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Full Length Research Paper

Determinates of small holder farmers willingness to pay for agricultural extension services: A case study from Eastern Ethiopia

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As a result of inability of public extension services to be responsive to the needs of farmers, a new paradigm is emerging. This study was designed to assess farmers' willingness to pay for extension services and to identify factors influencing the willingness to pay for agricultural information delivery services among the farmers. To achieve the objectives of the study, four PAs were included in the study purposively. A total of 140 households were selected randomly using probability proportional to size technique and interviewed using interview schedules. The proportion of the respondents was increased to 64.2% when the improvement in the quality of the services was stated. Analysis of determinants of the willingness to pay from logit model showed a significant positive relationship between willingness to pay (WTP) and household income, and farm size. Other household characteristics such as age of household head, media exposure, and family size were found to be negative but significantly related to WTP.

Key words: Willingness to pay, agricultural extension, commercialization, public service.

INTRODUCTION

The importance of agricultural extension in rural development is widely acknowledged, particularly in developing countries like Ethiopia where the majority of the population lives on Agriculture as the main source of livelihood. Agriculture in this part of the world is very complex and facing a number of serious problems in present era for which it is not easy to find good solutions (Anderson, 2007). Van den Ban and Hawkins (1996) noted that everywhere the farming system is changing rapidly and only efficient farmers are to survive. Agricultural extension services take the lions share to create competent and efficient farmers who are able to increase productivity by making effective use of knowledge and information which is available from or can be generated by several different information sources.

Agricultural production in Ethiopia has, for long, remained subsistence with limited market orientation and poor institutional support. Farmers produce for various valid reasons, with little market-orientation (Azage et al., 2005). However, the rate of agricultural growth in Ethiopia

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heavily depends on the speed with which the current subsistence oriented production system is transformed into a market orientated production system (Berhanu et al., 2006). Currently, transforming agriculture from its current subsistence orientation into market oriented production system forms the basis of the agricultural development strategy of the Government. However, producing for the market requires re- orientation of the production system and development of a knowledge base and responsive institutional support services.

The agricultural extension service is one of the institutional support services that have a central role to play in the transformation process (Berhanu et al., 2006). Ethiopia's long history of extension services has been documented by a number of researchers (Belay, 2003; Habtemariam, 2004; Berhanu et al., 2006). The current extension service for small holders farmers in Ethiopia is almost exclusively funded and provided by the government with Nongovernmental actors operating in limited and dispersed areas. It is critically commented that extension system of the country lacks pluralistic framework and should reform itself to respond to the changing nature of the country's agricultural situation (Berhanu et al., 2006).

As is very evident from different studies (Wilson, 1991; Rivera et al., 2009; Shekara, 2005; Anderson, 2007), there are no models or external prescriptions that are entirely appropriate or applicable to the particular needs of individual countries or geographical locations within the country. Each case is different and the most crucial factor in assuring progress in services reform, including privatization measures, and development of successful partnership between the public and private sectors is the preparedness of all actors to engage in open experiential learning processes and foster the self-confidence and local leadership necessary for their own lessons and capacities to bring about the outcomes and ends they require.

According to Rivera et al. (2009) commercialization of extension services is only possible if farmers are willing to pay for these services and where extension services have previously been provided free of charge, assessment should be made to understand commercial demand for agricultural information. However, information on farmer valuation of current extension benefits, willingness to pay for extension services, types of services they are willing to pay for, and opportunities and obstacles to commercialization of extension is very scanty in the country. There is little or no effort to scrutinize alternative delivery extension mechanism. Ethiopian experiences need to be documented, analyzed and disseminated for a better understanding and implementation of commercial extension concept and how to achieve collaborative efforts in Ethiopian context in general and Haramaya district in particular. Consequently, this study was initiated to explore the willingness of farmers to pay for advisory services and empirically identify which characteristics make farmers more or less favorable towards paying for extension services.

Objectives of the study

The general objective of this study was to assess the need for and the implications for the development of commercial extension as an alternative to existing public extension support systems in Eastern Ethiopia. The specific objectives of this study were:

1. To assess farmers' willingness to pay for extension services, and
2. To identify factors determining willingness of farmers to pay for agricultural extension services.

METHODOLOGY

Study area

The study was carried out in the Eastern districts of Ethiopia. The district was selected purposively because of its long history in agricultural extension service provision. It was the place where the first Extension program was launched in Ethiopia. Haramaya is one of the sixteen Districts in Eastern Hararghe Zone with an estimated size of 52,163 ha. It is situated in the semi-arid tropical belt of eastern Ethiopia and characterized by a sub-humid climate with an average annual rainfall of about 790 mm, annual mean temperatures of 17°C with mean minimum and maximum temperatures of 9.4 and 24°C, respectively. The area experiences biannual type of rainfall classified as short and long rainy seasons. The short rainy season usually occurs from end of February to mid May and the long rainy seasons occur from July to end of September (District Agriculture office, 2009). Its altitude ranges from 1600 to 2100 m above sea level. The livelihood of the farmers is based on a mixed type of agriculture that is subsistence in nature. Sorghum, maize and chat are the most important agriculture crops in the area and dominantly consumed by rural community. Farmers intercrop sorghum and maize with chat and produce varieties of vegetable crops for export to Djibouti and Somalia and mostly using irrigation water.

Data sources and sampling technique

To achieve the objectives of the study, a combination of suitable qualitative and quantitative data were collected using both primary and secondary data. Primary data were collected from sample respondents through structured and pre-tested interview schedule. Four villages were purposively selected due to their high level of participation in terms of extension services, commercial orientation, access to transportation and market infrastructure, and access to irrigation facilities. Simple random sampling techniques were employed to select sample household heads from the four villages. The sample household percentage proportions to be selected per each sample village were calculated by using probability proportional to size technique. In all, a total 140 households were sampled for the study. Information gathered from farmers include: Questions related to socioeconomic, demographic and institutional characteristics of the households, current sources of information, the nature and extent of contact between the farmers and public

extension agents, and farmer willingness to pay (WTP) for extension services. Secondary data were also collected from annual reports and other published documents from various sources including district offices of agriculture and village administrative centers. Finally, qualitative data were also collected through focused group discussions, key informants interview.

Data analysis

In this particular study both descriptive statistics including percentages, mean, standard deviation, frequency of appearance and econometric models including Logit model, Chi-square test, t-test were used to analyze the data obtained from the field.
The specification of the logit model is as follow:

$$\frac{1}{1+e^{-z(i)}} \quad (1)$$

Where Pi denotes the probability that the i^{th} farmer will fall in the group of farmers who are willing to pay (yi=1) and (Zi) stand for function of n explanatory variables (Xi), and expressed as:

$$Zi = \beta_0 + \beta_1\chi_1 + \beta_2\chi_2 + \text{--------} + \beta_n\chi_n \quad (2)$$

Where β0 is the intercept and β_i are the slope parameters in the model. The slope tells how the log-odds in favor of being willing to pay for extension services change as independent variables change. Since the conditional distribution of the outcome variable follows a binomial distribution with a probability given by the conditional mean P_i, interpretation of the coefficient will be understandable if the logistic model can be rewritten in terms of the odds and log of the odds (Gujarati, 1995). The odds to be used can be defined as the ratio of the probability that a farmer will practice (P_i) to the probability that he/she will not ($1-P_i$).

$$1 - Pi = \frac{1}{1+e^{zi}} \quad (3)$$

Therefore,

$$\left[\frac{pi}{1-pi}\right] = \frac{1+e^{z(i)}}{1+e^{-z(i)}} \quad (4)$$

And,

$$\frac{p(i)}{1-p(i)} = \frac{1+e^{z(i)}}{1+e^{-z(i)}} = e^{\beta 0 + \sum_{i=1}^{n} \beta ixi} \quad (5)$$

Taking the natural logarithms of the odds ratio of Equation (5) will result in what is known as the logit model as indicated here:

$$\ln\left[\frac{p(i)}{1-p(i)}\right] = \ln\left[e^{\beta 0} + e\sum_{i=1}^{n}\beta ixi\right] = z(_i) \quad (6)$$

If the disturbance term U ($_i$) is taken into account the logit model becomes:

$$Z(i) = \beta_0 + \sum \beta ixi + Ui \quad (7)$$

In reality, the significant explanatory variables do not all have the same level of impact on the willingness of farmers to pay for extension services. Therefore, the impact of each significant variable on the probability of willingness to pay (WTP) will be calculated by keeping the continuous variables at their mean values and the dummy variables at their most frequent values (0 or 1).

Dependent variable of the model

In this investigation, willingness to pay for extension services (WTP) was treated as a dichotomous dependent variable, that is, it took the value 1 if the farmer is willing to pay and 0 otherwise. Accordingly, for understanding the determinants of the willingness to pay, the binary responses were analyzed within the logit regression framework.

Independent/explanatory variables of the study

Different empirical studies conducted elsewhere on factors influencing farmers' willingness to pay for extension services indicate the role of many social and economic factors in determining farmers' willingness to pay. The choice of explanatory variables was based on these studies and the characteristics found among the respondents. The a priori expectations of the variables are also specified in Table 1.

Summarizing, the independent variables of the study those which were hypothesized to have association with the willingness to pay for agricultural extension services were presented independently here under.

RESULTS

Willingness to pay

The data obtained from the survey depict that only 10.5% of sampled farmers agreed to pay for current extension service provided by development agents in their village. The remaining 89.5% of the respondents were not willing to pay for the current services. As can be seen from the above 60% of the willing respondents agreed to pay between 100 - 250 birr annually followed by 20% willing to pay between 300 - 450 birr per year.

Conditions for willingness to pay by farmers

In first scenario, no suggestion was made about any improvement in service quality. Thus, the resulting estimates are contingent on the current quality of the public extension services. In the second scenario, the improvement of the service quality was proposed. Majority (38.4%) of the willing respondents would have WTP between 350 and 550 birr annually. 27.9% would have WTP between 500 and 750 birr; and 18.6% agreed to pay between 800 and 950 birr per year. The remaining 8.1 and 6.9% of the willing respondents would have WTP greater than 1000 birr and less than 350 birr per year respectively. The farmers were also asked conditions under which they could make payments; accordingly majority of respondents (about 90%) among unwilling farmers, show willingness to pay under the condition of profit guaranteed specific advices for their farm, if payment made after production. Qualitative data analysis indicates that large proportions of the household were

Table 1. Definition of explanatory variables and their expected effect on willingness to pay.

Codes	Variables definition	Expected effect
SEX	Sex of household head, 0 = female, 1 = male	+
AGEHH	Age of household head in years	-
EDULHH	No of years of formal schooling	+
FXPHH	Farm experience of Household head in years	-/+
LDSH	Leadership involvement of the household head, 0= no 1= yes	+
FAMS	Family size of household	-/+
FARMS	Farm size of household in hectares	+
IRRIG	Whether a farmer use irrigation or not 0= no, 1= yes	+
INCOME	Total income of the household in Birr	+
TTLU	Livestock ownership in TLU	+
CREDIT	Credit use, 0= no, 1= yes	+
EXCTACT	Frequency of extension visit per year	+
LSTR	Radio ownership & listening 0=no, 1= yes	+

Table 2. Types of information / services for which farmers were ready to make payment.

Advice on marketing opportunities	40	46.5
Advice on improved seeds of crops	26	32.2
Advice on improved varieties of vegetables	50	58.1
Advice on crop protection	32	37.2
Animal health	8	9.3
Dairy development	27	31.3
Irrigation facilities	56	65.1
Agricultural implements and machineries	42	48.8
Arrangement of input supply	38	44.2
Liaison with credit services	17	19.8
Advice on micro enterprise and nonfarm activities	9	10.5
Advice to solve specific problems	10	11.6

* indicates, the percentage do not add up to 100 because of multiple counting.

willing to pay for the services. Concerning the amount of money, if the service can satisfy their needs, they can pay even a lot depending on the improvement on their farm income. Farmers were also asked to indicate whether they prefer in group or individual to make payment. Large proportion (92%) of the respondents preferred to pay in group/cooperative. The rest 8% respondents indicated that they want to pay individually.

Types of information / services for which farmers were ready to make payment

Farmers who had expressed their willingness to pay for agricultural information were asked to indicate the types of services for which they would be willing to pay. The top services indicated that farmers are preferring to pay for includes irrigation facilities (65.1%), providing information on improved varieties of vegetables (58.1%), advice on agricultural implements and machineries (48.8%), information on marketing opportunities (46.5%), advice on crop protection (37.2%), arrangement of input supply (44.2%), information on new varieties of crops (32.2%), dairy development (31.3%), and liaison with credit services (19.8%) (Table 2).

Econometric results for the binary logistic regression model

Before using the logit model for hypothesized variables, it is necessary to test the problem of multicollinearity or association among the potential independent variables. There are two measures that are often suggested to test the existence of multicolinearity. These are: Variance Inflation Factor (VIF) for association among the

Table 3. The maximum likelihood estimates of the logit model.

Variables	Coefficient	Wald - statistics	Sig. level	Odds ratio
	Constant		**1.691**	
AGEHH	-0.139	3.399	0.065*	0.870
EDHH	-0.056	0.273	0.601	0.945
SEX	-0.508	0.155	0.693	0.602
FAMSIZE	-0.235	3.307	0.069*	0.790
EXCTACT	0.030	1.575	0.210	1.031
TTLU	0.270	1.105	0.293	1.310
FXPHH	0.48	0.415	0.520	1.050
FARMSIZE	1.406	4.586	0.032**	4.078
INCOME	0.087	3.836	0.050**	1.091
LDSHP	-0.526	0 .745	0.388	0.591
IRRIG	0.381	0.345	0.557	1.464
LSTR	-2.559	9.529	0.002***	0.077
CREDIT	0.949	0.559	0 .455	2.583
Model- chi-square value	38.980***			
-2 log likelihood	80.750			
Correctly predicted (%)	80.6			
Sensitivity	82			
Specificity	78.1			

continuous explanatory variables and contingency coefficients for dummy variables. VIF shows how the variance of an estimator is inflated by the presence of multicolinearity (Gujarati, 2003).

As a rule of thumb continuous variable having variance inflation factor of less than 10 are believed to have no multicollinearity and those with VIF of above 10 are subjected to the problem were excluded from the model. Similarly, the contingency coefficient, which measures the association between various discrete variables based on the Chi-square, were computed in order to check the degree of association among the discrete explanatory variables to detect multicollinarity problem.

Contingency coefficient value ranged between 0 and 1, and as rule of thumb variables with contingency coefficient below 0.75 shows weak association and value above it indicates strong association of variables. The contingency coefficient for the dummy variables included in the model was less than 0.75 that didn't suggest multicollinearity to be a serious concern In total, 13 independent variables were used to estimate the determinants of willingness to pay for agricultural extension services, among hypothesized explanatory variables that are supposed to have influence on households. Using a statistical package known as SPSS version 18. These are education, family size, farming experience, farm size, tropical livestock unit, credit access, sex, age of household head, leadership status, income, irrigation availability, frequency of extension visit, and listening to the radio. These variables were selected on the bases of theoretical explanation and the results of various empirical studies. Moreover, they were selected by testing significant differences of the mean using t-test and $\chi 2$ and testing the existence of muliticollinearity using Variance Inflation Factors (VIF) and contingency coefficients.

The various goodness of fit measures were checked and validate that the model fits the data. The likelihood ratio test statistics exceeds the Chi-square critical value at less than 1% probability level. This implies that the hypothesis, which says all coefficients except the intercept is zero, was rejected. The value of Pearson Chi-square test shows the overall goodness of fit of the model at less than 1% probability level. Another measure of goodness of fit of the model was based on a scheme that classifies the predicted value of events as one if the estimated probability of an event is equal or greater than 0.5 and 0 otherwise. From all sample farmers, 80.6% were correctly predicted into willing and non-willing categories by the model. The correctly predicted willing and correctly predicted non-willing of the model were 82 and 78.1%, respectively. The estimated model, thus, groups willing and non-willing sampled respondents accurately. The maximum likelihood estimate of the parameters and the effect of independent variables on probability of WTP were analyzed and presented

DISCUSSION

As indicated earlier, thirteen key characteristics of farmers which are hypothesized to have influence on

WTP for agricultural extension services/advisory services in the study area were included in the model. These variables include: Sex of household head (SEX), age of household head (AGE), education level of household head (EDULHH), farming experience of household heads (FXPHH), leadership position of the household head (LDSHP), family size (FAMS), farm size FARMS), total income of household (INCOME), total tropical livestock holding (TTLU), credit access (CREDIT), frequency of extension contact (EXCTACT), irrigation availability (IRRIG), and listening to the radio/mass media (LSTR) .

Five of the variables were found to be statistically significant at different levels of significance. Result from the logit model shows that listening to the radio/mass media (LSTR) was found significant at less than one percent probability level. Farm size (FARMS) and household income (INCOME) were significant at less than 5% significance level. The other two variables, age of household head (AGE) and family size (FAMS) were significant at less than ten percent probability level. The remaining eight variables, namely sex of household head (SEX), education level household heads (EDUHH), farming experience of household heads (FXPHH), frequency of extension contact (EXCTACT), irrigation use (IRRIG) and total livestock holding (TTLU) were not statistically significant. As expected, the coefficient on frequency of extension contact (EXCTACT), total livestock holding (TTLU), farm size (FARMSIZE), household income (INCOME), irrigation use (IRRIG) were positive. This indicates that an increase in any of these variables will lead to an increase in the probability of willingness to pay for extension services. The more farmers are frequently visited by extension agents, the more they hold large number of livestock, the more they use irrigation, the more they earn farm income and the more they hold large farm sizes the higher the probability of the willingness to pay for extension services. The coefficient on the age of household head (AGEHH) was also statistically significant and conforms to *a priori* expectations. The variable of listening to the radio (LSTR) significantly influenced the attitude of respondents towards payment for extension services but negatively. Contrary to *a priori* expectations, other variables, such as education level (EDUHH), leadership position (LDSHP), sex (SEX), and family size (FAMS), were found negatively related to WTP. The negative signs indicate that these variables were inversely related to farmers' willingness to pay for extension services.

CONCLUSION AND RECOMMENDATIONS

The study indicated that, 89.5% of the respondents were not satisfied with the extension services provided while only a small proportion of the respondents (10.5%) were satisfied by the current extension services. However, the findings in this study clearly show that there is a great opportunity to commercialize agricultural extension services. Majority of respondents (64.2%) were favorably disposed to paying for extension services if the service is satisfying them and could earn more profit than what they are now getting. The results imply that there exists significant demand by farmers for extension information services, making it potentially attractive for commercialization or privatization if high-quality extension services can be provided. These findings suggest that cost recovery mechanisms might be able to enhance the funding of extension delivery systems that farmers indicate they find useful and important. One can also easily deduce from the results of this survey that there is great opportunity for graduates of agricultural sciences to be organized and establish consultancy firms to serve farmers through providing quality information useful to farmers to make good decision. This can have two fold advantages. The result of the econometric analysis that age have an inverse and significant relationship with willingness to pay for extension services should be properly considered. To ensure financial sustainability of extension service young farmers should be targeted. Household income, farm size and household size are critical to how much farmers will be willing to spend on extension services. By targeting farmers, with high level of incomes, large farm sizes and small household sizes, the commercialization of extension services could be enhanced. However care should be taken to equally address poor, household with large families as well as household with small land holdings.

Conflict of Interest

The authors have not declared any conflict of interest.

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