

*Full Length Research Paper*

# Analysis of access to apiculture supporting services by smallholder farmers in northern Ethiopia

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This study was conducted to analyze factors affecting access to apiculture supporting services by smallholder beekeepers in Ahferom district of Tigray region, Ethiopia. Primary data were collected by interviewing 130 randomly selected smallholder beekeepers during March to April 2011. The data were analyzed using descriptive statistics and econometric (probit) model. Probit model results of farmers' access to extension service revealed that number of productive members, beekeeping experience, age, farm size, distance to Farmers Training Center (FTC), number of bee colonies and ownership of Radio, TV and/or mobile phone were significant factors. Likewise, other off/non-farm activity, distance to FTC and number of bee colonies significantly affected farmers' access to credit service. Similarly, sex, other off/non-farm activity, distance to FTC and district town, beekeeping experience, ownership of radio, TV and/or mobile phone were significantly associated with farmers' access to input supply service. Therefore, these significant factors in accessing apiculture supporting services should be considered by policy-makers and planners of governmental and NGOs in setting their policies and strategies of institutional services development and apiculture production improvement interventions in Ahferom district and in areas with similar settings.

**Key words:** Extension service, input supply service, credit service, probit model, apiculture.

## INTRODUCTION

Agriculture is the backbone of Ethiopian economy therefore the country is in the process of transforming its agricultural sector from subsistence to market orientation (MoARD-IPMS, 2006). Apiculture is a promising off-farm enterprise, which directly and indirectly contributes to smallholder's income in particular and nation's economy in general. It has significant role in generating and diversifying the income of subsistence Ethiopian smallholder farmers mainly the small land holders and landless (EARO, 2000; Gezahegn, 2001). In Ethiopia traditional, transitional and improved beehives were

recognized for honey production with total of 5.15 million beehives (of 93% traditional) and the farm households keeping bees were 1.4 million. Endowing with diverse agro-climatic zones, the total honey and beeswax production estimates about 39,700 and 3,800 tons per year. Such an amount puts the country 10<sup>th</sup> in honey and 4<sup>th</sup> in beeswax production worldwide. Moreover, Ethiopia has the potential to produce up to 500,000 tons of honey and 50,000 tons of beeswax per year (GDS, 2009).

The current Ethiopian government has increased its attention to develop the apiculture sub-sector as one of

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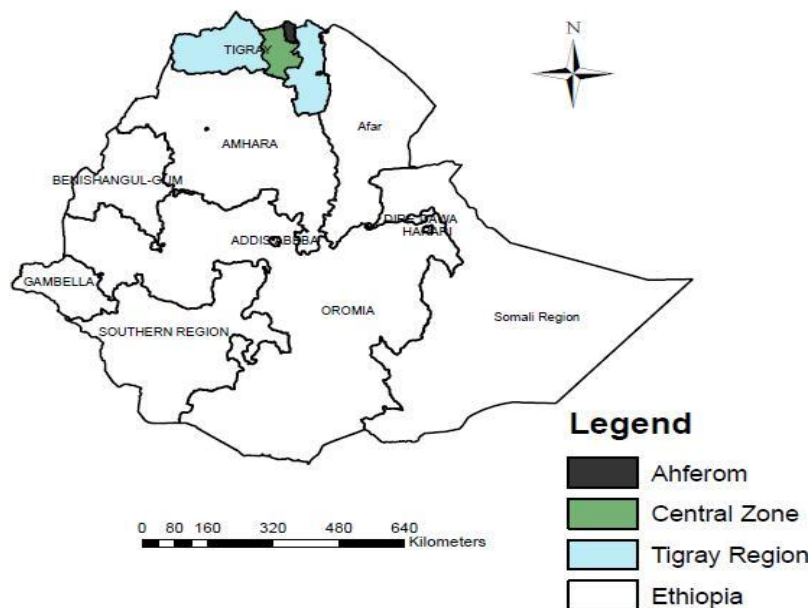


Figure 1. Location map of Ahferom district.

its strategies for poverty reduction and export diversification; in addition different NGOs have been intervening to assist the poor smallholder farmers through the introduction and promotion of box hive to obtain higher honey production of good quality that can enable the smallholder farmers market oriented (GDS, 2009). Similarly, great effort has been made by regional government extension package and Relief Society of Tigray (REST) to promote improved box hive technology in the region to increase the quantity and quality of honey production and build the capacity of beekeepers for better management of bees and hives for honey and beeswax production (Gidey and Mokenen, 2010).

Therefore, the necessary ingredients for achieving market orientation are technologies and service delivery. Service delivery includes generation and introduction of new technologies, the supply of inputs and financing of these inputs, and marketing. In the last seven years, a range of institutional changes has begun to take place. For example, rural extension services are on the threshold of a major shift in extension delivery through the approach that established farmer training centers (FTC) (MoARD-IPMS, 2006). The service is predominantly supply driven. Technology packages were prepared based on the available improved technologies and attempts were made to transfer them to farmers. This supply driven approach of extension was a common feature of all the extension service programs in the country.

Although socio-economic surveys were made to develop the menu of household level packages in Tigray and Amhara regions, it was not clear if farmers' needs and preferences were incorporated in the design of the packages. However, as time goes, the extension service

becoming demand driven and community resource based; the wealth of indigenous knowledge of farmers also used as source of improved technology option (Berhanu et al., 2006). Therefore, the agricultural extension service at the FTCs has been playing an active role in linking farmers with other institutional support services such as input supply, credit, co-operative promotion, and agricultural produce marketing, particularly, for apiculture sub-sector development.

Despite all the efforts have been made by government and NGOs at national, regional and district level to provide these supporting services for the improvement of apiculture produces, and whatever the service delivery approach changes from supply to demand driven; there has been no adequate study on determining access to extension, credit and input supply services and the determinant factors of these services at smallholder level. Therefore, the primary objective of the study was to analyze the factors affecting access to extension, credit and input supply (that is, improved box hive) services provided for the improvement of apiculture enterprise by the smallholder beekeepers in Ahferom district.

## METHODOLOGY

### Description of the study area

Ahferom district (Figure 1) located in  $14^{\circ} 20' 0''$  N latitude and  $39^{\circ} 10' 0''$  E longitude is among the major honey producing districts in Tigray region. However, up to around a decade back, all beekeepers of the district were only occupied in traditional production system (OoARD, 2009) though improved box hive has been introduced and promoted in the country since 1970 to overcome the low production, productivity and quality of honey (HBRC, 1997).

**Table 1.** Sample distribution in the selected *Tabias*.

Sample <i>Tabia</i>	THHH*	Total beekeeper HHH**	Sample beekeeper HHH**
Sero	2138	427	41
L. M. Tsemri	1716	396	38
My-Suru	1099	282	27
Degose	1065	251	24
Total	6018	1356	130

*Tabias* recorded, 2011, \*THHH: total household heads, \*\* HHH: household heads

### Sampling technique and sample size

Multi-stage sampling procedure was used to select sample smallholder beekeepers for the study. Ahferom district was selected purposively based on the honeybee production, availability of bee flora and improved box hive promotion. The district comprises of thirty three *Tabias*, of which six are urban *Tabias* and twenty seven are rural *Tabias*. Excluding the five rural *Tabias*<sup>1</sup> that were affected by the Ethio-Eritrea war, four *Tabias* were selected randomly out of the remaining 22 rural *Tabias*. Having the list of beekeeper households from each *Tabia*, 130 sample beekeepers were selected randomly based on the probability proportional to size sampling technique from the selected *Tabias* (Table 1).

### Method of data collection

Primary data were obtained from sample respondents during March to April 2011 by using semi-structured questionnaire through interview method. Before embarking into data collection, the questionnaire was pre-tested to check its appropriateness for gathering the required information. Four enumerators who speak the local language, *Tigrigna*, were recruited based on their prior experience in data collection, and also they were familiar with the study area. All the enumerators were qualified with diploma. Enumerators were trained regarding the contents of the questionnaire and procedure of data collection. Trained enumerators were interviewed on the sample respondents under the continuous supervision of the researchers. Secondary data were gathered from various sources such as reports of MoA at different levels, CSA, district BoARD, NGOs, previous research findings, internet and other published and unpublished materials.

### Methods of data analysis

#### Specification of probit model

In the case of categorical dependent variables (binomial or multinomial) qualitative choice models such as the logit and Probit are usually specified. These models are commonly used to analyze situations where the choice problem is whether or not (0-1 value range). The Probit specification has advantages over logit models in small samples (Gujarati, 2004). The present study therefore employed a Probit model to examine determinant factors of beekeeper farmers' decision to access or not access extension, credit or input supply (that is, improved box hive) service. The Probit model specification used in this study is given by:

$$SERV_i = \beta_0 + \beta_i X_i + \varepsilon_i, i = 1, 2, 3, \dots, n \quad (1)$$

where  $SERV_i$  – is a dummy variable indicating the access to services that is related to the equation as  $SERV_i = 1$  if a farmer have access to the services and  $SERV_i = 0$ , otherwise,  $X_i$  – are explanatory variables in the probit model,  $\beta_0$  – intercept term estimated by the model,  $\beta_i$  – a vector of parameters to be estimated by the model,  $\varepsilon_i$  – disturbance term with  $\varepsilon_i \sim N(0, \sigma^2)$  (Table 2).

## RESULT AND DISCUSSION

### Descriptive results

#### Access to apiculture supporting services

The institutional services that increase agricultural production and productivity, among others, are extension service, input supply service, credit service and marketing infrastructures development. Ahferom district Office of Agriculture and Rural Development (OoARD) has three teams: crop production, livestock production and natural resources management teams. The crop production team also includes the input supply expert, an irrigation expert and home economics agent, in addition to other experts of crop production. The livestock production team includes experts in quality controls, an apiculture technician, and an AI technician, in addition to other livestock production experts. The natural resources management team includes soil and water conservation experts, socio-economist expert, forestry and agro-forestry expert. Currently each *Tabia* has three development agents who reside at FTC: one each in crop production, livestock production and natural resource management.

The study result revealed that about 84.6% of the respondents had got extension access (training, workshop and apiary visit). In addition to access to extension service, frequency of farmers' contact with extension agents makes difference in improvement of apiculture produces. Out of those who had extension contact, 30.9, 55.5, 10.0 and 3.6% of sample respondents had contact

<sup>1</sup> *Tabia* – the smallest administrative unite in Tigray region.

**Table 2.** Summary of variables of access to support services used for probit model.

Variables	Code	Type	Measurement
Access to extension service	SERV <sup>1</sup>	Dummy	No=0, Yes=1
Access to credit service	SERV <sup>2</sup>	Dummy	No=0, Yes=1
Access to input supply (i.e. improved box hive)	SERV <sup>3</sup>	Dummy	No=0, Yes=1
Household head sex	SEX	Dummy	Female=0, male=1
Household head age	AGE	Continuous	Years
Household head educational status	EDUC	Dummy	0 = illiterate, 1 = literate
Household head leadership participation	LEADP	Dummy	No=0, Yes=1
Total family size	FAMLYSIZ	Continuous	Number
Working labor force	LABFORC	Continuous	Number
Other off/non-farm activity involvement	OFFACT	Dummy	No=0, Yes=1
Household farm size	FARMSIZ	Continuous	Hectares
Households' livestock holding	TLU	Continuous	TLU
Beekeeping experience	BEEKEEXP	Continuous	Years
Number of bee colonies	BEECOLO	Continuous	Number
Frequency of extension contact	FREQCONT	Continuous	Number per month
Distance to farmers training center	DISTFTC	Continuous	Kilometers
Distance to nearest market	DISTMKT	Continuous	Kilometers
Distance to district town	DISTWRDA	Continuous	Kilometers
Distance to all weathered road	DISTROAD	Continuous	Kilometers
Radio, TV and/or mobile ownership	RTVMOBIL	Dummy	No=0, Yes=1

with extension agents once, twice, three times and four times per month, respectively (Table 3).

Most smallholder farmers in the study area are in need of credit for honey production improvement, hence, some of them may obtained but some of them may not obtained due to high financial constraints of the credit providing organizations. On the contrary, some farmers may not need credit due to problems related to terms of reimbursement and high interest rate. Particularly, interest rate is the main problem in the area since it is as high as 18%. From the total sample farmers, 80.0% needed credit. Of those credit needed sample farmers, 79.8% received credit for improvement of beekeeping activity (Table 3). As the respondents pointed out, Dedebit Credit and Saving Institution (DCSI) is the sole financial organization providing credit for honey production improvements in collaboration with the district OoARD. Most probably farmers who accessed credit service were predominantly selected by the OoARD of the district and had got *Kupen*<sup>2</sup> from DCSI if the credit is in kind.

In the study area, improved inputs were delivered by the OoARD of the district in collaboration with DCSI if the farmers were utilized improved inputs in the form of credit; and model farmers get improved box hive additionally as an incentive from REST. The production, productivity and quality of honey are partly determined by

the type of the hive used. Furthermore, the type of accessories, particularly honey extractor and casting mold, used for production of honey also determine honey production, productivity and quality. However, not only the availability of accessories but also the time that the accessories supplied to farmers determine the production, productivity and quality of honey produced as most of the accessories, honey extractor and casting mold, supplied at harvesting season from each *Tabia* rather the individual beekeeper holds. Thus, if the accessories, particularly honey extractor, delayed little time to supply to the beekeepers at harvest season, there would be high probability to deteriorate the produce and this might lead to low production, productivity and low quality of honey. With this in mind, out of the total respondents, 60.0% indicated that they have received improved box hive regardless of their adequacy and timeliness. As the samples asked to answer for improved box hive access problems, about 65.4, 13.8 and 20.8% of the sample responds that improved box hive is constrained by high price, lack of credit and lack of supply, respectively. Moreover, improved box hive accessed respondents were also asked for timely supply of improved box hive accessories, in this case honey extractor and casting mold; hence, 83.3% of them responds that they were obtained casting mold and honey extractor at the time of preparation of foundation sheet and honey harvesting, respectively (Table 3).

Farmers sold part of their agricultural products immediately after harvest to cover their costs of

<sup>2</sup>Kupen is a credit card ordered by DCSI, which represents a farmer to obtain input from OoARD of the district.

**Table 3.** Institutional characteristics of sample beekeepers for discrete variables.

Characteristics		Total sample beekeepers	
		N	%
Extension access	Yes	110	84.6
	No	20	15.4
Frequency of extension contact per month	Once	34	30.9
	Twice	61	55.5
	Three times	11	10.0
	Four times	4	3.6
Radio, TV and mobile own	Yes	59	45.4
	No	71	54.6
Credit need	Yes	104	80.0
	No	26	20.0
Credit access	Yes	83	79.8
	No	21	20.2
Input supply (improved box hive) access	Yes	78	60.0
	No	52	40.0
Input access constraints	High price	85	65.4
	Lacks credit	18	13.8
	Lacks supply	27	20.8
Accessories timely supply	Yes	65	83.3
	No	13	16.7

Survey output, 2012, \*\*\* and \*\* represents 1% and 5% significance level, respectively, N – Number of observations, % - percentage of observations.

**Table 4.** Institutional characteristics of sample beekeepers for continuous variables.

Characteristics	Total sample beekeepers
	Mean(STD)
Distance to market/district	12.52(2.79)
Distance to road	4.97(2.23)
Distance to FTC	3.35(1.67)

Survey output, 2012,\*\*\* represents 1% significance level, respectively, STD = standard deviation.

production, social obligation and urgent family expenses in the nearby market. The result indicates that the average distance of farmers' residence from the nearest market place was 12.52 km. Infrastructure is another key service for farmers, as it helps them to sell their farm products. The average distance of the farmers' home

from all-weather roads was 4.97 km. The FTC has been recently established at each *Tabia* to serve as nodes, which could provide extension service (packages), training (short term and modular), demonstration and, centers of exhibition and information, as a result, disseminates agricultural technologies (Ibrahim, 2004;

**Table 5.** Maximum likelihood estimation of probit model of apiculture extension service access.

Variables	Coefficients	Robust STD. ERR.	t-value	Marginal effect
SEX	-0.3185414	0.691944	-0.46	-0.0013951
AGE	-0.1092366	0.0442901	-2.47**	-0.0006689
EDUC	-0.1197492	0.5149899	-0.23	-0.0006816
LEADP	0.5719492	0.4252651	1.34	0.002707
LABFORC	0.4698898	0.1778988	2.64***	0.0028774
OFFACT	0.860343	0.7976947	1.08	0.0031714
FARMSIZ	-2.739059	0.986726	-2.78***	-0.0167726
TLU	0.1729471	0.1498836	1.15	0.001059
BEEKEEXP	0.06576	0.0366094	1.80*	0.0004027
BEECOLO	-0.7725696	0.1652418	-4.68***	-0.0047308
DISTFTC	-0.4892228	0.1568134	-3.12***	-0.0029958
RTVMOBIL	2.495484	0.8777245	2.84***	0.031889
_CONS	11.24834	2.132738	5.27***	
Log pseudo likelihood = -22.438155, Number of obs. = 130, Wald $\chi^2(12)$ = 48.37, Prob > $\chi^2$ = 0.0000,				
Correctly predicted = 99.8%.				

\*\*\*, \*\* and \* represents 1, 5 and 10% significance level, respectively, model output, 2012.

Berhanu et al., 2006; MoARD-IPMS, 2006). The average distance of farmers' home from FTC was 3.35 km (Table 4).

## Econometric models results

### Factors affecting access to apiculture extension service

Probit maximum likelihood estimation was used to analyze factors affecting access to apiculture extension service. Table 5 shows the model correctly predicted about 99.8% of the observations with significant wald-chi-square of 48.37. The dependent variable in this analysis is a dummy variable, taking the value one if a farmer received extension service and 0, otherwise; whereas the explanatory variables comprises both continuous and discrete. A total of twelve explanatory variables were considered in the model, of which seven variables were found to significantly influence smallholder farmers' access to extension service. Marginal effect (for continuous explanatory variables) indicates that the effect of one unit change in an explanatory variable on the dependent variable, while for the dummy variables the values reported are changes in the dependent variable in response to a change in the binary variable from zero to one.

The probit model result shows that age of the household head had negative and significant influence on extension service access. Given other factors constant, one year increase in household head age the probability of the farmer access to extension service reduced by 0.07%. This implies that older farmers might have less

access to extension activities regarding apiculture improvement than younger farmers. On the contrary, labor force illustrated by the total number of productive members (age 15 to 64) associated positively with farmers' access to extension service. As the household productive member increase by one person, probability of access to extension service for honey production improvement increased by 0.30%. This implication might be due to households with large number of productive members more probably participate in different apiculture improvement trainings, workshops and apiary visits than households with small productive members. Farm land holding had negative and significant effect on apiculture extension program participation. As farmer's farm size decrease by one hectare his probability of access to extension service increased by 1.7%. Because apiculture is off-farm activity that required small land and it is usually true that small land holders and landless farmers practice. Hence, farmers with small farm size might be participated in improving beekeeping extension activities than others.

Number of bee colonies holding had negative influence on beekeeping improvement extension service access. Since, in this study, the large portion of bee colonies are in traditional hive and it does not require improved management and inspection, as a result, large number of bee colonies holding farmers had less probability to contact with extension agents as per the number of the bee colonies than small number of bee colonies holders. However, beekeeping experience had positive effect on beekeepers accessed to extension service at 10% significant level. This might be due to beekeepers those who rich in beekeeping experience perhaps acquire indigenous knowledge that helps them to know the

**Table 6.** Maximum likelihood estimation of probit model of access to apiculture credit service.

Variables	Coefficients	Robust STD. ERR.	t-value	Marginal effect
SEX	0.4240756	0.4193967	1.01	0.1591923
AGE	0.0136609	0.0323777	0.42	0.0048201
EDUC	0.0249541	0.4043023	0.06	0.0088288
LEADP	0.0490634	0.2973156	0.17	0.0172187
FAMYSIZ	0.0133536	0.1153223	0.12	0.0047117
LABFORC	-0.0689404	0.142254	-0.48	-0.0243248
OFFACT	1.198252	0.3519407	3.40***	0.3283266
FARMSIZ	-0.0478802	0.5676487	-0.08	-0.0168939
TLU	-0.067437	0.0790644	-0.85	-0.0237943
BEEKEEXP	-0.0313658	0.0251087	-1.25	-0.011067
BEECOLO	0.3557805	0.0783777	4.54***	0.1255326
DISTFTC	-0.129562	0.0748158	-1.73*	-0.0457143
RTVMOBIL	-0.0545195	0.2865645	-0.19	-0.0192785
DISTWRDA	-0.0509256	0.048536	-1.05	-0.0179684
_CONS	-0.4426221	1.552035	-0.29	
Log pseudo likelihood = -68.01111, Number of obs. = 130, Wald $\chi^2(14) = 32.94$ , Prob> $\chi^2 = 0.00$ , Correctly predicted = 68.9%.				

\*\*\*, \*\* and \* represents 1, 5 and 10% significance level, respectively, model output, 2012.

advantage of participation in extension activities regarding beekeeping improvement systems than those who less experienced.

The other highly significant variable in this model is distance of farmers' residence from the FTC. This is infact farmers resides far from the FTC have less attended in extension programs such as apiary visit, workshop and trainings regarding beekeeping improvement than those who resides near to FTC. Moreover, farmers also acquire extension information and knowledge regarding apiculture sub-sector improvement through mass Medias, for instance in this case, by possessing radio, TV and mobile. Farmers who owned at least one of these three information source increased the probability of accessed to extension service by 3.2%.

### Factors affecting access to apiculture credit service

The econometric model used to analyze this problem was the probit maximum likelihood estimation. The dependent variable in the model is access to apiculture credit service, taking the value one if a farmer received credit service either in cash or in kind and 0, otherwise. The independent variables included here are both continuous and discrete. As shown in Table 6, the choice of explanatory variables correctly predicted farmers' credit condition for about 69% of the observations with significance wald-chi-square of 32.94. Out of fourteen hypothesized explanatory variables, three of them had significant effect on farmers' access to credit service. One of the significant variables had negative correlation

with the farmers' access to credit service whereas the two were correlated positively.

Involvement in other off/non-farm activities was among the highly significant factors affecting access to credit service for apiculture improvement. This might be due to farmers involved in other off/non-farm activities probably earn additional income which helps them to repay to the borrowed money relative to those who did not. In addition, the number of bee colonies of beekeepers had significant and positive effect on credit service access. This is due to the fact that bee colony is liquid asset (easily changed into cash) that help beekeepers to take credit confidently for their honey production improvement.

Distance of beekeepers' residence from FTC had significant effect on the beekeepers access to credit service as it was hypothesized negative sign. The marginal effect for distance from FTC indicated that, other variables being constant, as the distance of beekeepers residence from FTC far by one kilometer the probability of these beekeepers access to credit service reduced by 4.6%. In view of the fact that FTC is a bridge to broadcast extension information through extension agents to the farmers concerning requirements, utilization and importance of credit for honey production improvement. As a result, farmers those who reside far apart from FTC have relatively less probability to borrow credit from lending institutions than their counter parts.

### Factors affecting input supply service (improved box hive) access

Probit model was employed to analyze the factors

**Table 7.** Maximum likelihood estimation of probit model of access to input supply service (improved box hive).

Variables	Coefficients	Robust STD. ERR.	t-value	Marginal effect
SEX	1.082474	0.5455031	1.98**	0.411328
AGE	0.042097	0.0364656	1.15	0.0150621
EDUC	-0.5039956	0.4267684	-1.18	-0.1688428
LEADP	-0.4127935	0.2994113	-1.38	-0.1524156
LABFORC	-0.2405052	0.152025	-1.58	-0.0886671
OFFACT	1.457815	0.3854027	3.78***	0.3824946
FARMSIZ	-0.1428221	0.5749504	-0.25	-0.0511009
TLU	0.0963839	0.0840324	1.15	0.0344856
BEEKEEXP	-0.0942801	0.0285285	-3.30***	-0.0337329
BEECOLO	0.0880682	0.0815238	1.08	0.0315103
DISTFTC	-0.1692456	0.0845351	-2.00**	-0.0605551
RTVMOBIL	0.5564423	0.3198151	1.74*	0.1927168
DISTWRDA	-0.1212092	0.0569221	-2.13**	-0.043368
_CONS	1.728543	1.672151	1.03	
Log pseudo likelihood = -57.03387, Number of obs. = 130, Wald chi <sup>2</sup> (13) =53.52, Prob> chi <sup>2</sup> = 0.0000,				
Correctly predicted = 68%.				

\*\*\*, \*\* and \* represents 1, 5 and 10% significance level, respectively, model output, 2012.

affecting farmers' access to input supply service, taking the value one if farmers received input supply service (improved box hive) and 0, otherwise. Thirteen explanatory variables comprising both continuous and dummy variables were included in the model. Out of these, three continuous and three dummy variables had significant influence on access to input supply service. The model correctly predicted 68% of the observations with significance wald-chi-square of 52.53 (Table 7).

Table 6 illustrates that being male-headed households have more likely to receive improved box hive from the district OoARD and/or from NGOs as males are more informed to the transferring of bee colonies to the box hive, management and inspection of box hive, harvesting of honey from improved box hive than female-headed households. Involvement in off/non-farm activities other than beekeeping may enable to earn additional income so as to purchase improved box hive for honey production improvement. Hence, smallholder farmers involved in other off/non-farm activities had significant effect on input supply service access than those who did not involved in it.

Beekeepers' residence distance from FTC had significant effect on access to improved box hive supply as it was hypothesized negative sign. The marginal effect for distance from FTC indicated that, other variables being constant, as the beekeepers reside far from the FTC by one kilometer probability of getting them improved box hive reduced by 6.1%. This implication might be as FTC is a bridge to transmit extension information through extension agents to the farmers in relation to management and inspection of improved box hive and production of honey from this type of hive. As a

result, farmers those who reside far apart from FTC have relatively less probability to get improved box hive from providing institutions than their counter parts. Similarly, since the district OoARD is the main source of improved box hive, as farmers become far from their district town it might be difficult for them to get improved box hive supply. Consequently, as farmers' residence becomes far and far from the district town, the probability of having access to improved box hive decreased.

Beekeeping experience had affected negatively input supply accessibility at 1% significant level. This result implies that the experience beekeepers' acquired is mostly traditional. More experienced farmers in traditional honey production system might be indisposed to accept new ideas and take improved box hive than less traditionally experienced beekeepers rather they are more immersed to continue with the use of traditional beehive. However, ownership of radio, TV and mobile positively affected input supply service access at 10% significant level. Ownership of radio, TV and mobile acquires knowledge concerning the relative advantage of improved box hive. Under ceteris paribus condition, 19.3% increased the probability of taking improved box hive as farmers possess at least one of these three information source.

## CONCLUSION AND RECOMMENDATIONS

Based on the findings of the study, the following recommendations are suggested to be considered by governmental and non-governmental organizations in their future intervention strategies aimed at providing



apiculture supportive services to improve apiculture produces in the study area in particular and other areas with similar settings. Extension service providing institutions should extend their extension service to the beekeepers who did not have extension service access via apiary visit, training on beekeeping improvement. Distance of beekeepers' residence from FTC limits them from extension service access; therefore, extension service need to be provided at village-levels, Churches and Mosques, at *Idir* and *Mahber*; and beekeepers should develop the habit to focus on mass Medias.

Financial institutions should primarily offer substantial village-level extension information regarding the utilization and repayment of the credit they would be borrowed and followed by credit provision to beekeepers according to their capacity to repay; otherwise it is putting them down in debt. Besides, NGOs and cooperatives are required to intervene in providing financial service to satisfy the credit need of smallholder beekeepers in the area, particularly, to beekeepers who have large number of bee colonies that helps them to purchase as a result transfer their bee colonies from traditional to improved box hive.

Great effort need to be made by the district OoARD, REST and other NGOs to adequately and timely supply improved box hive at reasonable price to every smallholder beekeepers; and extension workers must address accessories to the beekeepers seasonally, particularly honey extractor and casting mold, for the improvement of box hive productivity and honey quality. In addition, mass Media is required to broadcast the relative advantage of improved box hive over traditional beehive.

### Conflict of Interest

The authors have not declared any conflict of interest.

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