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ASSESSMENT OF THE PROFITABILITY OF IMPROVED APICULTURE IN FEDERAL CAPITAL TERRITORY (FCT) ABUJA, NIGERIA

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ABSTRACT

Sustainable increase in honeybee production and productivities is *sine qua non* to bridge honey products gaps in Nigeria and a path to self-sufficient in food production and conservation of ecosystem through honeybee pollination service. The study was undertaken to assess the profitability of improved apiculture among bee farmers in Abuja, Nigeria. A purposive sampling technique was used to select 140 bee farmers from three area councils of Federal Capital Territory (FCT) Abuja namely, Abaji, Bwari and Kwaliin. The data were analyzed using descriptive statistics, Farm budgeting techniques and t-test inferential statistic. Results revealed that all bee farmers were male and between the age range of 30-39 years with a mean of 37. The average household size was 6. About 63% of the bee farmers had a secondary education, indicating that they are largely literates. The estimated net farm income of beekeeping per hive of 0.7m^2 was ₦27, 514.56 and the returns to naira invested of 1.65. The calculated t value of 6.34 was greater than the t critical one-tail (1.65) and the t critical two-tail (1.96). About 35% of the beekeeping farmers had an annual income of ₦300, 000–399,999 from their beekeeping enterprise with a mean of ₦309,671.43. The constraints were ranked from most critical. Bee farmers should be trained by extension agents on modern beekeeping to adopt technology capable of improving the life of bee households, and sustain bee resources for future generation. Beekeeping farmers should also leverage beekeeping association as an avenue to access finance, inputs, technical information and market.

Keywords: Apiculture, credit, extension service, Kenya Top Bar, Nigeria

INTRODUCTION

Apiculture is the art of rearing, breeding and managing honeybee colonies in artificial hives for economic gains (Shu'aib *et al*., 2009), which leads to the production of valuable materials such as honey, bee wax, propolis, bee pollen, bee venom and royal jelly (Oladimeji *et al*., 2017a). Globally, there is a growing consumption of honey and other bee products because of its high values in maintaining good health and in treatment of various diseases (Onwubuya *et al*., 2013; Ajao *et al*., 2014).

Apart from honey and other by-products derived from honey bee, estimates suggest that between 35 percent and 73 percent of the world's cultivated crops are pollinated by some varieties of bees indicating that most of the plant species rely on bee insects for pollination (Klein *et al.*, 2007; Harshwardhan *et al.*, 2012; Oladimeji *et al.*, 2017b). Honeybees also provide numerous benefits to the natural environment and capable of providing pollination services to a wide variety of crop species with an estimated annual contribution valued at $3.1 billion (Morse *et al*., 2000; Oladimeji *et al*., 2017b). Hence, bee production has a critical role in maintaining biodiversity and sustains the environment, that is, the ability of natural ecosystems to maintain their biological processes and functions. Furthermore, it also provide social and economic sustainability which implies the ability to meet our own needs without compromising the needs of future generations and just and equitable use and re-use of resources respectively. It suffices to note that bees are renewable resources whose stock can be replenished. However, their renewability critically depends on the quality of management they are subjected, to maintain maximum sustainable yield (Oladimeji *et al*., 2014). Proper management of natural resources particularly flora and water resources are critical for bee sustainability as they can be a driver for sufficient food and achievement of global Sustainable Development Goals (SDGs) (Oladimeji and Abdulsalam, 2014).

In most ecosystems, bees (Hymenoptera: Apidae) are the primary pollinators of flowering plants. The species (Apis mellifera) has shown great adaptive potential, as it is found almost everywhere in the world and in highly diverse climates. In a context of climate change, the variability of the honey bees life history traits as regards the environment shows that the species possesses such plasticity and genetic variability that this could give rise to the selection of development cycles suited to different environmental conditions (Mazeed, 2004, Rattanawannee *et al.*, 2010; Oladimeji *et al.*, 2017b).

In spite of the favorable climatic and socio-economic environment, low-cost and sufficient availability of flowering plants and manpower in tropical countries, most developing countries including Nigeria have not tapped the available apicultural potential optimally. With the current growth in domestic consumption of honey in Nigeria and growing demand in the international market, the future of apicultural enterprise is very bright as the demand for honey is bound to increase, it could provide food, nutritional, and livelihood security to the rural work force on an ecologically sustainable basis. Ojo (2004) opined that apicultural practices needs relatively small investment capital and most of the equipment needed for modern beekeeping can be sourced locally. In beekeeping, the quality of land required is less important because hives are placed either on the trees or on the ground. It is also not competing with other enterprises for resources as the bees use nectar and pollen grains of plants.

The FCT Abuja has a vegetation and climatic condition that is favourable to beekeeping activities. The vegetation of the study area is of guinea, woodland and derived savannah, with trees like *Parkia biglobosa, Butyrospermum parkii, Azadiracta indica, Mangifera indica, Acacia species Delonix regia, and Anacardium occidentale* (Ajao *et al.,* 2014a & b). These species of trees provide forage for the honeybees, however despite this fact, these natural resources are not being maximally utilised. Most beekeepers involved in honey production in the study area are not utilizing all the bee products but are mostly interested only in honey and bee wax extraction.

There is scanty data in beekeeping related research with respect to the level of profitability contribution of beekeeping especially to household income in the study area. Based on the foregoing, this study intends to answer the following objectives:

(i) describe the socio-economic characteristics of the beekeepers,
(ii) determine the profitability of beekeeping,
(iii) contribution of beekeeping to household income
(iv) identify the constraints faced by beekeepers in the study area.

Hypothesis

i. Bee-keeping is not profitable in the study area.

The use of modern bee hives: Modern movable- frame hive consists of precisely made rectangular box hives (hive bodies) superimposed one above the other in a tier. The number of boxes varied seasonally according to the population size of bees. The commonest modern hives used in the study area include the top bar and the Langstroth hives. The Kenyan Top Bar (KTB) hive is originated from Kenya. This is the most recommended type of hive for the beginners (Figure 1). KTB hive aimed to obtain the maximum honey crop, season after season, without harming bees (Nicola, 2002; Oladimeji *et al.,* 2017a).

The Langstroth Hive: The Langstroth hive is the most productive of all the type of hives used in the study area (Fig. 2). This hive unlike the Kenyan top bar and other hives is made up of detachable components namely, the hive cover, the inner cover, the super chamber, the queen excluder, the brood box and the floor board. In the super chamber(s) and the brood box there are some moveable frames that are fitted with wax foundations. The hive cover acts as the roof of the hive and is usually made of a metal sheet. The rest of the part is made of wood except the queen excluder that is made up of metal gauze with holes that only permit worker bees to pass through. The gauze is fitted into a wooden frame. Unlike in the KTB hive, the brood chamber is specifically meant for brood rearing. Looking at the structure of the hive you would notice that this brood chamber or hive body is the largest in terms of volume. This has been designed so that enough brood and food (honey) is available in required proportions in the hive at any time of the year since the beekeepers are not going to disturb the chamber.

Fig. 1: The Kenya Top Bar hives (KTB)

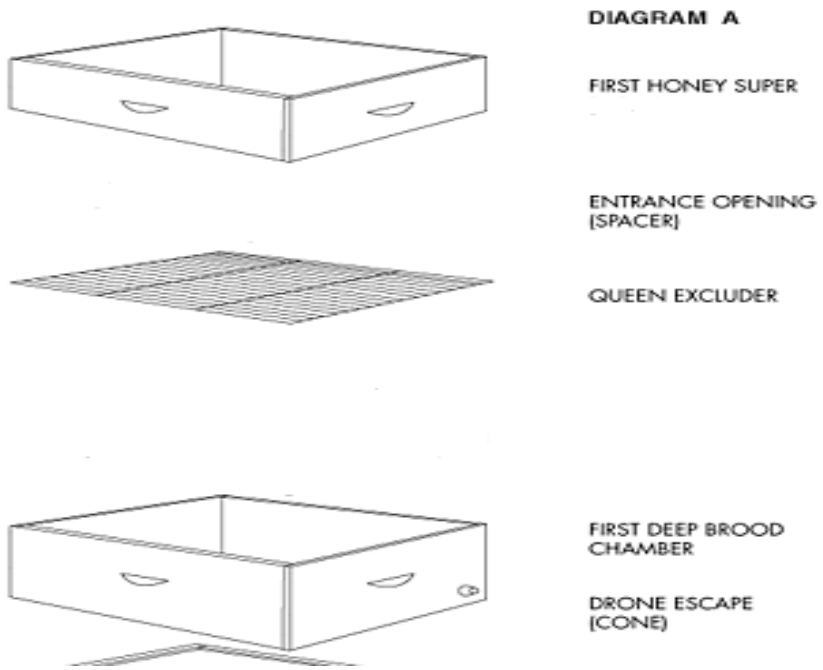

Fig. 1: The Langstroth Hive

During harvesting, the beekeeper is not supposed to disturb the brood box so that he/she leaves enough honey for the brood and the swarm in the brood box. The brood box is usually separated from the super chamber by a queen excluder. Since the beekeeper is not supposed to harvest honey from the brood box, the queen excluder serves the right purpose to ensure that the queen is confined to the brood box. Combs in the super should not at any given time have brood. If this happens when the queen excluder is on then it would mean that investigations should be carried out. It might be that the colony is now queen less and a worker bee is now laying eggs or that the excluder might be damaged as to allow penetration by the queen. The queen's confinement to the brood box guarantees the probability of the beekeepers

acquisition of honey only from the super(s) during harvesting. The movable frames fitted in the super and brood chambers are designed to allow standardized comb building and the availability of bee space between the combs. Wax foundations for the Langstroth frames are fitted to the frames, to the bees they appear as unfinished combs and hence would encourage the bees to finish them off-thereby encouraging productivity (BKAZ, 2013).

Figure 2: A typical KTB hives in a farm (Source: Onwubuya *et al*. (2013).

MATERIALS AND METHODS

Study Area: Abuja the Federal Capital Territory (FCT) was formed in 1976 from parts of former Nasarawa, Niger, and Kogi States and it is in the central region of Nigeria. It is bordered to the north by Kaduna State, to the east by Nassarawa State, to the south-west by Kogi State and to the west by Niger State. It lies between latitudes 8º 25'N and 9º 20'N and longitude 6º39' and 7º 45' East of the Greenwich meridian (NPC, 2006). It covers a land mass of about 8,000 sq. km. (Abuja master plan, 2000) and has a current projected population from NPC, (2006) of 2,514,738 at 3.2 % national population growth rate. The FCT is divided into six area councils namely, Abaji, Abuja Municipal, Bwari, Gwagwalada, Kuje, and Kwali (Fig. 3). The vegetation of the FCT is normally classified as park savannah, with scattered trees, pockets of guinea, woodland and derived savannah; which is suitable for modern beekeeping activities. Its temperature ranges from 30.4ºC and 35.1ºC. Mean annual rainfall is about 1400 mm (Abuja master plan, 2000).

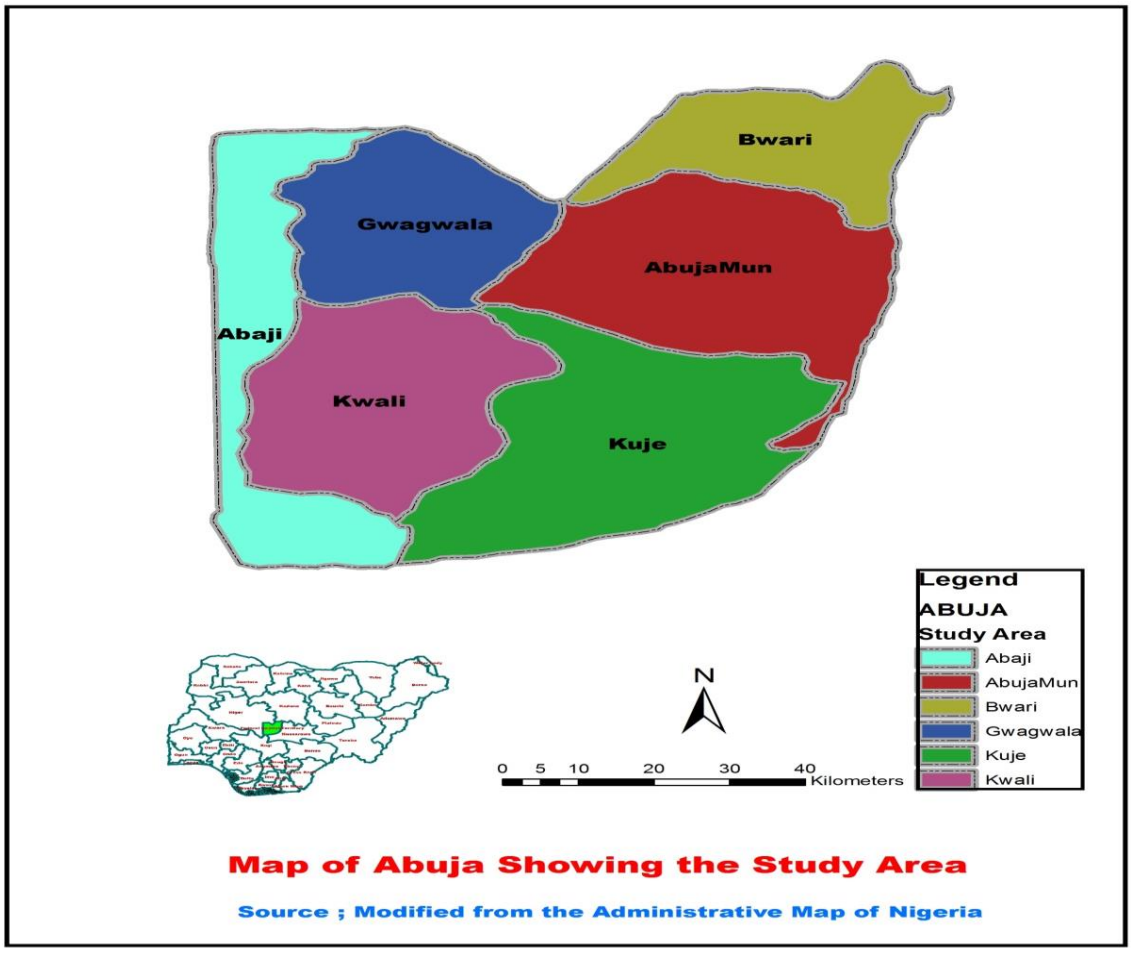

Fig. 3: Map of Abuja FCT showing the study area

Data Collection, Sampling Size and Sampling Techniques: Primary data were collected with the aid of structured questionnaire. Information was collected on: households' socio-economic characteristics input and output prices and constraints faced by beekeepers. The modern apiculture farmers in Abuja FCT were the target population for the study. A purposive sampling technique was employed for selecting the bee farmers. Three area councils: Abaji, Bwari and Kwali from the list of six area councils were purposively selected, because of the predominance of beekeepers in the 3 area councils. This was discovered based on reconnaissance survey conducted in the area. In the second stage, two villages each were randomly selected from the list of villages identified on beekeeping activities and all the bee farmers in each of the villages were sampled which results in a total of 140 respondents as shown in Table 1.

Table 1: Distribution of Bee Farmers

Area Councils	Villages	Sample Frame
Abaji	Yaba	22
	Gawu	14
Bwari	TunganBijimi	31
	GidanJaba	27
Kwali	Chikuku	20
	LeleyiGwari	26
Total		**140**

Source: Reconnaissance survey, 2013/14

Analytical Techniques: This involved the use of percentages, means, frequency distributions and standard deviations to describe the socio-economic characteristics, honey output and wax production. Net farm income was used to evaluate the cost and return to obtain a net profit. The equation for net farm income is given as

$$NFI = TR - (TVC + TFC) \qquad (1)$$

Where: NFI = Net Farm Income (₦), TR = Total Revenue (₦), TVC =Total Variable Cost (₦), and TFC =Total Fixed Cost (₦). The fixed inputs were depreciated using the straight line method.

RESULTS AND DISCUSSION

Socio-economic Characteristic of Respondents

The sampled respondents in Table 1 were males which imply that beekeeping in the study area is a male dominated activity. Ajao and Oladimeji, (2015), Oladimeji *et al.* (2017b) also reported dominance of males in honey hunting and beekeeping in Kwara State, Nigeria. The result also indicates that majority of the respondents (95.6%) were married, an indication of the availability of family labour for their bee farming *ceteris paribus* and also, a motivation for active participation in beekeeping to generate income for meeting the needs of their families. This is in line with Famuyide *et al*. (2014) and Oladimeji *et al.* (2017a) that found 79.4% and 92.2% of the bee farmers married in Oyo and Kwara State respectively.

The result of the distribution of the respondents based on age in Table 2 shows that majority of the respondents (98.6%) were within the active age of 20– 59 years with a mean age of 37. This implies that most of the respondents can participate actively in the day to day running of their beekeeping enterprise, can readily adopt better agricultural technologies for enhancing their productivity as they may not be risk averse like older farmers. This is in line with Oluwatosin (2008) and Tijani *et al.* (2011) who reported the modal age of beekeepers in Ekiti State was 31 – 40 years and 31-35 in Chibok Local Government Area of Borno State respectively.

The result of the distribution of the respondents based on educational status as presented in Table 2 shows that the bulk of beekeepers (62.9%) had secondary educational qualification and also, 10.7% had tertiary educational qualification indicated that the beekeeping farmers have a good educational status. This is similar to the findings of Ezekiel *et al*.

(2013) and Oladimeji *et al.* (2017a) that reported majority 90% and 68% respectively of the bee farmers in Oyo and Kwara States had educational background.

Table 2: Socioeconomics characteristics of bee Farmers

Variables	Range	Frequency	Percentage	Cum. Freq.
Gender	Male	140	100	140
	Female	0	0	**140**
Marital status	Married	134	95.6	136
	Single	6	4.4	**140**
Age	20-29	14	10	14
	30-39	88	62.9	102
	40-49	29	20.7	131
	50-59	7	5.0	138
	60 & above	2	1.4	**140**
	mean	37		
Education	No formal education	12	8.8	12
	Primary education	25	17.9	37
	Secondary education	88	62.9	125
	Tertiary education	15	10.7	**140**
Household size	1-5	74	52.9	74
	6-10	58	41.4	132
	>10	8	5.7	**140**
	Mean	6		
Bee farming exper.	1-3	63	45.0	63
	4-6	43	30.7	106
	7-9	24	17.1	130
	>9	10	7.1	**140**
	Mean	8		
No. of Beehives	1-20	26		26
	21-40	65		91
	>40	49		**140**

The result of the frequency distribution of the respondents based on household size as presented in Table 2 shows that majority (52.9%) of the bee farmers had household size of 1–5 persons with the mean household size 6 persons. This is comparable to the finding of Onwumere *et al.* (2012), Oladimeji and Ajao, (2015) bee farmers' household size in Abia and Kwara State respectively. The result of the distribution of the respondents based on number of beehives shows that the average number of beehives owned by the bee farmers in the study area was 36 beehives and this implies that a larger proportion of the bee farmers had high number of beehives suggesting that beekeeping farming is prevalent in the study

area. This does not conform to the findings of Oladimeji *et al*. (2017b) who found an average of 60 beehives per modern bee farmers in Kwara State.

Costs and Returns of Beekeeping

The result presented in Table 3 shows the average costs and returns of beekeeping per 2,500 m^2 (6 hives) which was largely the KTB hive of 4 feet length and 2 feet width in the study area and the farmers owned an average of 36 beehives.

Table 3: Costs and returns of beekeeping of 50m by 50m per production cycle

Variables	Items	Amount (₦)	% TVC or TFC	%TC
A. Variable	Cost of labour	7, 188.00	59.2	36.51
	Cost of transportation	1, 550. 33	12.8	7.88
	Cost of bait materials	2, 300.21	18.9	11.68
	Cost of package materials	1, 100.50	9.1	5.59
	Total Variable Cost (TVC)	**12, 139.04**	**100.0**	**61.66**
B. Depreciation	Beehive	2, 129.44	28.2	10.81
of fixed items	Hive stand	1, 800.00	23.9	9.14
	Honey extractor	350.14	4.6	1.78
	Smoker	821.55	10.9	4.17
	Uncapping knives	95.60	1.3	0.49
	Uncapping trays	188.11	2.5	0.96
	Bee garment	561.94	7.4	2.85
	Rent	1,600	21.2	8.13
	Total Fixed Cost (TFC)	**7, 546.78**	**100.0**	**38.3**
	Total Cost (TC)	19, 685.82		100.0
C. Revenue	Av. honey output (litre)	56.7		
	Unit price	700.0		
	Revenue from honey	39, 680.28		
	Bee wax output	50.1		
	Unit price of bee wax	250.0		
	Revenue from bee wax	12, 520.10		
	Total Revenue	52, 200.38		
	Net Farm Income (NFI)	27, 514.56		
	RNI (NFI/TC)	1.65		

Test of hypothesis

The result presented in Table 4 shows that the difference between the average returns of beekeeping per 2, 500m^2 (₦52, 200.38) and the average cost of beekeeping (₦19, 685.82) is statistically significant at 1% level of significance. The calculated z value of 6.34 was greater than the z critical one-tail (1.65) and the z critical two-tail (1.96). This result implies that bee farming is profitable in the study area and therefore, the null hypothesis was stated as ‘‘beekeeping is not profitable in the study area’’ was rejected and the alternate was accepted.

Table 4: Z test result between costs and returns of beekeeping

Items	Costs (₦)	Returns (₦)
Mean	19, 685.82	52, 200.38
z-calculated	6.34***	
Z Critical one-tail	1.65	
Z Critical two-tail	1.96	

NB: *** Implies 1% level of significance

Contribution of Beekeeping to Household Income

The result presented in Table 5 shows that majority (35%) of the beekeeping farmers had an annual income of ₦300, 000 – 399, 999 from their beekeeping enterprise which is an indication that the beekeeping is a good income generating enterprise in comparison with the national civil servants minimum wage of ₦216, 000 per annum (₦18, 000 per month) in Nigeria. This is closely followed by 33.6% of the respondents with an income of ₦200, 000 – 299,999. The least proportion of the farmers (1.4%) had annual income of ₦1 – 99, 999 and above ₦ 499, 999. The mean annual income of the beekeeping farmers was ₦ 309, 671.43 and this suggests that it possess the potential for generating high income in the study area if resources are properly managed.

Table 5: Distribution of respondents based on total income from beekeeping enterprise

Total income (₦)	**Frequency**	**Percentage**	**Cum. Freq.**
1,000-99,999	2	1.4	2
100,000-199,999	13	9.3	15
200,000-299,999	47	33.6	62
300,000-399,999	49	35.0	111
400,000-499,999	27	19.3	138
>499,999	2	1.4	140
Total	140	100.0	-
Mean	309,671.43		

Constraints Encountered in Beekeeping

A number of constraints were enumerated by the respondents as shown in Table 6. The constraints were ranked from most critical (Inadequate capital (69.3%)) to the least poor market price (15.7%). Several studies- Onwumere *et al.* (2012), Ajao and Oladimeji, (2013); Ajao and Oladimeji, (2017), Oladimeji *et al.* (2017b) observed similar results among bee farmers in Oyo and Kwara State respectively.

Table 6: Frequency distribution of the constraints in beekeeping

Constraints	Frequency	Percentage	Rank
Inadequate capital	97	69.3	1st
Theft	73	52.1	2nd
High cost of labour	63	45.0	3rd
Absconding of bees	56	40.0	4th
Inadequate extension	54	38.6	5th
Bee aggressiveness	38	27.1	6th
Access to improved technology	35	25.0	7th
Poor market price	22	15.7	8th
Total	437*		

NB: The total frequency exceeded the sample size due to multiple responses

CONCLUSION AND RECOMMENDATIONS

Sequel to the findings of the study, it can be concluded that beekeeping is a profitable enterprise with huge potentials for contributing immensely to household income and poverty alleviation in the study area. Thus it can be exploited for job creation, income generation and enhancement of well-being of the farmers coupled with the high demand for beekeeping products especially honey. The following recommendations have emanated from the findings of the study so as to enhance beekeeping production in the study area:

1. The study has established that beekeeping is a male dominated farming activity since all the beekeepers were males. Based on this result, it is strongly recommended that women should be sensitized on the opportunities in bee farming and also, trained on the technical know-how of beekeeping so that they can take advantage of the opportunities (income generation and poverty reduction) that beekeeping in the study area.
2. The result of this study has revealed that beekeeping is a profitable farming activity that contributed a significant income to the beekeepers. Hence, beekeeping is a viable income generating activity that can create jobs for the teeming unemployed youths and it is therefore recommended that it should be integrated in the Youth Empowerment in Agriculture Program (YEAP) in the study area.
3. Inadequate capital was the major constraint limiting beekeeping in the study area as indicated by the bee farmers and therefore, it is recommended that the bee farmers should leverage beekeeping association as an avenue to access finance, inputs, technical information and market.
4. The problem of inadequate agricultural extension has to be properly addressed in view of the vital role of extension. Hence, bee farmers should be trained by extension agents on modern beekeeping to adopt technology capable of improving the life of bee households, and sustain bee resources for future generation. And also, the beekeeping farmers should take advantage of the print media (extension bulletin) and electronic media (radio, television) to access information on sustainability of beekeeping.

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