

Socio-economic factors determining the commitment to participate in an agricultural development project in rural Ethiopia

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Cite as:

Urquía-Grande, E. y Del Campo, C. (2017). Socio-economic factors determining the commitment to participate in an agricultural development project in rural Ethiopia. *Iberoamerican Journal of Development Studies*, 6 (2): 4-27
https://doi.org/10.26754/ojs_ried/ijds.218

Abstract

Ethiopia is suffering a massive exodus of rural people towards the capital. Thus, the Government is trying to support projects carried out to stimulate opportunities given to the agriculture sector. In this line a project has been designed, working together with a Non-Profit Organization (NPO). The present research paper analyses the factors which determine the farmers' socio-economic, educational and nutrition commitments to design an assignment criterion in the frame of a rural development project in Ethiopia where all the families are surveyed. The donated wells are intended to make possible their access to safe water and the creation of a small vegetable garden with the final goal of improving their living standard. However, because the number of wells to donate was limited, it was crucial to identify assignment criteria to maximize the outcomes of the project. The selected families must help in the building of additional wells to other families and improving social status of the village through commitment to (i) return a percentage of exceeding crops for the community, (ii) assist to continuous training in agriculture, budgeting and nutrition and (iii) enroll their children in school. The article seeks to understand which socio-demographic and economic variables determine families' different commitments. A descriptive analysis of the sample is made and different multivariate techniques are applied. Interesting results were observed such as women income, having an animal for transportation and owning a mobile, which are variables that determine these commitments.

Keywords: agriculture, well donation, socio-economic commitments, cooperation for development projects.

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Resumen

Etiopía está sufriendo un éxodo masivo de población rural hacia la capital. Por lo tanto, el Gobierno trata de apoyar los proyectos realizados para estimular las oportunidades dadas al sector agrícola. En esta línea se ha diseñado un proyecto, en el cual se trabaja junto con una organización sin ánimo de lucro (ONG). En el presente trabajo de investigación se analizan los factores que determinan los compromisos socioeconómicos, educativos y nutricionales de los agricultores con el fin

de diseñar un criterio de asignación en el marco de un proyecto de desarrollo rural en Etiopía, donde todas las familias han sido encuestadas. Los pozos donados se destinan a posibilitar su acceso a agua potable y a la creación de un huerto pequeño, con el objetivo final de mejorar su nivel de vida. Sin embargo, debido a que el número de pozos era limitado, resultó crucial identificar criterios de asignación para maximizar los resultados del proyecto. Las familias seleccionadas han de ayudar, asimismo, en la construcción de pozos adicionales para otras familias y mejorar así el estado social de la aldea mediante el compromiso de (i) devolver un porcentaje de los cultivos excedentes a la comunidad, (ii) ayudar a la formación continua en agricultura, contabilidad y nutrición y (iii) matricular a sus hijos en la escuela. Con el artículo se busca comprender qué variables sociodemográficas y económicas determinan los diferentes compromisos de las familias. Se realiza igualmente un análisis descriptivo de la muestra y se aplican diferentes técnicas multivariantes. Se observaron, de hecho, resultados interesantes, como un ingreso económico para las mujeres, la incorporación de un animal para el transporte o la posesión de un móvil, variables que determinan tales compromisos.

Palabras clave: agricultura, donación de pozos, compromisos socioeconómicos, proyectos de cooperación para el desarrollo.

1 Introduction

Ethiopia is one of the world's poorest countries, according to statistics from UN Human Development Indicators (United Nations 2015). It covers an area of 1,104,300 square kilometers and has a population of 85,219,000 inhabitants. There is a low level in education due to low school enrolment, insufficient educational materials, low educational level of teachers or even undernourishment (Bernard & Taffesse 2014). In the Ethiopian National Plan (MOFED 2012) it appears that pre-school education is one of the areas left behind in the country so the Government is willing to prepare teachers and give licensing supervision to Non-Profit Organisations (NPOs),¹ missions and private individuals.

After 17 years of socialism and military dictatorship, in 1991 Ethiopia launched a comprehensive set of economic reforms marking the country's transition to a market-based economy. Additionally, the fall of the Marxist-oriented government coincided with the elimination of many restrictions on market activities (Mani, Hoddinott & Strauss 2013; Dercon, Hoddinott & Woldehanna 2012). Also, a growth strategy called Agricultural Development Led Industrialization (ADLI) gives priority to the agricultural sector was introduced (Shiferaw & Bedi 2013) with several reforms in land tenure (Bezu & Holden 2014; Holden & Otsuka 2014; Minten, Stifel & Tamru 2014). However, as in many other developing countries, Ethiopia is still suffering a massive exodus of the rural population towards the capital in search of a job in any other sector than farming. Hence the Ethiopian Government is willing to support projects carried out outside the cities to increase the standard of living and attraction of the rural areas (MOFED 2012).

1 An NPO is a non-profit organisation, often devoted to furthering a particular social cause.

In rural Ethiopia, agriculture is the major source of income and livelihood implying that the dynamics of growth in agricultural productivity directly affect the welfare of the bulk of the rural poor (Abro, Alemu & Hanjra 2014; Jayne, Chamberlin & Headey 2014; Mutoko, Hein & Shinsaya 2014). Moreover, Ethiopian nutrition for its population is dependent on one grain harvest after the rainy season. From the health point of view, a lack of knowledge of proper nutrition can affect Ethiopian children with chronic undernourishment (Alderman, Hoddinott & Kinsey 2006).

A research work was developed by the authors to help a Non-Profit Organisation (NPO) and design a privately funded finance project to build four wells for a total of sixteen families in one village in rural Ethiopia so they could have access to clean water and they could cultivate more nutritional crops all year round. Vegetable gardens are shown to work in the area if there are enough water besides other determinants (Bellon, Gotor & Caracciolo 2015; Nyysöla, Pirttilä & Sandström 2012; Valbuena *et al.* 2015). Moreover, the introduction to domestic vegetable gardens and small farms at a family level will lead to a substantial improvement in the standard of living of the rural population.

In his research paper, it is seeking to analyse the socio-demographic and economic variables that determine farmers' different commitments. As resources are scarce and no more than four wells can be built with private donations, a survey was carried out in order to identify the most committed families in the village for the wells were donated. Each well is intended to provide four families with enough clean water to drink and, at the same time, maintain a small vegetable garden (Sellamuttu *et al.* 2014). The selected families will have a counterpart because they should help in the building of additional wells and improving the social status of the village through commitment to (i) return 10 % of exceeding crops for the community, (ii) attend continuous training in agriculture, budgeting and nutrition and (iii) enrol their children in school.

The desire is for the donated wells to be a socially, economically and nutritionally sustainable project due to the help they will achieve for poor farmers' families to improve their nutrition standards, increase their agricultural, economic and budgeting culture and raise children's education in line with the Yunus ideals (1983) and in experiments in an agriculture research context (Kebede & Zizzo 2015; Singh 2015). Each of the four hand-dug wells would be an infrastructure grant donated to groups of four farmer families who have to share the well and its water equally, where group bond and solidarity will provoke better performance in line with Gine and Karlan (2014); Mason (2014), and Wydick, Hayes and Kempf (2011).

The structure of this paper is as follows. First, a bibliographical review is made of financially and socially sustainable agricultural plans within an African context as well as the socio-economic

commitments these plans can introduce. In section 3 the statistical methodology and the sample description are presented. In the fourth section of the paper it is discussed the results in which socio-demographic and economic variables are analysed in a rural village of around 600 inhabitants in the Muketuri area who live in clay houses, without water or light and do not have roads complicating communications. Finally, conclusions are drawn and future research lines are defined.

In the present research, it has been founded that farmers would have an increase of vegetable cultivation with the donated hand-dug well so they commit to attending continuous training and enrolling their children in school. However, they are not ready to return a percentage of these crops equal to the infrastructure cost for other members of the village to benefit from the construction of another well and achieve, in the long term, the improvement of family nutrition in the whole village. Additionally, women's income is one of the common variables which determine the decision of committing to the infrastructure donation. Other variables such as having a vehicle (assuming a donkey or mule to be a vehicle) or owning a mobile phone influence the decision of saving and returning part of the well grant as well as promoting the enrolment of their children in school.

2 State of the art/background and research questions

The deindustrialization and a severe lack of mechanization in Ethiopia's key economic sectors have led to an unstable economic situation. Among the main countrywide problems there is the need to improve cognitive and transversal skills among the farmers who are self-employed. The decline in social enterprises, particularly state sponsored cooperatives, has accelerated the turning of the Ethiopian society into subsistence-based livelihoods with important consequences for natural resources management. Nevertheless, over the past few years, there has been a great endeavour by the population to create groups in substantial farming of products and other services (Bali & Varghese 2013). Therefore, an emerging social economy of small organizations is presently taking place despite the prerequisite legal sanction to safeguard and support their development. However, banks and other potential creditors are reluctant to provide those small self-employed farmers with loans. Also, most African farmers, although they might be creditworthy, are risk-averse and have no interest in being financed with micro-credits because they consider banks too risky for them (Ciravegna 2006). Additionally, they do not understand the system of borrowing for investments and do not have a «savings culture»

(Adusei 2012; Ashraf *et al.* 2006; Bernarzi & Thaler 2004; Duflo *et al.* 2006; Saez 2009). Such situation slows down the enormous potential of farms to generate jobs and contribute to business and agricultural development programs within the country (McIntosh, Villaran & Wydick 2011; De Mel, McKenzie & Woodruff 2014).

In such a context, and in order to understand the different financial sources, it is necessary to analyse the way that would best suit the farmer's needs. Fafchamps *et al.* (2014), Karlan & Zinman (2012), McKenzie & Woodruff (2008), Urquía-Grande & Rubio-Alcocer (2015) and De Mel *et al.* (2008, 2009, 2012) have demonstrated by different empirical methodologies in different countries like Ghana, Mexico, Ethiopia or Sri-Lanka that the grants in-kind (grants given in physical assets not in money or credit) related to business (either rural or urban) have a better result in helping poverty alleviation and economic growth. Informal lending has also been very much researched mainly in Africa where it has been proved to be successful in businesses sustainability (Bahng 2013; Madestam 2014; Pellegrina 2011; Ravi 2014; Turvey & Kong 2010). The essential part is that self-employed farmers must be taught how to manage and forecast their small farms' basic revenues and costs or they would not be able to access basic financial resources like savings, insurance and lending in order to sustain their businesses. The main financial source used by Ethiopian farmers, which is mainly an «informal» type of financial resource, is the savings wheel or tontine. Some authors have researched these types of finance and have called it Rotating Savings and Credit Associations (ROSCA) built on informal understandings among friends or family pooling resources, from agricultural subsistence (Armendariz & Morduch 2010). This is the reason why the return for the grant in-kind for the hand-dug well was organised following a ROSCA model. This type of informal lending has been credited with improving financial outcomes (increase in sales, income results, asset accumulation and job creation) and non-financial outcomes (health, food security, nutrition, education, women's empowerment, housing and social cohesion) (Adjei *et al.* 2009; Barnes *et al.* 2001; Doocy *et al.* 2005).

A large amount of research has been done about the improvement of agriculture training in low income countries (Dethier & Effenberger 2012; George 2014; Nyssöla, Pirttilä & Sandström 2012). Another line of research has covered the economic culture for poverty reduction, socio-economic commitments and the improvement of living standards since Yunus and the Grameen Bank in 1983. Currently, research is focusing on analyzing the real quantitative impact of all these measures linked also to improvements in health, education, agriculture and economics together and aligned with the Millenium Development Goals (MDG) (Armendariz & Morduch 2010; Karlan & Appel 2011; Van Rooyen, Stewart & De Wet 2012). Van Rooyen, Stewart and De Wet (2012) show that the majority of re-

searchers demonstrate that financial or grant aid in the form of group lending and with training in business management and agriculture have a greater impact in health, food security and education although there are some exceptions. In this way agriculture is linked with nutrition and health provision. Research demonstrates that greater household control over resources improves child well-being basically in the form of better nutrition and more education (Sraboni *et al.* 2014; Yoong, Rabonovitch & Diepeveen 2012).

In parallel, another analysed issue is gender impact, since the majority of the research is about women and whether they are determining for the success of finance and economic development (De Brauw, Gilligan, Hoddinott & Roy 2014; Luke & Munshi 2011).

The research question is deduced directly from the following:

RQ: Which variables determine educational and economic commitments in poor rural Ethiopian families for village empowerment?

This general question can be broken down into the following three sections:

RQi: Which variables determine families' commitment to return a percentage of surplus crops for the community?

RQii: Which variables determine families' commitment to attend continuous training in agricultural, budgeting and nutrition?

RQiii: What determines commitment to enrol families' children in school?

3 Methodology

Prior to building the wells the village population's commitments in returning yearly 10 % of surplus crops for the community, in attending continuous training courses and in enrolling their children in school were analysed. There is no modification of the commitments once the well was assigned because there was an oral contract between the farmers and the NPO in charge of building the wells. It was assumed that the four families would share the water from the well equally. In this way, the study can be linked to the research line of financing assets (such as the hand-dug well) focused on measuring the improvement not only in the economics and agriculture but also in health and education of villages in Africa (Armendariz & Morduch 2010; Karlan & Appel 2011).

Although there is an Ethiopian Rural Household Survey (ERHS) used by many researchers, we decided to design and implement a pen-and-paper micro-survey directly focused on our issues in order to monitor the economic, social and nourishment commitment of the families, in the long term, once the hand-dug well is donated, built and operating.

The survey consisted of 15 closed-ended questions organized around eight axes: social and demographic characteristics, education background, work status, income, assets and finance, consumer goods, taxes, and commitments following Bernard & Taffesse (2014), Bezu *et al.* (2014), Sraboni *et al.* (2014) and Deressa *et al.* (2008). The description of the variables can be found in Table 1.

Variable	Possible Values	Codification
Number of family members	Discrete variable	FAM_MEMB_HH
Husband and wife assets	No asset	NO_ASSET
	Land	LAND
	Animals	ANIMAL
	Houses	HOUSE
	Vehicles	HUS_VEHICLE, WOM_VEHICLE
Household assets	No consumer goods	NOTHING
	Gas	GAS
	Water	WATER
	Phone	PHONE
	Music player	MUSIC
Husband and wife age	0-20	HUS_0-20, WIFE_0-20
	21-30	HUS_0-20, WIFE_0-20
	31-40	HUS_0-20, WIFE_0-20
	41-50	HUS_0-20, WIFE_0-20
	> 50	HUS_0-20, WIFE_0-20
Husband and wife education level	None	HUS_NONE, WIFE_NONE
	Primary	HUS_PRIM, WIFE_PRIM
Husband labour status	Unemployed	HUS_LS_UNEMPL
	Agriculture	HUS_AGRICULT
	Employed	HUS_LS_EMPL
	Self-employed services	HUS_LS_SELFSEV
	Retired	HUS_LS_RETIRED
Wife labour status	Unemployed	WIFE_LS_UNEMPL
	Agriculture	WIFE_LS_AGRICULT
	Employed	WIFE_LS_EMPL
	Self-employed services	WIFE_LS_SELFSEV
	Housewife	WIFE_LS_HW
Husband and wife's incomes (in dollars/month)	None	HUS_INC_NONE, WIFE_INC_NONE
	< 50	HUS_INC_>50, WIFE_INC_>50
	50-100	HUS_INC-50-100, WIFE_INC-50-100
	101-200	HUS_INC-101-200, WIFE_INC-101-200
	> 200	HUS_INC_>200, WIFE_INC_>200

Table 1
Description of variables

The survey was designed and tested by NPO directors and the authors, after it has been translated to English. The survey was done by the NPO volunteers² to the whole village, before constructing any well. The village has around 600 inhabitants divided in 98 families who are all very poor (live on less 2 \$ per day). They were first informed and trained about the survey aims. After accessing the results, it was found that all families had answered negatively to several of those items, such as if they paid taxes for their income or for their land property; therefore, it was decided to exclude these items from the analysis.

3.1. Statistical methodology

In addition to descriptive statistics, logistic regression was used to identify the variables that determine the savings culture and the social, nourishment and educational commitment. Logistic or logic regression is a type of probabilistic statistical classification model which is used to predict a binary response variable from one or more predictor variables. Particularly, the probabilities describing the possible outcomes of a single trial are modelled, as a function of the independent variables, using a logistic function, hence its name.

Three logistic models (Logit, Probit & Gompertz) were run for each of the research questions. According to the goodness of fit statistics, pseudo R-squares, AIC (Akaike information criterion), SBC (Schwarz's Bayesian Information Criterion) and -2 Log Likelihood statistic, the best model was selected in each of the cases.

In order to facilitate the readability, only the variables found to be significant by the Wald Chi-Square statistic, which tests the sole contribution of each predictor in the context of the other predictors, were included in the respective tables.

Unless otherwise noted, all analysis was done using XLstat 2011, a statistical add-on for Excel.

3.2. Sample description

This research is developed in a village located about 5 kilometres from the town of Muketuri, 78 kilometres North of Addis Ababa in the North Shoa region, one of the most food insecure and poorest areas in Ethiopia. Despite being located only 78 kilometres away from the capital, it is part of the rural area where most of the country's population live in clay houses and where access to main services, like water, light energy and communications, are minimal. Their way of life is based on agriculture and breeding cattle, sheep and goats. However, their agriculture is limited to the rainy season, obtaining only one harvest a year. It is important to highlight that the teff is the major crop cultivated in large fields which have no necessary land characteristics. The teff is the local type of cereal

2 An NPO volunteer is an individual who performs hours of service for civic, charitable or humanitarian reasons without any expectation of economic compensation.

with very low vitamin and protein properties causing very poor nourishment that affects the inhabitant's nutritional level, while family food diet should include a mixture of other vegetables. This is one of the major objectives a donated well and a small vegetable garden cultivated should help to achieve. It should be pointed out that the economy of this village is not based on money but on the teff's exchange as a means of payment which increases the cultural complexity of these villages.

In the present research, it is analysed a village, randomly chosen among those in the area, of around 600 inhabitants where direct beneficiaries would be the families who will have irrigation and safe water from the hand-dug wells donated by the NPO. That could enable them to plant vegetables and fruit trees. Educational and economic commitments were analysed in order to select the families that should be prioritized to donate the first four wells. Moreover, the entire village will benefit from knowing that there is a possibility of cultivating vegetables outside the rainy season from the experience that proves that food can be produced in the dry season. The experiment should be simple, reliable and sustainable taking into account some of the recommendations of Collins *et al.* (2009) in their study of households in India, Bangladesh and South Africa where the village's population must have the major commitment to develop a self-disciplined economic behaviour among the village inhabitants to return a percentage of crops for the community to build new wells for their village neighbours (De Meza & Webb 2001; Platteau 2000).

There were 98 responses, one from each of the 98 households in the village, although 25 of them had non-reliable data because they were without any information, so they were rejected. The majority of the families is formed by five or more members with the wife being younger than the husband. Many families have three children or more, living also with the grandparents. The employment status of the husband and wife are very similar with 26 % unemployed, 72 % self-employed in the agricultural sector and a 2 % working for a company.

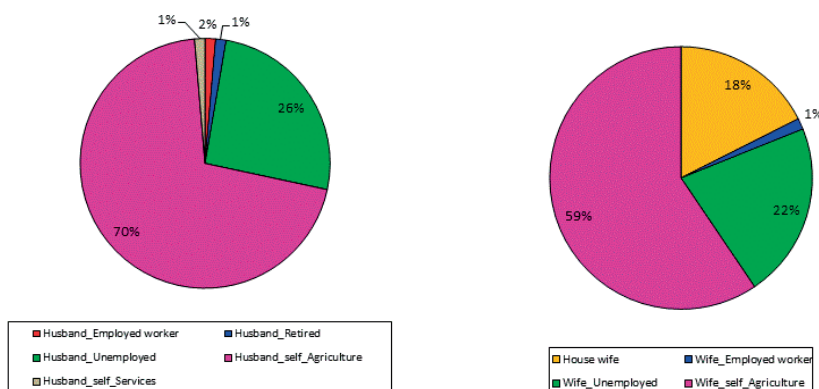


Figure 1
Employment status

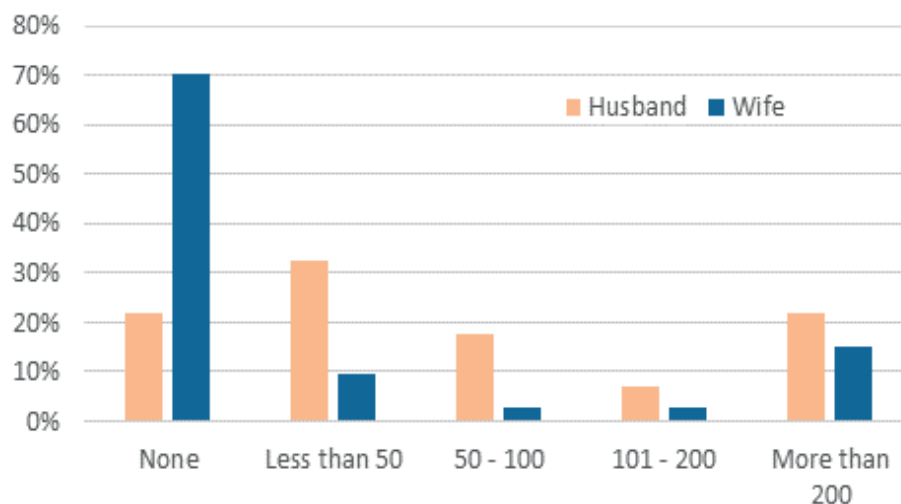


Figure 2
Declared income

It was interesting to observe that although answers referring to labour status were very similar the answers referring to labour income are totally different (see Figure 2) as 71 % of the women declare that although they work (mostly in agriculture) they do not obtain any income, while only 22.5 % of the men have this payment. In the case of the men who are unemployed, it is only logical because they consider they do sporadic jobs. However, the authors think that women declare no earned income although they work in agriculture because they give it all to the household.

Education level shows an increasingly positive trend among the population. The grandparents do not have education whatsoever. The second generation shows relative disparity since there are less than 10 % educated women and around 23 % educated men, strictly referring to primary studies. The third generation (children) shows rates of approximately 50 % having primary studies, while secondary and university studies are rarely registered.

When the survey was carried out, families cultivated small farms in the rainy season and 27 % of the families have cultivated some vegetables such as potatoes, onions, beet, carrots... In the respondent families 68 % have animals, 65 % have a house (made of clay) and 59 % have a land area (see Figure 3). Land is not really owned by the family because the Government has given a long term lease so the land ownership finally belongs to the State. This issue is not perceived by the majority of the citizens because they answer that they own the land; some of them explain this system of land ownership thoroughly because, if they have many children, the land is divided among them during the lease. The ownership situation of the land, animals and income level is similar where women answered that they have fewer assets than men when land, animals and house are owned by the whole family.

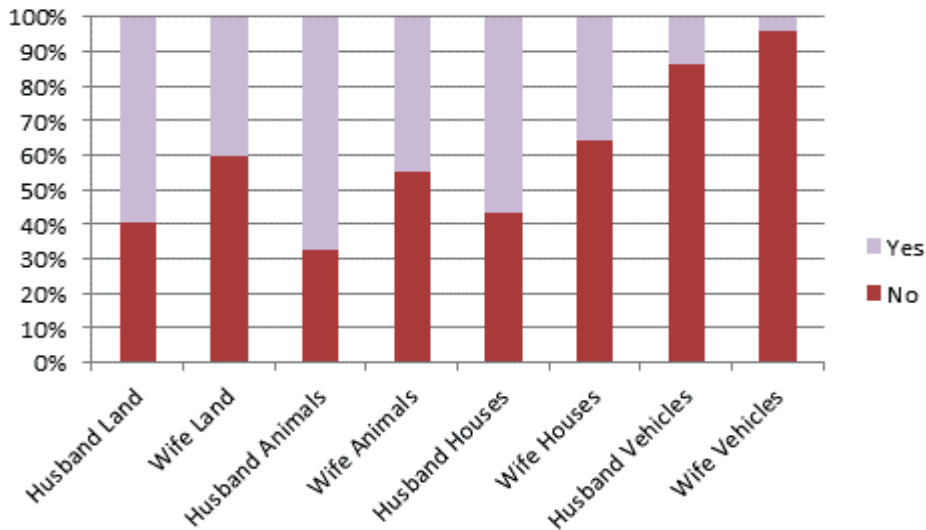


Figure 3
Declared possessions

None of the respondents has ever used a bank service, or has a credit card or required a bank loan or mortgage, the majority not even knowing what it is. When asked about the economic commitment to return the amount of the cost of building the well and using the water, there is a clear resistance even to pay back with a part of the crops cultivated thanks to the well. On the contrary, 50 % of the respondents are prepared to compromise socially and pay their children’s school fees and participate in training courses on agriculture, nutrition and budgeting.

4 Results and discussion

In order to analyse the commitment of farmers’ family to return a percentage of their crops to the village a logistic regression was carried out with all the variables taken into account in the survey. According to the goodness of fit statistics, the best model was the Probit one as all the calculated pseudo R-squares were slightly higher and the AIC (Akaike information criterion), the SBC (Schwarz’s Bayesian Information Criterion) and the -2 Log Likelihood statistic lower.

Four of the five levels of women’s income (see Table 2) were found determinant to the commitment of returning to the community a part of their crops, with wife’s incomes between 50 and 100 and 100 and 200 dollars per month being the highest. Also, the wife’s incomes above 200 \$/month has less influence on commitment, while the income below 50 \$/month has no influence. Together with those variables there also appears whether the family had gas (used to cook or to heat the house) or the husband owned

a vehicle. All coefficients are positive, meaning that for every unit of change of each of those variables the odds of returning (versus non-returning) 10 % of the crops increases by the respective value on the table. Finally, 78 % of cases are correctly predicted by our model.

This result will be of utility for the reapplication of the finance project of building hand-dug excavated wells in other villages, because the researches would only have to focus on women having income, families having gas and husbands owning a vehicle in order to infer their economic commitment. Additionally, these results related to the main determinant being women's income are in line with research done by Karlan & Appel (2011) in Africa; Feingenberg, Field & Pande (2010) in India; and Afrane (2002) in Ghana and South Africa.

Source	Value	Standard error	Wald Chi-Square	Pr > Chi ²
Intercept	-2.119	1.072	3.906	0.048
HUS_VEHICLE	1.455	0.567	6.589	0.010
GAS	2.941	1.868	2.478	0.115
WIFE_INC_NONE	1.541	1.075	2.053	0.152
WIFE_INC_>200	1.653	1.137	2.114	0.146
WIFE_INC-101 200	-3.291	1.647	3.991	0.046
WIFE_INC-50 100	-3.291	1.647	3.991	0.046

Statistic	Independent	Logit	Probit	Gompertz
Observations	73	73	73	73
Sum of weights	73.000	73.000	73.000	73.000
DF	72	66	66	66
-2 Log (Likelihood)	97.204	57.756	50.509	52.936
R ² (McFadden)	0.000	0.406	0.480	0.455
R ² (Cox & Snell)	0.000	0.417	0.473	0.455
R ² (Nagelkerke)	0.000	0.567	0.642	0.618
AIC	99.204	71.756	64.509	66.936
SBC	101.494	87.789	80.542	82.969
Iterations	0	12	6	10

Goodness of fit statistics (Variable: Commitment to donate a % exceeding crops to the community)

Table 2

Model parameters (Variable: Commitment to return a % exceeding crops to the community)

A logistic regression was also run to analyse the variables influencing the farmers' family commitment to have continuous training in agriculture, nutrition and budgeting when they had the well donated. The Gompertz model proved to be more reliable in this case, as all the calculated pseudo R-squares were slightly higher and the AIC, the SBC and the -2 Log Likelihood statistic lower (see Table 3).

Source	Value	Standard error	Wald Chi-Square	Pr > Chi ²
Intercept	-0.057	0.677	0.007	0.933
PHONE	-1.511	0.506	8.922	0.003
HUS_LS_UNEMPL	0.063	0.463	0.019	0.891
HUS_LS_RETIRED	-0.981	1.671	0.345	0.557
HUS_LS_SELFSEV	1.374	1.486	0.855	0.355
HUS_LS_EMPLWORK	-1.730	1.627	1.130	0.288
WIFE_INC_NONE	0.887	0.672	1.744	0.187
WIFE_INC_>200	0.138	0.730	0.036	0.851
WIFE_INC-101 – 200	0.544	1.426	0.146	0.703
WIFE_INC-50 – 100	-0.991	1.306	0.576	0.448

Statistic	Independent	Probit	Gompertz
Observations	73	73	73
Sum of weights	73.000	73.000	73.000
DF	72	63	63
-2 Log (Likelihood)	101.186	47.708	47.465
R ² (McFadden)	0.000	0.529	0.531
R ² (Cox & Snell)	0.000	0.519	0.521
R ² (Nagelkerke)	0.000	0.692	0.695
AIC	103.186	67.708	67.465
SBC	105.476	90.613	90.370
Iterations	0	9	7

Goodness of fit statistics (Variable: Commitment to assist to training in Nutrition, Agriculture and Budgeting)

Table 3

Model parameters (Variable: Commitment to assist to continuous training in Nutrition, Agriculture and Budgeting)

The different level of the variables husband labour status and wife's incomes and whether the family has a phone determines this training commitment. The classification results show 71.23 % correct classification. Again, the different levels of the wife's incomes are significant when deciding the commitment to attend continuous training in line with Doi, McKenzie & Zia (2014), De Mel, McKenzie & Woodruff (2014) and Lakwo (2006). In this case the husband labour status also influences the decision. However, the negative coefficient on husband retired or employed by a company indicates that the probability of having continuous training in agriculture, nutrition and budgeting is reduced in line with research done by Karlan & Appel (2011). Wife's incomes between 50 and 100 with a negative coefficient also imply that the chances of committing to the continuous training are less than the baseline. Surprisingly, wife's incomes influence the commitment but the wife labour status does not. Possible reasons have been previously discussed.

Although it might seem bizarre, it is very common for the families to have a mobile phone due to the NPO's donations in different Ethiopian villages even if those families do not have electricity or gas. In fact, Heeks (2010) and Ojo, Janowski & Awotwi (2013) affirm in their research conclusions that owning a mobile phone is a highly significant determinant for development. For further development projects to be replicated they will only have to focus on those variables to deduct their training commitment.

Finally, all the calculated pseudo R-squares on Table 4 for the Probit model are slightly higher and the AIC, BSC and the -2 Log Likelihood statistics lower when analysing the social commitment of the farmers' household to free their children from work and enrol them in school once they have the well and have enough vegetable surplus to save.

In this case we can observe in Table 4, where only the significant variables were included to facilitate readability, variables such as the number of members in the household, labour status of husband and wife, and once again wife's incomes are the ones that condition our dependent variable of committing to the continuous training. In our model, it has been correctly classified the outcome for 76.71 % of the cases.

In fact, results in Table 4 show that, for the third time, the different levels of wife's incomes are determinant in the decision, but with a negative coefficient, meaning that that the odds of enrolling their children in school are lower even when women declare they have no incomes. Therefore, questions in the survey related to this variable should be revised. Nevertheless, the design of the infrastructure donation assignment for the well construction must definitely take this variable into account.

Source	Value	Standard error	Wald Chi-Square	Pr > Chi ²
Intercept	4.038	1.378	8.580	0.003
FAM_MEMB_HH	-0.871	0.494	3.106	0.078
HUS_LS_UNEMPL	-1.751	0.605	8.376	0.004
HUS_LS_RETIRED	-0.059	1.630	0.001	0.971
HUS_LS_SELFSEV	1.281	1.601	0.640	0.424
HUS_LS_EMPLOYED	0.568	1.572	0.130	0.718
WIFE_LS_HW	-0.713	0.478	2.229	0.135
WIFE_LS_UNEMPL	0.606	0.537	1.273	0.259
WIFE_INC_NONE	-2.024	0.841	5.790	0.016
WIFE_INC_>200	-3.077	0.965	10.172	0.001
WIFE_INC-101 – 200	-4.338	1.614	7.227	0.007
WIFE_INC-50 – 100	-1.855	1.218	2.320	0.128

Statistic	Independent	Logit	Probit	Gompertz
Observations	73	73	73	73
Sum of weights	73.000	73.000	73.000	73.000
DF	72	64	61	64
-2 Log (Likelihood)	101.186	58.138	31.843	50.209
R ² (McFadden)	0.000	0.425	0.685	0.504
R ² (Cox & Snell)	0.000	0.446	0.613	0.503
R ² (Nagelkerke)	0.000	0.594	0.818	0.670
AIC	103.186	76.138	55.843	68.209
SBC	105.476	96.752	83.329	88.823
Iterations	0	6	8	10

Goodness of fit statistics (Variable: Commitment to the education of children)

Table 4

Model parameters (Variable: Commitment to the education of children)

In this case the labour status of the men and women is determinant as well, with husband retired or unemployed and wife being housewife, reducing the odds of enrolling the children in school. It seems that the members of this village do not have very clear the relation between education level and improvement in the labour status in the long term. The number of members with a negative coefficient at household is also logical because if the number is high they will be more reluctant to enrol their children in school in line with Lacalle Calderón *et al.* (2008).

5 Conclusions

Ethiopia is one of the world's poorest countries where agriculture is the major source of income and livelihood. A research work was designed, working together with an NPO, to understand the variables that determine farmer's commitments after the donation of hand-dug wells.

The majority of the families is formed by five or more members with women being younger than the husbands. Many families have three children or more living also with the grandparents. The employment status of the men and women are very similar with the majority being self-employed in agriculture, although the woman has the additional responsibility of taking care of the children and the domestic activities. It is interesting to observe that women state that they work in agriculture but also declare not receiving any income. This is probably due to discrimination against women in line with Husain, Mukherjee & Dutta (2010); Mayoux (1999); Rahman (1998). There is no use whatsoever of financial resources within the village population. There is a huge need amongst its citizens for light and water, but, surprisingly, cell phones and music players are more available than basic commodities such as gas and water.

In the experiment, it is analysed the variables affecting economic, nutrition and training commitments. The village families declare themselves committed to enrolling their children in school and receive continuous training in budgeting and agriculture much more than to pay back the cost of building the well. Variables such as women's income is a determinant in the economic and education commitment in line with research of Adusei (2012); Boehe & Cruz (2013); De Mel, McKenzie & Woodruff (2009); Doi, McKenzie & Zia (2014); Husain, Mukherjee & Dutta (2010); Rikjers & Costa (2012). Particularly, having access to gas, owning a vehicle and wife's incomes are the only factors determining the farmer's commitment to give back a percentage of the surplus exceeding crops in line with Van Rooyen, Stewart & De Wert (2012); De Brauw *et al.* (2014).

Regarding the farmer's commitment to receive continuous training in agriculture, budgeting and nutrition the only variables that have to be taken into account are phone ownership, the husband's labour status and wife's incomes. Surprisingly, the fact of the husband being retired or employed as well as owning a phone and wife's incomes being between 50 and 100 dollars per month decrease the probability of committing. The results of owning a phone towards the commitment is opposite to those in Heeks (2010).

The components determining the enrolment of farmer's children in school are family members, husband's employment status and wife's employment status and income level. It is interesting to highlight that the number of family members, husband being un-

employed or retired and women being housewives and all levels of wife's incomes influence negatively the probability of enrolling their children in school. These results are somewhat different from Karlan & Appel (2011), Luke & Munshi (2011).

As a main contribution to practitioners in Ethiopia in Muketuri's area there are 24 small villages that would be indirect beneficiaries if this research is replicated in other villages. Also, to replicate this experience in other villages, women's income, household having an animal as a vehicle, owning a mobile phone and men's employment labour status would be the key variables analysed for assignment purposes. Finally, in line with De Mel, McKenzie & Woodruff (2014); Husain, Mukherjee & Dutta (2010), and Sraboni *et al.* (2014), this research is important for women's empowerment through practical classes of agriculture and budgeting, preparing them to know how to make a nutritious and balanced diet with the aim of improving their families' and the entire population's nutritional level at the same time.

Main future research lines will be to follow the project all the way from the well's donation and construction, while observing its performance and checking the assignment criteria was correct. Also, it is necessary to verify whether nutrition in the households has improved with children's growth measures or sickness rates and whether budgeting has improved the savings and financial culture of each family. Thus, it has to be designed another survey in order to corroborate whether the families with a donated well are better-off and more committed towards the economic, health and educational improvement of the whole village. Findings such as that age or education level affect neither the economic nor social commitments, and they need to be further researched.

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Appendix A

Survey on the Wells Social and Economic Impact

SOCIAL AND DEMOGRAPHIC CHARACTERISTICS

1. Family members

- 1 $2 \leq x < 5$ ≥ 5

2. Age

Grandfather:

- $40 < x \leq 50$ $50 < x \leq 60$ > 60

Grandmother:

- $40 < x \leq 50$ $50 < x \leq 60$ > 60

Husband:

- ≤ 20 $0 < x \leq 30$ $30 < x \leq 40$ $40 < x \leq 50$ > 50

Wife:

- ≤ 20 $20 < x \leq 30$ $30 < x \leq 40$ $40 < x \leq 50$ > 50

Children:

- ≤ 0 $0 < x \leq 5$ $5 < x \leq 10$ $10 < x \leq 15$ > 15

EDUCATION

3. Education level

Grandfather:

- None Primary Secondary University

Grandmother:

- None Primary Secondary University

Husband:

- None Primary Secondary University

Wife:

- None Primary Secondary University

Children:

- None Primary Secondary University

LABOUR

4. What is your labour status?

Grandfather:

- Unemployed Self-employed Employed worker Retired

Sector:

- Agriculture Industry/Manufacturing Services Stock breeding

Grandmother:

- Unemployed Self-employed Employed worker Retired Home wife

Sector:

- Agriculture Industry/Fabrication Services Stock breeding

Husband:

- Unemployed Self-employed Employed worker Retired

Sector:

- Agriculture Industry/Fabrication Services Stock breeding

Wife:

- Unemployed Self-employed Employed worker Retired Home wife

Sector:

- Agriculture Industry/Fabrication Services Stock breeding

Children:

Unemployed Self-employed Employed worker

Sector:

Agriculture Industry/Fabrication Services Stock breeding

5. If your answer to the previous part was AGRICULTURE, what kind of crops?**Grandfather:**

Cereals Potatoes Vegetables Other

Grandmother:

Cereals Potatoes Vegetables Other

Husband:

Cereals Potatoes Vegetables Other

Wife:

Cereals Potatoes Vegetables Other

Children:

Cereals Potatoes Vegetables Other

6. What is your income per month (in \$)?**Grandfather:**

None ≤ 50 50 < x ≤ 100 100 < x ≤ 200 ≥ 200

Grandmother:

None ≤ 50 50 < x ≤ 100 100 < x ≤ 200 ≥ 200

Husband:

None ≤ 50 50 < x ≤ 100 100 < x ≤ 200 ≥ 200

Wife:

None ≤ 50 50 < x ≤ 100 100 < x ≤ 200 ≥ 200

Children:

None ≤ 50 50 < x ≤ 100 100 < x ≤ 200 ≥ 200

INCOME USE**7. What is your use of income?****Grandfather:**

Food Education Housing Others Savings

Grandmother:

Food Education Housing Others Savings

Husband:

Food Education Housing Others Savings

Wife:

Food Education Housing Others Savings

Children:

Food Education Housing Others Savings

ASSETS AND FINANCE**8. Do you use financial resources?**

Credit card Yes No

Consumption credit Yes No

Mortgage Yes No

9. Do you participate in a financial cooperation fund? Yes No

10. Do you have any capital assets?

Grandfather:

None Land Animals Houses Vehicles

Grandmother:

None Land Animals Houses Vehicles

Husband:

None Land Animals Houses Vehicles

Wife:

None Land Animals Houses Vehicles

Children:

None Land Animals Houses Vehicles

COMMITMENTS

11. If you received a proportional part of a well constructed in the property lands of five families, what amount of money will you be capable of returning each month?

None ≤ 5 5 < x ≤ 10 10 < x ≤ 20 ≥ 20

12. If you received a proportional part of a well constructed among five families, what commitments will you be ready to do?

- None Register all my children in school Give a percentage of the crops cultivated to the community
- Take all courses given by Emalaikat (nutrition, agriculture, micro-credits, education, etc.)

TAXES

13. Do you pay taxes?

14. If so, which one do you pay?

Grandfather:

No Yes Income tax Property tax Activity tax

Grandmother:

No Yes Income tax Property tax Activity tax

Husband:

No Yes Income tax Property tax Activity tax

Wife:

No Yes Income tax Property tax Activity tax

Children:

No Yes Income tax Property tax Activity tax

CONSUMER GOODS

15. Which consumer goods do you own?

None Light Gas Water Heating
 Car Motorbike Cell phone Computer
 Television Music player Washing machine

16. What would you like to have?

None Light Gas Water Heating
 Car Motorbike Cell phone Computer
 Television Music player Washing machine