5.To fill family requirement 6. To settle debt
7. For petty trade 8. Others (specify) _____

4.5. What are the problems/reasons in getting credit?

No need for credit=1 No credit available or few supply =2 Inadequacy of credit =3 Absence of informal sources =3 Unfavorable repayment time=4 High interest rates =5 Lack of collateral =6 others =7(specify) _____

4.6. How do you rate the availability and adequacy of credit?

1=bad 2= moderate 3=good

4.7. Did IPMS done any contribution in relation to credit?

Yes=1 No=0

4.8. If yes, what, how, specify? _____

B. Agricultural extension services

4.9. Did you participate in any extension program?

Yes=1 No=0

4.10. If yes, on which types of extension service you have been participated?

Demonstration=1 Training=2 Exhibition=3 Field day=4 5.

Others_____

4.11. Have you attended farmer's training within last years?

Yes=1 No=0

4.12. If yes, how many days of training? _____

4.13. If you have participated on training would you tell us the content of the training?

1=Crop production 2=Animals production 3=Marketing strategy

4=Disease control 5=Natural resource conservation

6=Others (specify) _____

4.14. Is there Agricultural Development Agent in your area?

Yes=1 No=0

4.15. If yes, do you get services or technical advice from development agents?

Yes=1 No=0

4.16. If yes, frequency of contact? _____ (total number of visits per year)

4.17. What is the distance in Km from your home to the development agent's office or residence? _____

4.18. How many hours it requires you to walk from your home to the development agent's office or residence? _____

4.19. What do you think is the contribution of IPMS for the extension service?

_____

4.20. Are you a member of any formal organization/association other than PAs?

Yes =1 No =0

4.21. If yes, which one?

Cooperatives =1 Women's group =2 Farmers' group=3 Others =4(specify) _____

4.22. 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) _____

4.23. Have you ever made contractual agreement so far?

Yes=1 No=0

4.24. If yes, how do you rate the contractual agreements (keeping promises among partners)?

1=low 2=moderate 3=high

4.25. Did IPMS made intervention on Cooperatives?

Yes=1 No=0

4.26. If yes, is there any change on cooperatives after IPMS intervention?

Yes=1 No=0

4.27. If yes, how?_____

V. FARM INCOME AND MARKETING

5.1. Where are your major markets for sale of farm products? _____

5.2. Distance of the nearest market in kilometers? _____ (walking hours _____)

5.3. Distance of the farthest market in kilometers? _____ (walking hours _____)

5.4. When do you sale most of your products?

1=Right after harvest 2=Later after harvest 3=Others _____

5.5. What is your opinion on the prices of commodities in 2008/09?

Good = 1 Fair =2 Bad =3

5.6. Have you participated in off-farm activities in last year?

Yes=1 No=0

5.7. If yes, on what type of off-farm activities in last year?

Table 16

Types of off-farm activities	Mode of participation 1= part-time(sometimes) 2= full time(throughout the year)	Estimated income earned	Remark
Livestock trading			
Crop trading			
Firewood/charcoal trading			
Pottery making			
Weaving			
Leather making			

5.8. How is the trend of your agricultural (on-farm) income since IPMS's intervention in the PA?

Increased=1 Decreased=2 Remained unchanged=3

5.9. 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

5.10. 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

5.11. 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_____

5.12. Is there any change in market access?

Yes=1 No=0

5.13. If yes, how? _____

5.14. Do you get market information about prices and demand conditions of agricultural **outputs**?

Yes=1 No=0

5.15. If yes, indicate the source of information

1=Radio 2=Merchant/traders 3= Development agents 4= Friends/ relatives/neighbors

5=Others (specify) _____

5.16. Do you get market information about prices and demand conditions of agricultural **inputs**?

Yes=1 No=0

5.17. If yes, indicate the source of information

1=Radio 2=Merchant/traders 3= Development agents 4= Friends/ relatives/neighbors

5= Others (specify) _____

5.18. Do you feel IPMS brought benefit to you in providing market information using bill board and speaker?

Yes=1 No=0

5.19. If yes, in what aspect? _____

5.20. After IPMS information provision did you get better return/ price?

Yes=1 No=0

5.21. Did IPMS market information help you in reducing transportation costs in relation to **output** markets?

Yes=1 No=0

5.22. If yes, how? _____

5.23. Did IPMS market information help you in reducing transportation costs in relation to **input** markets?

Yes=1 No=0

5.23. If yes, how? _____

5.24. Do you know the input supply shop?

Yes=1 No=0

5.25. What benefit do you get from that shop? _____

VI. Perception Related Questions (Only For Participants)

6.1. In your opinion, how do you rate positive impact of the project in creating and linking to market?

Poor=1 Good=2 Very good=3 Excellent=4

6.2. What is/are the rules and regulations you made with private traders if you made any linkage?

_____

_____

_____

_____

6.3. Have you seen any negative impact of the project?

_____

_____

_____

_____