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Tigist Mekonnen

Maastricht Economic and social Research institute on Innovation and Technology (UNU-MERIT)
email: info@merit.unu.edu | website: http://www.merit.unu.edu

Maastricht Graduate School of Governance (MGSoG)
email: info-governance@maastrichtuniversity.nl | website: http://www.maastrichtuniversity.nl/governance

Boschstraat 24, 6211 AX Maastricht, The Netherlands
Tel: (31) (43) 388 44 00

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Financing Rural Households and Its Impact: Evidence from Randomized Field Experiment Data*

Tigist Mekonnen (PhD)
Maastricht University and UNU-MERIT
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Abstract

We evaluate the short-term impact of financial support to smallholder farmers and training program to married women in two regions of Ethiopia. Using household-level panel data from the World Bank collected in 2010-2012, the combined Difference-In-Difference (DID) and matching methods are applied. The three main findings emerge from the analysis shows that first; the program seems to improve rural households' annual income from farm and non-farm economic activities (26 percent). Second, financial incentive positively affects smallholders' innovative farm practices, adoption of modern technologies and new marketing approach. Third, only training to resource-poor rural women is not enough to their income earning activities. Farm households engage themselves in non-farm economic activities measured in working days positively affect households' income. However, the whole household member participation in agricultural activities has a negative effect on income, suggesting that the surplus labor participation on a small land holding household resulting in diminishing marginal return on income.

JEL Classification: C93, O12, Q14
Key words: Rural capacity building, innovation, technologies, randomized control trials, Ethiopia

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Email: t.mekonnenmelesse@maastrichtuniversity.nl

1 Introduction

Lack of access to finance is considered to be a continuous barrier for rural and agricultural investment. In developing countries, most of the poor are residing in rural areas and employed in agricultural production. Rural households and enterprises need ongoing access to financial services to grow and generate income. From a macro point of view, increasing financial access holds the promise of increasing economic growth by encouraging investment (Rodrik and Rosenzweig, 2009). Financial support specific to the livelihood activities of the rural households enable them to reach on the market. However, short term capital loans with frequent expected repayment may not suit to seasonal or long term agricultural investment (Pearce, 2003). The theoretical argument focusing on access to finance claims that financial market imperfection can result in large inefficiencies as firms with productive investment opportunities under-invest (McKenzie and Woodruff, 2008).

In Sub-Saharan African (SSA) countries, agriculture is the main source of household income and food production. Matin et al. (2002) claim that financial incentives help the rural poor in a wide range of economic activities. However, constraints such as poor infrastructure and illiteracy are the major barriers that financial institutions are facing to work in rural areas. As a result, rural poverty in the world is higher than in the urban areas (Ravallion and Datt, 1996). Exceptionally in some of the Latin American countries, for example, in Brazil (78 percent), Paraguay (76 percent), and Peru (65 percent), the urban poor are the majority (De Janvry and Sadoulet, 2002). One of the important reasons is the lack of capital which is a precondition for the livelihood activities. In most SSA countries, agriculture is the main economic source of the rural households, however due to lack of efficiency, low productivity on primary agricultural production and high population pressure, rural poverty rate is higher than urban (Diao et al., 2010).

Transforming the large population of the rural poor through financial support increases the productivity of agriculture and income of households that facilitate the current economic growth, for instance in Ethiopia. The contribution of agriculture to the Ethiopian economy is 40 percent for GDP, 85 percent for employment, and 90 percent for export earnings (Yu et al., 2011). Nevertheless, the performance of the sector is lagging behind the growth of the population and demand for food and non-food products (Spielman et al., 2011). This low productivity of the sector is related to factors including socioeconomic, technological, innovativeness of the sector and institutional circumstances of the country. The sector is considered an engine to the Ethiopian economy, its progress can eventually ignite the rest of the economy to move and to improve the livelihood of the poor.

In recent years, following the principle of System of Rice Intensification (SRI) as a system of agricultural innovation by Uphoff (2008), the newly innovative row planting of *Tef* production in Ethiopia increases farmers' productivity by 3,400

to 5,100kg per hectare as compared to the traditional method of broadcasting that helps farmers produce an average of 500 to 1,200 kg per hectare (Vandercasteelen et al., 2013; Berhe and Zena, 2009). Yonas (2006) argues that smallholders adopting row planting increases *Tef* crop income by 1062.7 *Birr* per year. Besides reducing the usage of seed rate, the production system consumes more labor to transplant the seedling (Yonas, 2006). This indicates innovative agricultural production system also creates employment opportunity for the surplus and landless wage laborers in rural areas.

Funding for agricultural innovation is common, but funding farmers specifically targeted to rural smallholders is relatively rare. Inclusive and sustainable rural transformation requires financial investment on the rural households agricultural production to innovate and use modern agricultural technologies which ultimately results in enhancing rural households' well-being. One of the main agendas of the post-2015 Sustainable Development Goals (SDGs) is also reducing rural poverty through raising income level. Matin et al. (2002) argue that rural finance is essentially a matter of helping the rural poor to turn their savings into sums large enough to satisfy household consumption needs. Therefore, this study evaluates the extent to which financial support improves rural households' economic capability[1] through new innovation (adoption of improved agricultural technologies and innovation practices). The study also assesses if training program in the skills of financial literacy, extension advice, and improved input system specifically given to married woman whose husbands are in the Farmer Innovation Fund (FIF) program affects women's livelihood activities. The analysis is based on a randomized field experimental data collected from a randomly selected sample of rural households that received financial incentive and training.

Recently, the production, finance and improved technology plus (Profit +) program in Ethiopia and Zambia is contributing to the reduction of poverty of those in extreme poverty (USAID, 2015a). According to USAID (2015b), the profit plus project in these two countries improves the food security and income of the rural poor by increasing farm productivity. Focusing on small farmers adoption of improved technologies, new farm practices and increasing the participation of women in farmers' groups, the project benefited 200,000 farmers in Zambia by improving rural households' financial capacity such as increasing the behavior of cash saving and accessing credit. Besides, the government of Ethiopia designed to increase women participation in farmers' groups by up-to 30 percent. According to USAID (2015a), since 2014 more than 50,000 new women become members of farmers' groups and benefited from market information and knowledge management. Thus, finance, innovation and technologies are the key component for rural development and they are mutually interdependent.

Smallholder farmers address the livelihood constraints and explore new opportunities by experimenting with unique combinations of the indigenous knowledge and new ideas accessed from different sources such as through extension program

[1]Economic capability is defined as the economic return farm households received as income from farm and non-farm economic activities

and social learning. Farmers local innovation include both hard technologies such as new crop varieties, inorganic fertilizer and pest management techniques, and soft innovations such as new way of marketing system (Beratungslehre and Lemma, 2006). These kind of socio-institutional changes are generated by farmer' groups than individual farmer. As an example, PROLINNOVA program (promoting local innovation in ecologically-oriented agriculture and natural resource management) involved seven African and two other developing countries with a prime aim of enhancing local innovation.[2] One of the important approaches both governmental and non-governmental organizations identified is a need for flexibility funding mechanism to strengthen farmers' capability to experiment and solve their own problems (Hoffmann et al., 2007). Therefore, financing farmers is a sub-set of rural finance that is dedicated to financing their agricultural related activities such as improved inputs use, purchasing production equipment, distribution and marketing.

The other argument that is apparent in development economics literature is that, apart from agricultural activities, the participation of rural households in other economic activities is lower compared to the population density. Haggblade et al. (2010) argue that since the landless and small land holding households depend heavily on non-farm income for their survival, agricultural households working on non-farm earnings diversify the risk, moderate seasonal income swings and finance agricultural input purchases. Increasing the financial literacy of rural communities through rural education and training programs helps women to take part in the decision of households in their agricultural activities and in other businesses (Richter, 2011). Especially in rural areas where women are dependent on their husbands, financial access opens the opportunity to engage them in small businesses and diversify the household income. Economic theory suggests that a rise in women's share of income will increase the marginal utility of household food consumption and other investments in the quality of human capital (Thomas, 1993). According to Rodrik and Rosenzweig (2009), in developing countries, many interventions have been proposed to solve entrenched development problems and understand the level of poverty; rural finance and business trainings are some of the rural capacity building projects.

Improving rural women's economic capability implies a comprehensive strategy to overcome the persistence of poverty and obstacles that rural women face. In developing countries, women are confronting so many challenges such as access to schooling, employment opportunity, access to productive assets and financial market. They are lock-in to working in the informal market which may result in a negative impact on supporting their families and being economically dependent on their husbands. Financial incentive and training for rural women holds special importance. Although land is the most important asset for the entire household among the rural farm households, women are less likely to have land titled under their name than men. Due to cultural norms and legal barriers,

[2]The nine countries where the PROLINNOVA program is operational are Cambodia, Ethiopia, Ghana, Nepal, Niger, South Africa, Sudan, Tanzania and Uganda.

women have generally less control over such type of fixed assets which are necessary to be used as collateral to get loan. This bars women from entering into the financial markets in their own right. This makes the financial credit market to be gender biased. Since the contribution of women for agricultural activities and other rural economy is larger, financial assistance and training for women enable rural households to diversify their economy into both farm and non-farm activities. Increasing women's access to financial resources has a direct impact on investment in human capital in the form of children's health, education, and nutrition for the whole family (Thomas, 1993).

Given that the fixed assets such as land are scare resource, diversifying household income through participating into non-farm economy reduces the risk of agricultural income. Besides, as the labor demand of agricultural activities is seasonal, the surplus labor engaging into non-farm business activities can reduce the rural-urban migration and consume the surplus labor in rural areas. Although the Lewis's dual sector model acknowledges presence of a surplus and unproductive labor in the agricultural sector, such surpluses can easily move to manufacturing sector. Nevertheless, the current manufacturing sectors in Sub-Saharan Africa in general and in Ethiopia in particular do not have the capability to consume such surplus labor. Creating employment opportunity in rural areas is a better option and contributes to rural economic growth. The other earnings that households received such as remittances from temporary and seasonal migration by family members who are part of the household are also included as rural non-farm income.

Many financial support programs in SSA including microcredits are introduced in rural areas. In Ethiopia, funding farmers to innovate is one of the rural capacity building projects introduced in 2010 by the World Bank to reduce poverty in rural areas. It should be investigated how this program impacts rural households' economic capability measured as households annual income. Applying the combined Difference-In-Difference (DID) and matching methods, the results indicate that financial support helped rural households increase their income by 26.4 percent per year. However, only training provided to married women whose husbands are in the Farmer Innovation Fund (FIF) program is unable to affect women's livelihood activities. This suggests that training alone is not enough for rural poor women in terms of income generation. The result shows that financial support positively affects farmers innovative practice such as new farming methods, usage of modern agricultural technologies and new marketing approach. The working days that households themselves are engaged in non-farm economic activities is also found to have a positive effect on rural households' income.

The rest of the paper is structured as follows. The next section discusses finance, agricultural innovation and technologies in Ethiopia. Section 3 reviews the key empirical literature on financial and training programs for women's agricultural technology adoption behavior and its impacts on their livelihoods. Section 4 discusses the data and study design (experimental intervention). Section 5

discusses the econometric result. The last section concludes and forwards policy recommendation based on the findings.

2 Finance, Agricultural Innovation and Technologies

Most rural households lack access to reliable and affordable financial service to innovate and use modern agricultural technologies. However, innovation in agriculture in the last couple of years has become the issue of concern of development and policy discussions (Carberry et al., 2010). On the one hand, it emphasizes the importance of innovation for development and on the other hand, it is still hardly easy to be conceptualized in research and development. In recent industrial and agricultural innovation literature, a distinction is made between products, processes, and social/organizational innovations (Toborn and Harvesting, 2011). Agricultural innovations in many cases are conceptualized as products (new varieties, inorganic fertilizers, chemicals etc.). Thus, finance in the agricultural innovation process can provide farmers with the necessary financial resources to try new technologies. It can also help farmers to cover for production losses if they set aside part of their land for experimentation and to increase their willingness to bear the financial risk in case the technology does not perform well (Kloeppinger-Todd and Sharma, 2010).

Even though innovation in agriculture such as the development of new varieties is quite vital to respond to food insecurity and poverty alleviation by improving productivity, income, and livelihood of farmers, there is still limited effort to generate, innovate, and scale up agricultural technologies, especially in Sub-Saharan Africa. By the same token, adoption of even the existing yield increasing technologies and skills is by far low. This is related to producers' financial capacity. Rogers Everett (1995), Rogers (2002) and Toborn and Harvesting (2011) argue that the progress of adoption of agricultural technology development and innovations was not that encouraging, with the exception of Green Revolution, especially in Sub-Saharan Africa (SSA).

In most cases, agricultural technology adoption is synonymously and interchangeably used with innovation. Even with wider consensus and understanding in the importance of innovation, there is limited effort to study, document and scale out innovation practices. According to Sunding and Zilberman (2001), conceptualizing innovation ranges from embodied external innovations (seed, fertilizers, pesticides, etc.) to system changes, skills, new way of farm practice, knowledge in agronomic and managerial innovations. In recent works, innovations in agriculture are categorized according to their impact like new products, yield increasing innovation, cost reducing innovation and innovation that improves product quality (Toborn and Harvesting, 2011). Innovation in agriculture without a unique package of technology faces challenge (Ton et al., 2013). In-

corporating innovation related issues in agricultural study is vital to realize the inclusion of the issue in policy formulation and strategy design in agriculture for economic development. Development in agriculture are predominantly results of factors such as financial, technological, socioeconomic and institutional innovative processes of farmers. The most important question experts and policy maker raise is that why farmers in developing countries, especially in SSA where agriculture is the main economic driver, fail to invest in potentially profitable inputs and innovative agricultural production system?

One of the main reasons would be that smallholders do not have enough cash on hand when they need to purchase modern inputs. Although there are some rural microcredit organizations trying to address the financial problem of rural households, yet the typical microcredit loan which farmers are expected to repay during the harvesting time is ill-suited due to the bulk ratio and low crop price during the harvesting time. Addressing the liquidity constraint of the marginalized and poor rural households is the main aim of development organizations like the World Bank. According to the State of Food and Agriculture (2015), more than 80 percent of the rural population in SSA has no access to any form of financial or social assistance, and extreme poverty remains highly concentrated in rural areas where smallholder subsistence farming is the main source of rural households income.

Assisting financially constrained farm households' helps them to practice innovative farming system. Although the word innovation is used frequently in many papers, the application of the concept of innovation in agriculture and agricultural development is not intensively studied in Ethiopia. However, there are few studies outside the agricultural sector (Gebreeyesus and Mohnen, 2013) and on Ethiopia's specific horticultural crop (Gebreeyesus and Iizuka, 2012). Some other studies, for instance, Yu et al. (2011); Dercon and Christiaensen (2011) evaluate the importance of technology adoption (mainly of varieties and fertilizer) for the productivity of the farm. Yet they often focus on the physical adoption of the technology and they lack to include the innovative capacity of the household in their analysis. However, there is a big variability in the productivity of farms even for farmers with the same technology usage. The paper does not explicitly attempt to explain the variability, then trying to associate them with unknown variables. These variables can be more or less explained by the innovation behavior of the farm households and their capacity embedded with the technology. Thus, innovation in agriculture and its role is an important component in the rural households' economic development.

The difficulty of conceptualizing innovation, especially in a developing country and family farm context is its embeddedness with the existing physical input (seed, fertilizers, pesticides, etc) or technology and the fact that it cannot be at least easily spitted out. In other words, innovation is there with the physical product, though it is hardly easy to specify and detach from the physical product. This caused the issue of innovation to be overlooked in its economic contexts.

3 Overview of Financial and Training Programs and Rural Women Technology Adoption

In most developing countries, rural women are known to be more involved in agricultural activities than men. In terms of labor contribution, Ogunlela and Mukhtar (2009) reported that in rural area 60-80 percent are women laborers and 73 percent are involved in cash crops production and vegetable guarding in Nigeria. Similarly, Buvinic and Mehra (1990) claim that during harvest time and other peak periods of agricultural activities, women are contributing more to farming systems. In many African countries women's role in agriculture is considered as a help and not as an important economic contribution to agricultural production. To this effect, they are often secluded and dependent on men for economic support. Since finance is the most important resource in rural and agricultural development, assisting rural poor women enhances the decision making ability in agricultural production through the adoption of new technologies. Saito et al. (1994) claim that increasing the productivity of agriculture is central to rural economic growth, income distribution, improved food security, and alleviating of women's poverty in rural Africa. The financial incentive enables women farmers to adopt new agricultural production technologies.

Since agriculture is the first option for women income generation in rural areas, it should come with better access to land and financial resources to use improved inputs and purchase production equipment. Besides, production-oriented trainings increase women farmers' adoption behavior which ultimately increases the productivity, income and improves their families' social welfare (Buvinic and Mehra, 1990). Although the gender issues in agricultural production and technology adoption were examined for long time, most studies reported mixed evidence concerning the role of men and women in technology adoption which is expected to result in increasing women income from surplus crop production (Akudugu et al., 2012). Doss and Morris (2001) reported that there is an insignificant effect of gender on technology adoption in Ghana. Similarly, Overfield and Fleming (2001) found the same on coffee production in Papua New Guinea. In line with this, it is argued that a low level of improved technology used by women headed household would mean that women in general have low access, and that this would be reflected in lower income. According to Bindlish and Evenson (1993) the evidence from Kenya suggests that female farmers are equally likely to apply technical advice from extension agents and even more likely to adopt relatively complex innovative practices such as top dressing, agri-chemical use and stalk borer control.

Looking in to the large body of literature that investigates the impact of targeted programs on women to increase their resources like credit programs, girls' educational attainment and income transfer programs, the programs have had positive impacts on improving women's earning (Ruel et al., 2002; Ruel and Quisumbing, 2005), decision making ability (Adato et al., 2000) and child

nutrition (Skoufias and McClafferty, 2001; Maluccio and Flores, 2005). According to Naved et al. (2000) and Hallman et al. (2007), new earning opportunities for women are found to strengthen their position within the community and society. However, one should be aware of unintended effects of the programs on women time use and childcare that would be apparent in considering the intra-household issue (Cooke et al., 2000; Paolisso et al., 2002).

Specific studies that relate access to finance and agricultural technology adoption and its effects on women are, among others, Bouis (2000) and Paolisso et al. (2002). Bouis (2000) assessed three NGO programs targeted to women in Bangladesh that promoted commercial vegetables and production of polyculture fish through training and credit programs. Their quantitative study found only a modest effect on overall household income. However, the technologies are found to be highly profitable as compared to the already existing practice of rice production. In contrast, Naved et al. (2000) qualitatively reported that for most women, income gains from the adoption of the improved vegetable seeds were not substantial. The significant positive impact of the new technologies was on women empowerment. Comparing women in adopting households with those in non-adopting households, there was significant difference in freedom of movement, freedom from physical violence, and political awareness (Naved et al., 2000).

The other study by Hallman et al. (2007) reported that women in adopting households were more likely to have visited friends and relatives outside the village, to have attended NGO training, and to have known the names of political leaders at the local, state, and national levels. Paolisso et al. (2002) investigated the impact of a program designed to commercialize vegetables and fruits-Vegetable and Fruit Cash Crop Program on male and female time allocation. The program aimed at increasing the commercial value of the vegetable, fruit production, and raise household incomes of treated farmers. The program provided production inputs, training, and technical assistance to both male and female farmers. Generally, they found an increase in head male time in vegetables and fruits production than head females.

Specifically, Paolisso et al. (2002) reported two different effects depending on whether the household has one preschooler or more than one preschooler. For households with more than one preschooler, a program participation resulted in an increase in time spent on vegetable and fruit production by both men and women, an increase in time spent on care of children under five years old by women, a decrease in time spent on cereal and livestock production by both men and women, and a moderate decrease in time spent caring for children under five years old by men. Hence, the trade-offs associated with vegetable and fruit productions do not seem to be particularly detrimental to the care of children under five years old. In contrast, for households with one preschooler, the trade-offs seem more important. In these households, preschoolers receive less care from their parents, who spend more time on cash crop cultivation in particular, but also from food crop cultivation as well.

The earlier study by Kumar (1994) also analyzed the impact of adopting hybrid maize in Zambia. He found positive effect on overall household income but intrahousehold income benefits were unevenly distributed between men and women. The interhousehold income benefits were mixed. Despite their limited adoption, it was the small farmers that benefited most from the adoption. Technological change in agriculture could lead in to competing demands for labor. On the one hand, it would require additional labor time allocated to agricultural production. On the other hand, the rise in income due to improved productivity and the food energy requirement of the additional labor both demand for labor in consumption and other welfare activities. According to Kumar (1994), adoption of hybrid maize reduced women labor input in farm and non-farm activities, keeping farm size constant. He also found an increase in labor time for household maintenance activities with adoption of hybrid maize. This is in line with income effect of technology adoption.

4 Dataset and Study Design

4.1 Data

This study used household level panel data from two surveys of Farmer Innovation Fund (FIF) impact evaluation conducted in 2010 and 2012 by the World Bank in Ethiopia. The survey covers 2,675 households drawn from two regions and fifty-one rural villages. The baseline survey was carried out in August-October 2010. The first round gathered detailed information on the rural households' agricultural production system, technologies, new farm practices, agricultural innovation adoption variables, extension service, participation in rural associations, crop sale and rural households' participation in non-farm income activities.

Since the majority of the rural households are employed in agricultural activities and mainly receive income from these activities, the intervention of FIF was introduced in Amhara and Tigray region, Ethiopia. A randomized field experiment of FIF provides grants instead of loan to the rural farm households agricultural activities to use new inputs and farm practices. From 2,675 sample baseline survey households, 869 were assigned as a non-FIF to serve as a pure control group (comparison group), and on the remaining 1,806 households a simple lottery design was used to randomly assign 958 households to the treatment group and 848 households to the control group. Households in the treatment group received funds, while those in the control group did not, but have similar characteristics to those households in the treatment group. In the second round, 2,492 households were resurveyed in 2012 with a 7 percent attrition rate. In both rounds, households income from farm and non-farm activities were collected. The main aim of this study is comparing farm households' income before and after the program through DID method.

Besides funding, the program gave training for women whose husbands are in the FIF in the skill of extension service and financial literacy. The survey covers detailed information on the rural women's economic conditions. Using this database, the study provides empirical evidence on the extent to which the financial assistance and training program improve economic capability among the rural smallholder farmers in Ethiopia. Economic capability is measured as the total income households received from farm and non-farm activities. Particularly, the study focused on innovation adoption indicator variables such as farmers practicing new farming methods which is never tried before, new inputs use and the surplus labor participation in non-farm business activities which ultimately results in economic and social impacts. Hence, the analysis attempts to provide empirical evidence to theoretical ideas by drawing links to behavioral economics and to experimental evaluation methods.

Table 1: Definition of variables

Variables	Definition
Age of household head	Years of age
Educational level of head	Educational level in years of schooling
Gender of household head	=1 if the household head is Male, 0 if Female
Farm size	Farm size of the household in hectare
Household size	Number of person in the household
Tried new farming method	=1 if farmer practice new farming methods, 0 otherwise
Tried new marketing approach	=1 farmer start new marketing approach
Improved seed	=1 household use new improved seed
Inorganic fertilizer	=1 farmers use chemicals fertilizer
Participation in farmers groups	=1 farmers participate in farmers group
Participation in training centers	=1 farmers participate in farmers training centers
Rural saving and microcrdit	=1 membership of rural saving and microcrdit
Cash saving account	=1 household has saving account
Membership of local associations	=1 membership of local associations
Labor use for agricultural activities	Number of working days
Labor use for non-farm activities	Number of working days
Remittance	=1 if households received remittance
FIF group member	=1 if the farmer participate in FIF fund
Total income	Amount of income from farm and non-farm in *Birr*

4.2 Study design: using data from the randomized experiment

In development economics, randomized experimental approach have become increasingly popular to overcome many of the identification problems that arise with non-experimental methods. Many recent empirical studies use randomized experiment to evaluate development programs and policies. The randomized filed experiment of FIF provides fund to rural smallholders to implement innovative agricultural production system. This was accomplished by giving fund to a randomly selected sub-sample of households in the sample of 2,675 rural households.

The FIF is providing grants instead of loans. Since most of the rural poor in Ethiopia are employed in agricultural sector, development in the country depends on strengthening the rural households' economic capability through finance and business training. However, the likelihood that rural households would like to take credit would be affected by factors such as access to credit, collateral, interest rate, complex procedure to pass through a lot of approval stage and smallholders risk aversion behavior. Hence, providing funds reveals whether greater access to financial incentive to rural households has the potential to provide high returns in agricultural and non-agricultural business. The direct governmental and non-governmental organizations interest in financing rural smallholders to alleviate poverty in rural areas, whether households not currently borrowing have the potential to borrow once they economically capable.

In empirical economics, there are different evaluation techniques, while a randomized experiment is one of the most important tool to evaluate social programs. This paper used a field experiment dataset on smallholders' financial incentive and training program, which contains a pure control group which is a randomized sub-set of the eligible population to measure the impact of financial incentive and training on rural households' economic capability. We could observe the outcome variables for those in the program had they not participated. There would be no evaluation problem. Empirical literature also indicates a pure randomized experiment is the most convincing method of evaluation since there is a comparison group which is a randomized sub-set of the eligible population (Card and Robins, 1996; Hausman and Wise, 1985).

Using household level data from FIF that provides 3000 *Birr* (220 USD) for a randomly selected rural households, we evaluate the impact of financial incentive on improving rural households' income through innovative agricultural production and surplus labor participation in non-farm rural economy. A separate analysis for women who received training in the skills of agricultural production and extension system on their livelihood activities is also implemented.

Suppose the income of farm households who received FIF fund is

$$Y_{it} = X_{it}\beta + d_i\alpha + u_{it}, if\, t > k \tag{1}$$

$$Y_{it} = X_{it}\beta + u_{it}, if\, t \leq k \tag{2}$$

where Y is the farm households income that is assumed to dependent on a set of exogenous variables, X, and a dummy variable d such that $d_i = 1$ if farm household i has participated in the FIF in a certain period of time t and $d_i = 0$ otherwise, α and β are the parameters to be estimated, u_{it} is the error term with mean zero and constant variance, which is assumed to be uncorrelated with the exogenous factors, X and k is the period of time FIF started.

As we discussed above, the experimental data provide us the correct missing counterfactual by eliminating the evaluation problem and rule out the self-selection bias created by observable and unobservable factors. Once households

are randomly assigned to the FIF, the decision process to participate or not to participate into the program is ruled out. Thus, out of 2,675 sample farm households, the target group of the FIF are 1,806. Within this target group, assignment to the treatment is completely independent of a possible outcome, that means the outcome variable is independent of the treatment effect. Except the treatment status, it is assumed that the comparison group which is in non-treated is statistically equivalent to the treated group in all aspects once the treatment status is random. Thus, the impact of the treatment can be measured by subtracting the mean of the outcome variable between the treated and non-treated household as follows:

$$\hat{\alpha} = \overline{Y}_t^{(1)} - \overline{Y}_t^{(0)}, t > k(3)$$

where $\overline{Y}_t^{(1)}$ and $\overline{Y}_t^{(0)}$ respectively, are the treated and non-treated households' income at time t. Although some dropouts, specially in the control group, alter the fundamental characteristics of the randomized experimental data, comparing the observable characteristics of both the control and treatment groups is important to ensure the random assignment with respect to the observable characteristics. Table 2 below shows these characteristics.

Table 2: Characteristics of the treated and control groups in 2010 (baseline)

Characteristics	FIF participant		Comparison group		
	Mean	Std.dev.	Mean	Std.dev.	t/χ^2
Age	42.5	12.5	42.9	11.7	0.85
Educational level	3.5	1.8	3.6	2.0	1.51
Gender of head	77.4		66.9		-5.55***
Household size	5.7	2.2	5.6	2.1	-0.93
Farm size	1.14	3.9	1.09	3.9	-0.31
New farming method	50.1		42.3		-2.45***
New marketing approach	25.2		20.0		-2.45***
Improved seed	49.5		51.1		0.71
Chemical fertilizer	76.3		75.4		-0.51
Farmers groups partic.	94.17		83.7		-7.3***
Farmers training centers	87.4		85.8		-0.9
Rural saving and microcredit	13.5		12.5		-0.59
Cash saving account	4.23		3.6		-0.85
Local associations member	54.9		47.8		-2.8***
Labor use for agri. activities	324.7	201.6	332.4	214.3	0.76
Labor use non-farm income	198.2	291.7	177.0	159.4	-1.35
Remittance received	29.8		30.6		0.37
FIF group member	71.7		28.3		-1.67
Total income	4398.6	7941.5	3919.1	9968.7	-1.29

4.3 Characteristics of the two groups of sample households

Comparison of the sample household characteristics between FIF participant and comparison group of the baseline data are presented in Table 2. As the t-values indicate, the two groups of households are similar regarding average age, educational level, family size, farm size, agricultural technology adoption, membership of rural saving and micro-credit associations, cash saving accounts, remittance received, number of working days for agricultural and non-farm business activities and smallholders' participation in farmer training centers. There are some differences between the two groups such as gender of household head, rural households participation in local (informal) associations, farmers group, farm practice and marketing. In any particular random allocation the two groups of households may differ along with some specific characteristics. Once assignment to the groups is random, any differences are because of chance (Bruhn and McKenzie, 2008). Thus, using those variables is pertinent in our regression. Besides DID method, we also estimate the date through matching techniques by taking into account such differences.

As we can see from Table 2, the observable characteristics between participants and comparison groups are comparable which indicates that the randomization was successful in creating groups. The average age of the household heads is 42 years and 3.5 years of education. In both of the treatment and control groups

of the sample household more than 80 percent of the household heads are illiterate (zero level of schooling). The average land size of the sample households cultivable for crop production shows 1.1 hectare with an average family size of nearly 6 persons per household. The majority of the rural households in Ethiopia are headed by male (77 percent). In the randomized sampling method, adoption of agricultural technologies such as HYVs and inorganic fertilizer among the treatment and control groups are comparable. The rate of our sample households improved seed user is nearly 50 percent, whereas inorganic fertilizer user rate is higher than HYVs user which is more than 76 percent.

The behavior of the rural households in terms of having saving account on cash bases seems not developed. The sample households in both groups of FIF participant and non-participant shows that only 4 percent are those having saving account either in micro-finance institutions or any other formal organizations and around 13 percent are membership in rural saving and micro-credit associations. The majority of the sample households are members in the informal local groups, nearly 55 and 47.8 percents, respectively. The average number of working days the household members were employed in agricultural production in the treatment and comparison group are around 324 and 332, respectively working days per year. As we discussed earlier, since agricultural production is seasonal, farmers themselves are also working in non-farm income activities. The two group of sample households average number of working days they engaged in non-farm income activities are less than 200 working days per year.

5 Econometric Results

5.1 Impact of financial support on smallholders' economic capability

This section presents the estimation results of the impacts of financing rural farm households on their livelihood. The estimation result of the Difference-in-Difference (DID) method shows that the average income of farm households who participated in the Farmer Innovation Fund program increased by 26.4 percent as compared to the average income of non-participant households which increased only by 6.7 percent. This is from improving their agricultural practices and engaging into non-farm economic activities. The DID results show that the grant smallholders received positively and significantly affects rural households' income (see Table 3). It is the average difference between the incomes of similar pair of households that belong to the participant and non-participant groups, where the later group is not supported by Farmer Innovation Fund. Before the grant, the two groups of households are the same in 2010 which is evident from the fact that the p-value is not significant. After the grant, the annual income of farm households in 2012 shows improvement.

Consistently, impact evaluation studies focusing on microfinance also show the benefit of financial services to the households' income. Khandker (2005) reported that participants have benefited from microfinance intervention in terms of income redistribution or short-term income generation. Similarly, Kaboski and Townsend (2011) found that credit increases the profits of borrowers and the overall improvements in welfare related outcomes in Philippines and South Africa. This suggests that access to financial support improves the lives of capital constrained households especially those living in rural areas where there is limited access to financial market. McKenzie and Woodruff (2006) using Mexican national survey of microenterprises estimated the return to capital, and found that for the smallest firms with capital stock less than 500 USD, the returns to access to financial service lie in the range of 10-15 percent per month. This suggests that the development of financial service is at the heart of strategies seeking improvement in rural households' economic capability.

Table 3: Difference-in-Difference (DID) estimation result

	Baseline			Follow-up			
Outcome	Control	Treated	Diff(BL)	Control	Treated	Diff(FU)	DID
Total income	5099.7	6560.3	1460.5	3068.9	7167.7	4098.8	2638.3
	(280.4)	(1029.2)	(1066.7)	(255.3)	(943.4)	(977.3)	(1446.7)
z	18.19	6.37	1.37	12.02	7.60	4.19	1.82
P>z	0.000	0.000	0.171	0.000	0.000	0.000***	0.068*
Obs.= 4522							
Control	1913			2308			
Treated	142			169			
	2055			2477			

Inference: *** p<0.01; ** p<0.05; * p<0.1

Bootstrapped Standard Errors in parentheses

5.2 Factors affecting rural households' income

Besides financial constraint, there are other factors affecting rural households' income. As indicated in previous studies the microeconomic variables such as households wealth, human capital, family size, age of the household head and other innovation adoption variables are correlated with farm households income. Consistent with the theoretical argument we discussed earlier, the surplus labor participation in non-farm income economy is found to have positive and significant effect on households income. The coefficient of the household members participation on agricultural activities is negative. This may be because the participation of the surplus labor in a small land holding household may result in diminishing marginal return. Since the coefficient of family size is found to be positive and significant, some of the household members participation into

non-farm income generation activities reduces the risk of seasonal agricultural income and allow for households' income.

In our sample households, there are some smallholders that received remittances. Although it is expected that remittances could have a positive relationship with economic growth, we found that remittance has negatively significant effect on rural households income generation. Perhaps due to low educational level of rural households, they use remittances for household consumption purposes rather than, for instance starting new business in rural area or purchase modern agricultural inputs. Besides, the age of the household heads shows up as negative and significant effect. This indicates that younger household heads are more dynamic regarding new innovations in the agricultural production system and rural business.

Financing smallholder farmers is one of the main contributing factors to their agricultural activities. Improvement in the rural smallholders agricultural production system resulted in more impact on the level of households income and this shows the effectiveness of the grant. The analysis includes farmers agricultural innovation adoption variables and improved inputs use. Indicators used to measure innovation adoption are new agricultural practices which have never been tried before, new marketing approach, participation in farmers training center, participation in farmers group and the capability of the groups. The result shows that smallholders participation in new farming method, new marketing approach, and use of farm technologies positively and significantly affects rural households income. This suggests that the improvement in households income through grant supported agricultural production is not only the grant alone, but can also change farmers agricultural production system. Therefore, funds that facilitate farmer-driven experimentation and learning increase innovation and technology adoption in smallholders agriculture which ultimately impacts productivity and income of producers.

Table 4: Impact of financial support on households income

Farmer innovation fund	Coef.	Std. Err.
Age of head	-0.016***	0.005
Gender of head	-0.087	0.294
Household size	0.058**	0.028
Educational level of head	0.027	0.025
Farm size	-0.006	0.015
Tried new farming method	0.405***	0.108
Tried new marketing approach	0.401***	0.109
Improved seed used	0.091	0.101
Inorganic fertilizer use	0.445**	0.205
Membership of local associations	-0.063	0.103
Participate in farmers groups	0.218	0.216
Participate in farmer training center	0.083	0.220
Rural saving and microcredit	0.037	0.127
Cash savings account	-0.038	0.226
Labor use for agri. activities	-0.001***	0.000
Labor use for non-farm activities	0.000***	0.000
Remittance received	-0.290**	0.129
Constant	-1.643***	0.457
Probit regression		
Obs = 1491		
LR chi2(17)= 107.32		
Prob > chi2=0.000		
Log likelihood= -403.9		
Pseudo R2= 0.1173		

5.3 Impact of women's training program on income generation activity

This section presents the estimation result for married rural women who were trained by FIF program and whose husbands were granted by FIF to innovate in their agricultural production. Although the impact of the grant on both male and female headed household is positive in terms of households' income, training provided to women might not have a separate significant effect on women income generation. The two groups of women who are in the training and control groups do not show significant differences on their income level. This may be due to the fact that for resource poor women training alone might not be enough to influence their income earning activities. As indicated by Saito et al. (1994) technical advice coupled with financial support could result in a livelihood impact to women farmers. The finding of Hashemi et al. (1996) also shows this. The Grameen Bank and the Bangladesh Rural Advancement Committee (BRAC) as one of a rural development strategy programs in rural Bangladesh provides credit to poor rural women. The program has a positive and significant effect on women empowerment. The finding indicates that the credit program helps in securing

women economy by improving the ability to make purchase of small and large consumption good. They can also be involved in major household decisions.

Although attention to technical issues and production-oriented training of women in agricultural extension and marketing can overcome the shortcomings of some income generation projects, the lack of decision making ability of women within the family would result women being economically incapable (Buvinic and Mehra, 1990). Similarly, Quisumbing et al. (1995) reported that female farmers generally own fewer agricultural production tools than men, and the inability to get the financial capital could lock them into subsistence farming. Since farm capital contributes positively to yields, women farmers are likely to have lower yield than male farmers. Although there are a number of formal sectors that provide financial service in the form of loan, issues related to interest rate and passing a number of complex procedures to get loan hinder women from credit access. Thus, targeting programs to poor women such as developing income generation skill, strengthen local institutions like increasing women participation in farmers group might have a significant livelihood impact on rural women. Since training increases the efficiency of farm productivity, for women who farm their own plots, the financial incentive helps them to use new agricultural production technologies (Quisumbing et al., 1995).

Given equal access to financial resource and human capital, women farmers can achieve yields equal to men, even more according to Quisumbing (1996). Moock (1976) estimates that for a sample of male and women farmers with the same age, experience, education and inputs usage, yields among Kenyan women farmers increased by 7 percent. This indicates increasing women farmer capability in agricultural production reduce rural poverty. According to Saito et al. (1994) the key to increasing agricultural productivity may lie in educating women in rural areas and increasing their human and physical capital.

Table 5: DID estimation result on women's training program

	Baseline			Follow-up			
Outcome	Control	Treated	Diff(BL)	Control	Treated	Diff(FU)	DID
Total income	821.5	922.6	101.1	1034.5	1186.7	152.2	51.1
	(85.1)	(53.1)	(100.3)	(71.7)	(166.3)	181.1	207.1
z	9.66	17.35	1.01	14.4	7.14	0.84	0.25
P> z	0.000	0.000	0.314	0.000	0.000	0.401	0.805
Obs.= 3894							
Control	745			1047			
Treated	1907			195			
	2652			1242			

Inference: *** p<0.01; ** p<0.05; * p<0.1

Bootstrapped Standard Errors in parentheses

The matching method result of the sample households is presented in Table 6. As we discussed earlier, with some specific characteristics of sample households such as gender of household head and farm practices, the two groups of households seem different. Taking into account such differences, we run the regression through matching method. We found that the FIF program improved rural households' income by improving their agricultural production system. As we can see from Table 6, the t-test is statistically significant at 10 percent level. Hence, the average treatment effect of Farmer Innovation Fund (FIF) is an increase in household income of 6.72 percent per year (672.4 *Birr*).

Table 6: Matching method result

Variable	Sample	Treated	Controls	Difference	S.E.	T-stat
Total income	Unmatched	7374.8	6494.6	880.2	927.5	0.95
	ATT	7374.8	6918.2	456.6	863.1	0.53
	ATU	6494.6	7188.9	694.2	632.7	1.4
	ATE			672.4	288.4	22.5

6 Conclusion and Policy Recommendation

This study evaluates the impact of rural smallholder farmers financial support and training program to married women on households' economic capability measured in annual income of households. Although for many decades the extension program benefited rural farm households, the lack of access to economic resources, especially finance, constrained rural smallholders' economic growth and development. Rural capacity building project like Farmer Innovation Fund (FIF) is an important component to rural and agricultural development by tackling the financial constraint of the rural poor in order for them to practice new farming methods and modern agricultural technology use. We found evidence that funding farmers to innovate increases farm households' annual income by 26.4 percent as compared to the average income of households (6.7 percent). Importantly, the financial support helps farmers usage of improved agricultural inputs, new farm practice and new marketing approach. However, training provided to married women whose husbands are in the grant could not by itself result in a significant effect on women income earning activities. Therefore, the policy implication would be intervention on rural capacity building project like funding farmers to innovate and enhance rural non-farm economy could reduce poverty in rural areas.

References

Adato, M., B. De la Briere, D. Mindek, and A. Quisumbing (2000). The impact of progresa on women's status and intrahousehold relations. *Final Report, International Food Policy Research Institute, Washington DC*.

Akudugu, M. A., E. Guo, and S. K. Dadzie (2012). Adoption of modern agricultural production technologies by farm households in ghana: What factors influence their decisions? *Journal of Biology, Agriculture and Healthcare 2*(3), 1–13.

Beratungslehre, L. K.-u. and M. Lemma (2006). Farmer innovation in africa. *Knowledge and Innovation Management*, 154.

Berhe, T. and N. Zena (2009). Results in a trial of system of teff intensification (sti) at debre zeit, ethiopia. *Debre Zeit, Ethiopia*.

Bindlish, V. and R. E. Evenson (1993). *Evaluation of the performance of T&V extension in Kenya*, Volume 23. World Bank Washington, DC.

Bouis, H. E. (2000). Commercial vegetable and polyculture fish production in bangladesh: Their impacts on household income and dietary quality. *Food & Nutrition Bulletin 21*(4), 482–487.

Bruhn, M. and D. McKenzie (2008). In pursuit of balance: Randomization in practice in development field experiments. *World Bank Policy Research Working Paper Series, Vol*.

Buvinic, M. and R. Mehra (1990). Women in agriculture: what development can do.

Carberry, P., B. Keating, S. Bruce, and J. Walcott (2010). Technological innovation and productivity in dryland agriculture in australia. *A joint paper prepared by ABARE–BRS and CSIRO, Canberra*.

Card, D. and P. K. Robins (1996). Do financial incentives encourage welfare recipients to work? evidence from a randomized evaluation of the self-sufficiency project. Technical report, National Bureau of Economic Research.

Cooke, P. A. et al. (2000). Changes in intrahousehold labor allocation to environmental goods collection: a case study from rural nepal, 1982 and 1997. *Food Consumption and Nutrition Division Discussion Paper series, Discussion Paper* (87).

De Janvry, A. and E. Sadoulet (2002). World poverty and the role of agricultural technology: direct and indirect effects. *Journal of Development Studies 38*(4), 1–26.

Dercon, S. and L. Christiaensen (2011). Consumption risk, technology adoption and poverty traps: Evidence from ethiopia. *Journal of development economics 96*(2), 159–173.

Diao, X., A. S. Taffesse, B. Yu, and A. N. Pratt (2010). Economic importance of agriculture for sustainable development and poverty reduction: The case study of ethiopia. In *Global forum on agriculture*, pp. 29–30.

Doss, C. R. and M. L. Morris (2001). How does gender affect the adoption of agricultural innovations?: The case of improved maize technology in ghana. *Agricultural Economics 25*(1), 27–39.

Gebreeyesus, M. and M. Iizuka (2012). Discovery of flower industry in ethiopia: Experimentation and coordination. *Journal of Globalization and Development 2*(2).

Gebreeyesus, M. and P. Mohnen (2013). Innovation performance and embeddedness in networks: evidence from the ethiopian footwear cluster. *World Development 41*, 302–316.

Haggblade, S., P. Hazell, and T. Reardon (2010). The rural non-farm economy: Prospects for growth and poverty reduction. *World Development 38*(10), 1429–1441.

Hallman, K., D. Lewis, and S. Begum (2007). Assessing the impact of vegetable and fishpond technologies on poverty in rural bangladesh. *Agricultural research, livelihoods, and poverty: Studies of economic and social impacts in six countries*.

Hashemi, S. M., S. R. Schuler, and A. P. Riley (1996). Rural credit programs and women's empowerment in bangladesh. *World development 24*(4), 635–653.

Hausman, J. A. and D. A. Wise (1985). Introduction to" social experimentation". In *Social experimentation*, pp. 1–10. University of Chicago Press.

Hoffmann, V., K. Probst, and A. Christinck (2007). Farmers and researchers: How can collaborative advantages be created in participatory research and technology development? *Agriculture and human values 24*(3), 355–368.

Kaboski, J. P. and R. M. Townsend (2011). A structural evaluation of a large-scale quasi-experimental microfinance initiative. *Econometrica 79*(5), 1357–1406.

Khandker, S. R. (2005). Microfinance and poverty: Evidence using panel data from bangladesh. *The World Bank Economic Review 19*(2), 263–286.

Kloeppinger-Todd, R. and M. Sharma (2010). *Innovations in rural and agriculture finance*, Volume 18. Intl Food Policy Res Inst.

Kumar, S. K. (1994). *Adoption of hybrid maize in Zambia: effects on gender roles, food consumption, and nutrition*, Volume 100. Intl Food Policy Res Inst.

Maluccio, J. and R. Flores (2005). *Impact evaluation of a conditional cash transfer program: The Nicaraguan Red de Protección Social*. Intl Food Policy Res Inst.

Matin, I., D. Hulme, S. Rutherford, et al. (2002). Finance for the poor: from microcredit to microfinancial services. *Journal of International Development 14*(2), 273–294.

McKenzie, D. and C. Woodruff (2008). Experimental evidence on returns to capital and access to finance in mexico. *The World Bank Economic Review 22*(3), 457–482.

McKenzie, D. J. and C. Woodruff (2006). Do entry costs provide an empirical basis for poverty traps? evidence from mexican microenterprises. *Economic development and cultural change 55*(1), 3–42.

Moock, P. R. (1976). The efficiency of women as farm managers: Kenya. *American Journal of Agricultural Economics*, 831–835.

Naved, R. T. et al. (2000). *Intrahousehold impact of the transfer of modern agricultural technology: A gender perspective*. International Food Policy Research Institute Washington, DC.

Ogunlela, Y. I. and A. A. Mukhtar (2009). Gender issues in agriculture and rural development in nigeria: The role of women. *Humanity & social sciences Journal 4*(1), 19–30.

Overfield, D. and E. Fleming (2001). A note on the influence of gender relations on the technical efficiency of smallholder coffee production in papua new guinea. *Journal of Agricultural Economics 52*(1), 153–156.

Paolisso, M. J., K. Hallman, L. Haddad, and S. Regmi (2002). Does cash crop adoption detract from child care provision? evidence from rural nepal*. *Economic Development and Cultural Change 50*(2), 313–338.

Pearce, D. (2003). Financial services for the rural poor. *CGAP Donor Brief* (15).

Quisumbing, A. R. (1996). Male-female differences in agricultural productivity: Methodological issues and empirical evidence. *World Development 24*(10), 1579–1595.

Quisumbing, A. R., L. R. Brown, H. S. Feldstein, L. Haddad, C. Peña, et al. (1995). *Women: The key to food security*. International Food Policy Research Institute Washington, DC.

Ravallion, M. and G. Datt (1996). How important to india's poor is the sectoral composition of economic growth? *The World Bank Economic Review 10*(1), 1–25.

Richter, P. (2011). Empowering rural communities through financial inclusion. rural policy briefs. *International Labour Organisation (ILO), Geneva*.

Rodrik, D. and M. Rosenzweig (2009). Access to finance chapter 2, handbook of development economics, volume 5.

Rogers, E. M. (2002). Diffusion of preventive innovations. *Addictive behaviors 27*(6), 989–993.

Rogers Everett, M. (1995). Diffusion of innovations. *New York*.

Ruel, M. T., B. de la Brière, K. Hallman, A. Quisumbing, and N. Coj (2002). *Does Subsidized Childcare Help Poor Working Women in Urban Areas?: Evaluation of a Government-sponsored Program in Guatemala City*. Citeseer.

Ruel, M. T. and M. A. R. Quisumbing (2005). *The Guatemala community day care program: An example of effective urban programming*, Volume 144. Intl Food Policy Res Inst.

Saito, K. A., H. Mekonnen, and D. Spurling (1994). *Raising the productivity of women farmers in Sub-Saharan Africa*, Volume 230. World Bank Publications.

Skoufias, E. and B. McClafferty (2001). Is progresa working: Summary of the results of an evaluation by ifpri.

Spielman, D. J., K. Davis, M. Negash, and G. Ayele (2011). Rural innovation systems and networks: findings from a study of ethiopian smallholders. *Agriculture and human values 28*(2), 195–212.

Sunding, D. and D. Zilberman (2001). The agricultural innovation process: research and technology adoption in a changing agricultural sector. *Handbook of agricultural economics 1*, 207–261.

Thomas, D. (1993). The distribution of income and expenditure within the household. *Annales d'Economie et de Statistique*, 109–135.

Toborn, J. and R. W. Harvesting (2011). Adoption of agricultural innovations, converging narratives, and the role of swedish agricultural research for development? Technical report, Discussion paper. Swedish Agricultural Research for Development.

Ton, G., E. Friis-Hansen, K. d. Grip, L. Klerkx, M. Rau, and M. Douma (2013). *Effectiveness of innovation grants to smallholder agricultural producers: an explorative systematic review*. Evidence for Policy and Practice Information and Co-ordinating Centre (EPPI-Centre), Social Science Research Unit.

Uphoff, N. (2008). The system of rice intensification (sri) as a system of agricultural innovation. *Jurnal Ilmu Tanah & Lingkungan 10*(1).

USAID (2015a). Agriculture growth program – agribusiness and market development (agp-amde). Technical report, Danya International.

USAID (2015b). Innovative solutions for social impact. Technical report, Danya International.

Vandercasteelen, J., M. Dereje, B. Minten, and A. S. Taffesse (2013). Scaling-up adoption of improved technologies: The impact of the promotion of row planting on farmers' teff yields in ethiopia. Technical report, LICOS Discussion Paper Series.

Yonas, B. (2006). *The impact of row planting of teff crop on rural Household income: A case of Tahtay Maychew wereda, Tigrai, Ethiopia.* Ph. D. thesis, Mekelle University.

Yu, B., A. Nin-Pratt, J. Funes, S. A. Gemessa, et al. (2011). Cereal production and technology adoption in ethiopia. *Ethiopia Strategy Support Program II (ESSP II), ESSP II Working Paper 31.*

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