Journal of Community & Communication Research
ISSN: 2635-3318
Volume 7, Number 2, December 2022
Accessible at: https://jccr.sccdr.org

DETERMINANTS OF ADOPTION OF IMPROVED BEEKEEPING TECHNOLOGY AMONG SMALL-SCALE FARMERS IN IMO STATE, NIGERIA

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ABSTRACT

The study determined the adoption level of improved beekeeping technology among small-scale farmers in Imo state, Nigeria. The study adopted a multi-stage sampling procedure. A structured Questionnaire was randomly administered to one hundred and twenty respondents that were selected. Data were analyzed using descriptive statistics such as frequency, percentages, mean count, and the Tobit regression model. The result showed that 50.0% of honeybee small-scale farmers in Imo state were ages 41 and above. The result also revealed that the majority of the farmers were aware of improved beehive technology and the level of adoption of the two technologies was high. The respondents preferred to keep frame hive technology because of the high-quality output of honey, profitability, ease of management, and less expensive. The major sources of information to the farmers were the extension agents and their fellow farmers, while lack of finance was the major problem affecting the level of adoption. The study concluded that the major determinants of the adoption of improved beekeeping technology were age, level of education, farming experience, level of income, and extension contacts. This means that honey bee farmers' socio-economic characteristics have a lot of bearing on their ability to adopt the two technologies. The study, therefore, recommended that more awareness be created in the study area about the technology through the extension agents and that the honey bee farmers be given financial assistance by the government and NGOs to enhance honey output production.

Keywords: *Determinants of Adoption, Improved Beekeeping Technology, Small-Scale Farmers, Imo State.*

INTRODUCTION

Beekeeping is one of the most important livestock subsectors that contributes to the improvement of the livelihood of people in many countries (Uchechukwu *et al*., 2020). Conventional beekeeping practice is the major and oldest type exercised for more than thousands of years in Africa. It is characterized mainly by forest beekeeping which is common in Africa and backyard beekeeping which is practiced in the majority of the country (Amulen, 2019). This practice is associated with low productivity, and poor product quality and has been declared as environmentally unfriendly and a major threat to the sustainability of bee colonies.

This system of beekeeping especially by hanging above the long tree in the forest is not fitting with female farmers. Beekeeping is likely to be most profitable when improved beekeeping technology is used with its full packages (Berhe *et al*., 2019). Langstroth and Kenyan top bar are the two improved beekeeping technologies that involve the use of movable frame hives which is significantly more productive, profitable, and easier to manage (Berhe *et al*., 2019). The low productivity of smallholders calls for measures to provide improved technologies to bee farmers to boast honey production and productivity levels. Even though a large number of improved bee hive technology have been introduced by the government and non-government agencies over the years, the amount of bee hive technology used by farmers were very limited (Uchechukwu *et al*.,2020). Attempts have been made to improve the adoption and productivity of beekeeping by various organizations.

Despite the technical advantage of these technologies, studies have revealed that the adoption rate of such technologies by small-scale beekeepers is still unknown (Berhe *et al*, 2019). Therefore, the purpose of this study was to describe the socio-economic characteristics of the respondents, determine the awareness and adoption level of langsthrote and top-bar improved bee honey technology, the reason for adoption, source of information on the two technologies and constraints to adoption in the study area.

METHODOLOGY

The study was conducted in Imo State. The state has 21 Local Government Areas with three agricultural zones namely, Orlu, Okigwe, and Owerri. Farming is the predominant occupation of the people. The study adopted a multi-stage sampling procedure, in the first stage, four LGAs with a high potential for beekeeping were randomly selected. In the second stage, two communities were randomly selected from each of the LGAs to give a total of eight communities. In the third stage, two villages were selected to give a total of twenty-four villages. In the last stage, five respondents were randomly selected from each village making a total of 120 respondents. A structured questionnaire was used to collect information from the respondents and was analyzed using appropriate statistical tools. Objectives i, ii, iv, v, and vi were analyzed using descriptive statistics such as frequencies, percentages, and tables while a 3-point Likert-type scale was used to analyze objectives ii. Mean scores higher than 2.0 were regarded as high while mean scores lower than 2.0 were regarded as low, the procedure was used following Amadi *et al* (2020), and inferential tools such as the Tobit regression model. The level of awareness was measured using frequency and percentage while the level of adoption was measured using a 3-point Likert-type scale graded thus: adopt and still using = 3, adopt and stopped = 2, never adopt = 1. The values of the responses were added and further divided by 3 to obtain a mean score of 2.0, which was regarded as the mean level of adoption level.

Thus, mean = $\underline{X} = \sum fx/N$, (the mean score).
The mean (X) of each item was computed by multiplying the frequency of positive response to each question with its appropriate Likert nominal value and the sum was divided by the sum of the number of respondents to the items. This is summarized with the equation below:
$\overline{X} = \sum fn/N$.
Where
$\overline{X}$ = mean score;
$\sum$ = summation sign;
F = frequency or number of respondents who responded positively;
n = Likert nominal value;
N = Number of respondents.

RESULTS AND DISCUSSION

Socio-economic characteristics of the respondents

The result in Table 1 shows that 50.0% of the farmers in Imo state were between the ages of 41 and above. The mean age was 48.1 which showed that the farmers fell within the economically productive proportion of the population that is likely to favour the adoption of langsthrote and top bar. The study revealed that 97.8% had acquired one form of education or another. It enables

a farmer to seek and utilize useful information from both print and electronic media, which will speed up the rate of adoption of technologies (Agbarevo *et al*., 2019). Furthermore, 47.5% of the respondents had 1 -5 years of experience in bee farming. This implies that bee farming was at its preschooler stage in the study area. This could mean that the farmers lacked relevant skills in bee management. About 63.3% are into bee farming part-time, while 36.7% are into full-time farming, which means that the farmers practice beekeeping as a supplementary income-generating activity. About 51.7% do not belong to any cooperative society while 57.5% of them have steady extension contact. The majority (42.5%) had an annual income of 50-80,000 while the majority (40.8%) of the respondents used personal savings as capital for bee farming. This corroborates with Mbam (2019) who found that income level is an important factor in determining farmers' decision to adopt agricultural technologies.

Table 1: Socioeconomic characteristics of respondents

Variables	Frequency	Percentage
Age		
20 – 30	20	16.7
31 – 40	40	33.3
41 and above	60	50.0
Level of education		
No formal education	4	3.3
Primary education	26	21.6
Secondary education	55	46.8
Tertiary education	35	29.2
Years of farming experience		
1 – 5	57	47.5
6 – 10	9	7.5
11 and above	54	45.0
Farm involvement		
Full time	44	36.7
Part time	76	63.3
Social Organization		
Member of beekeeper association	58	48.3
Non- Member	62	51.7
Extension contact		
Yes	69	57.5
No	51	42.5
Level of Income		
50,000 – 100,000	51	42.5
101,000 – 150,000	49	40.8
151,000 and above	20	16.7
Access to credit facilities		
Personal savings	49	40.8
Loan	48	40.0
Friends/relatives	23	19.2
Total	**120**	**100**

Source: Field survey data, 2022

Level of Awareness of improved bee hive technology

The distribution of honey bee farmers according to their level of awareness of improved bee hives in Imo State is presented in Table 2. The results revealed that 75.0% of the respondents were aware of improved bee hive technology while the other 25.0% were not aware. This implies that the majority of the farmers were aware of the new technology and it is encouraging.

Table 2: Distribution of respondents according to the level of Awareness of improved bee hive technology

Variables	Frequency	Percentage
Awareness		
Yes	90	75.0
No	30	25.0
Total	**100**	**120**

Source: Field survey data, 2022

Level of adoption of improved bee hive technology

Table 3 shows the mean scores distribution of the adoption of improved bee hive technology and the result shows that the overall adoption level of langsthrote was very high with a mean score ($\bar{x}$ = 2.40) which is greater than the decision mean cut-off of 2.0 while that of top-bar was ($\bar{x}$ = 2.22) which is greater than the decision mean cut-off of 2.0 with a grand mean ($\bar{x}$ = 2.31) which is also greater than the decision mean cut-off of 2.0. It is also expected that high adoption would bring about improvement in the health and economic condition of the farmers and eradicate boost livelihood in the study area. This agrees with the findings of Amadi *et al*., (2020) that low or non-adoption could be conditioned by institutional and structural factors, such as social networks and the market structure of seed systems.

Table 3: Mean responses of the respondents on the adoption of selected improved bee hive technology

Variables	Adopt and still using	Adopt and stopped	Never adopt	Total	Mean
Langsthrote (frame hive)	79(239)	8(16)	33(33)	288	2.40
Top-bar	68(204)	10(20)	42(42)	266	2.22
Grand mean					**2.31**

Source: Field survey data, 2022

Reasons for adoption level of improved bee hive technology

It also indicates in Table 4 that 53.3% and 50.0% of the respondents preferred to keep farm hive technology because a high quality output of honey is being harvested and its profitability while 50.0% and 47.5% preferred top bar hive because it is easy to manage and less expensive. This implies that good technology increases adoption.

Table 4: Distribution of respondents based on the reasons for adoption of improved bee hive technology

Reasons	Frame Hive		Top-bar	
	Frequency	Percentage	Frequency	Percentage
Honey output	64	53.3	42	35.0
Easy to manage	52	43.3	60	50.0
Profitable	60	50.0	56	46.7
Less expensive	38	31.7	57	47.5
Total		**100**		**100**

Source: Field survey data, 2022 *Multiple responses recorded

Sources of information to awareness of improved bee hive technology

The results in Table 5 showed that the major sources of information to the respondents were the extension agents 48.3%, and 26.7% of the farmers received their own information from other bee farmers. This is expected as the extension provides farmers with information on newly developed technology, availability, and technical skills for using it. Extension contact would inform and build the capacity of farmers, increasing their knowledge and reducing their uncertainty in decision-making, and positively influencing the adoption and continued use of agricultural technologies.

Table 5: Distribution of respondents according to sources of information to awareness of improved bee hive technology

Sources of Information	Frequency	Percentage
Private consultant	9	7.5
Radio/ Television	9	7.5
Fellow bee farmers	32	26.7
Cooperative society	12	10.0
Extension agents	58	48.3
Total	**120**	**100.0**

Source: Field survey data, 2022

Challenging factors to the adoption of improved bee hive technology

Table 6 below revealed that constraints such as lack of finance (67.5%) were the major problem affecting the level of adoption of improved beekeeping technologies. This was followed by access to loans as indicated by 48.3% of the respondents. This result collaborated with Amadi *et al*., (2020) who reported that the availability of finance and loan is essential to the adoption of innovation and credit makes it easy for farmers to use new technologies and even extension services

Table 6: Challenging factors to adoption of improved bee hive technology

Variables	Frequency	Percentage
Difficulties in accessing loans to purchase the equipment	58	48.3
Lack of finance	81	67.5
Skilled manpower	36	30.0
Lack of information about the improved bee hive technology	21	17.5
Poor access to the equipment	18	15.0
High cost of the equipment	49	40.8
Total	**120**	**100.0**

Source: Field survey data, 2022 *Multiple responses recorded

Tobit Regression estimates of determinants of adoption of langsthrote and top-bar in Imo state.

The influence of socio-economic characteristics of small-scale honey bee farmers on the adoption of langsthrote and top-bar improved bee hive technology in Table 7 was analyzed using the Tobit regression model. The R^2 value (0.7151) for langsthrote implies about 71.5% of the variation and R^2 value (0.5241) for the top bar which implies that about 52% of the variation in the adoption of langsthrote and top-bar was explained by independent variables and Chi^2 was highly significant at 1% level of probability respectively indicating goodness of fit. The result indicated that age, level of education, farming experience, level of income, and extension contact were the factors that were significantly related to the langsthrote and top-bar improved bee hive technology in the Imo state. This implied that small-scale honey bee farmers' socio-economic characteristics have a lot of bearing on their ability to adopt the two technologies. Specifically, the coefficient of age was significant at a 5% level of probability and was positively related to the adoption of the two technologies. The implication of the results is that increase in age is an added advantage to adoption. This result disagrees with that of Berhe *et al.* (2019) that new crop varieties are more likely to be adopted by younger farmers because the youth are more likely to be risk takers and therefore try new innovations. Similarly, education was positive and highly significant at 1% for langsthrote and top-bar respectively. The coefficient of education had a positive effect on the adoption of the two technologies and as a result output of honey gets increased in the study area. Ekweanya *et al* (2020) and Agbarevo *et al*., (2019) suggested that as farmers' education level improves, they are likely to adopt and utilize technology. The coefficient of farming experience was positive and highly significant at 1% for langsthrote and 5% for top-bar technology. This concurs with the submission of Amadi *et al*., (2022) that increased experience influenced the adoption of new technologies. Similarly, the level of income and extension contact were positive and highly significant at 1% for langsthrote and top-bar

respectively. It can be adduced that an increase in income increases the probability of the adoption of improved technology by farmers. This is in line with *a priori* expectations. An increase in farm income is expected to boost the adoption of agricultural technologies because a poor farmer may not readily adopt an innovation that is too expensive. This agrees with the report of Ohakam and Akpomi (2018) that increased income increases farmers' level of adoption and utilization of new technologies. This is also in line with *a priori* expectation as the extension provides farmers with information on availability and technical skills for using it. Access to the extension has been widely reported to positively influence the adoption and continued use of agricultural technologies (Amadi *et al*., 2020) and Agbom (2016).

Table 7: Tobit Regression estimates of Determinants of adoption of selected improved bee hive technology

Variables	Langsthrote	Top-bar
Constant	0.3866(2.74)**	2.256521(0.033)**
Age	1.9153(5.76)**	.085(2.525) **
Level of education	.3150691(0.004)***	.2510157(0.010)***
Farming experience	0.0139(5.07)***	.507(.260)**
Level of income	.0675293(0.001)***	0.01253(5.02)***
Extension contacts	735 1(12.710)***	.169 (4.369) ***
Chi^2 (X^2)	67.09***	54.09***
Pseudo R^2	0.7151	0.5241
Log Likelihood	-131.2075	-30.307

Source: Field Survey data, 2022

Note: *Figure in parenthesis represent t-ratios; ***= significant at 1%, **=significant at 5%, *= significant at 10%.*

CONCLUSION/RECOMMENDATIONS

This study concluded that the majority of the farmers were aware of improved bee hive technology and there was a high level of adoption of the two technologies among farmers in the study area. It was also concluded that the farmers preferred to keep frame hive technology because the high-quality output of honey is being harvested, profitable, easy to manage, and less expensive. More so, major sources of information to the farmers were the extension agents and their fellow farmers while lack of finance was the major problem affecting the level of adoption of improved beekeeping technologies. The study concluded that the major determinants of the adoption of improved beekeeping technology were age, level of education, farming experience, level of income, and extension contacts and this means that honey bee farmers' socio-economic characteristics have a lot of bearing on their ability to adopt the two technologies. The study, therefore, recommends that more awareness be created in the study area about the technology through the extension agents and that the honey bee farmers be given financial assistance by the government and NGOs to enhance honey output as well.

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