Analysis of The Economic Benefit of Bee Keeping Among Rubber Farmers in Ogun State, Nigeria: A Strategy for Poverty Alleviation

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Abstract: The study analysed the economic benefits of beekeeping among some rubber farmers in Ogun State, Nigeria. Beekeeping otherwise called apiculture requires little for its investment, mainly construction of hives and protecting the hives from fire through fire tracing. The honey produced by the bees is very important for human use, both as food and medicinal purposes. This is in addition to the effective role the bees themselves play in crops pollination during their search for nectar. The study was a pilot study aimed to introduce and educate the rubber farmers on the modern method of apiculture in order to optimise their economic benefits from the rubber farming. Data were collected through the use of questionnaire from ten randomly selected rubber farmers in four villages from two Local Government Areas of the state. Farm location, number of beehives installed, honey produce (litters) per annum and the revenue generated from sales of the honey, age of respondents, educational level and household size were the data collected for the study. Both descriptive and inferential statistical tools were used to analyse the data. The results of the analysis revealed that a total of 899.83 litters of honey was produced and generated total revenue of 2,208,921.00 annually by the respondents. Gini-Cofficient was used to examine the revenue distribution among the respondents and result indicated a high level of inequality (GC = 0.374). The R^2 of the regression result was 0.992, implying 99.2% of the variation in the dependent variable (Revenue) was jointly explained by the independent variables used in the model. The coefficients for age (experience), level of education and quantity of honey produced were positive and significant at 1% level of probability; while household size and farm location had negative coefficients and not significant. Thus the business of apiculture in the study area was economical.
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1. Introduction

Beekeeping is one of the mini-livestock farming system technology practiced among some tree crops farmers. A honey bee is a member of the genus *Apis*, primarily distinguished by the production and storage of honey in constructed perennial colonial nests from wax (Kedar, Shiva and Resham, 2016). Currently only 7 species of honeybee are recognized as the best known honey bee species *Apis mellifera L.* (western honey bee) which has been domesticated for honey production and crop pollination. Honey bees present only a small fraction of roughly 20,000 known species of bees, but only members of the genial *Apis* are true honey bees (Babatunde and Omotesho, 2008). Beekeeping otherwise called apiculture involves the process of making bee hives, installing the hive in strategic locations attractive for bees to colonies. Managing the colonised hives may require ensuring availability of water not more than 1 kilometre away from the site and also to do fire tracing to prevent fire hazard on the farm. There are many benefits man derives from apiculture, this include pollination of crops by the bees, production of different products like Royal jelly, bee pollen, bee propolis, bee venom and bees wax among others. Apiculture is also a means of land maximisation system whereby small farm holders can optimise the land utilization by beekeeping to provide other food necessities in addition to his crops produce. It thus enhances economic status and social wellbeing among the farmers.

Honey is used for different purposes by humans since time immemorial. It can be consumed directly after harvest or as an ingredient in meals as well as for medicinal purposes such as anti-bacterial substance. Kedar, Shiva and Resham, (2016) reported that Manuka honey, a product from New Zealand, is particularly efficacious and has proven to kill over 250 types of bacteria. Beeswax is used for making candles for millenia. It is a sealant from moisture, hence used as a coating material on leather and fabrics. This implies that the significance of apiculture in the economic development of a nation that recognised the resource cannot be over emphasized. For instance, the Commercial Beekeeping in Agriculture is a big business in the United States as it has a direct connection to one in every twelve jobs in the country. Since the early twentieth century, 'migratory' beekeepers have provided a critical service to U.S.

agriculture by moving their hives seasonally to pollinate a wide variety of crops. According to Nicola (2017), commercial beekeeping adds between $15 and $20 billion in economic value to agriculture each year to U.S.

Globally, honeybees provide important natural products and services to man and plants by being very active pollinating agents. This is because most plants are totally dependent on certain types of bees for reproduction. The honeybee is unique in its activities as it focuses on particular plants at a time in every outing. A single honeybee can pollinate thousands of flowers daily (Kedar, Shiva and Resham, 2016).

According to Kedar, Shiva and Bahadur (2016), Bee pollination is considered the most essential service in regulating and supporting the cultural ecosystem as bees pollinate over 70% of valuable crops directly consumed by man. This implies that decline in the population of honey bee will directly affect the yield and production of many crops.

Nigeria has a total land area of 98,321 million hectares of which only about 200,000 hectares are under rubber cultivation with a declining yield of 90,000 tonnes per annum coming mainly from old and aging plantations. Ogboloagha, F. Nkechinyere (2002), explain that agriculture is the economic backbone of most rural areas in developing countries. In an attempt to promote rubber production in Nigeria, the Agency, Common Fund for Commodities (CFC) in collaboration with Federal Government Nigeria initiated policies and programmes to motivate farmers to increase rubber production. Some of these were the programme to cultivate 360,000 hectares of land in Nigeria over a period of 12 years, from 2006 to 2017, distribution of farm inputs for both crops and mini-livestock production (RRIN, 2008). Rubber Research Institute of Nigeria (RRIN) whose mandate is to develop and promote the production of rubber in Nigeria, is always finding ways of encouraging farmers to rekindle their vigour and interest in rubber business. One of the recognized impediments to farmers' interest is the long gestation period of rubber (7 years). In order to break this impediment, RRIN had to develop some farming technologies – the intercropping and mix farming with rubber crop to guarantee farmers some economic benefits before and even after the gestation period of rubber. One of these technologies is the mini-livestock (Beekeeping)/apicultural farming system which can be effectively done even after the rubber canopy closes purposely to empower the rubber farmers.

Apiculture requires little resources to start it, thus it is viewed as a key instrument for empowering the poor resource rubber farmers with it. Stephen (1990) and Kobra, L; Ahmad, S and Shohred G. (2011) suggests that empowerment is to increase the strength of individuals, or communities in order to be more effective and efficient spiritually, politically, socially and economically. It can also mean to develop confidence in one's own capacities, to gain skills and knowledge that will allow them to overcome obstacles in life.

Literatures on honeybees/beekeeping have shown that it can be a source of empowerment to small scale farmers as it has enamours direct and indirect contributes to food production systems. According to the Natural Resources Defence Council (NRDC), in U.S. about $150 million is realized from honey annually, and in the UK also, at least 70 crops are known to be dependent on bee pollination for production (Tijani, B.A; Ala, A.L; Maikasuwa, M.A and Ganawa, N.; 2011; and Ogboloagha, F. Nkechinyere, 2002).

In Nigeria, there is no reliable data as to the economic benefits derived from honeybees. Thus as a matter of deliberate policy, RRIN initiated a pilot study on beekeeping among rubber farmers with case studies in south-south and south – west Nigeria. This particular study was carried out in Ogun State (South-West Nigeria); first to sensitize farmers for the need to domesticate honey bees and the keeping of data for reference purposes.

2. Material and Methods

The Study Area: Ogun State is located in the South –West Nigeria; a rain forest zone characterized with thick forest that favours honey bee production. The State has a total hectarage of 19,706.00 hectares of land under natural rubber cultivation with 17,807.00 as estate and 1,899.00 hectares under smallholders. The State was selected as one of the pilot study on apiculture. Waterside and Ikenne Local Government Areas in the State were purposively selected for the study. These Local Government Areas are known to have more than 80% of rubber crops grown in Ogun State (RRIN, 2008).

Sampling Procedure and Sample Size: Being a pilot study, a purposive sampling of 3 villages in Waterside LGA, namely; Ilushin, Ayila and Ibiade were considered, while Ikenne town in Ikenne LGA was chosen for the study. In Ilushin and Ibiade villages, 3 rubber farmers were randomly selected each, while 1 in Ayila village. This was based on the rubber farms distribution in the LGAs. There were also 3 rubber farmers randomly selected in Ikenne LGA for the study. This gives a total of 4 villages and 10 rubber farmers selected. The selected farmers were each given a constructed bee hive (Kenya Top bar hive), installed in their farms and a complete harvesting kit in 2010 by Rubber Research Institute of Nigeria (RRIN) to serve as demonstration apicultural farms in the areas. The locations of each farmer's farm

were identified on the global map using GPS for record purpose as indicated in Table 1.

Data Collection and Analysis: The study therefore collected data on the average production of honey produce and economic value of the produce. The data were analysed using inferential and descriptive statistics models in order to evaluate the economic impact of beekeeping among the selected rubber farmers.

3. Results and Discussion

Table 1: Output and Revenue from the 10 Pilot Rubber Farmers/Apiculturists selected in Ogun State

GPS/ location of Bee hives	Village	LGA	No. of Hives		Output/Annum (Litter)	Unit Price (₦)	Total Revenue (₦)
			2012	2018			
N06o31.831 E004o22.881	Ilushin	Waterside	1	8	85.05	2,500.00	212,625.00
N06o32.081 E004o24.601	Ilushin	Waterside	1	10	60.32	2,500.00	150,800.00
N06o31.931 E004o23.861	Ilushin	Waterside	1	7	100.12	2,500.00	250,300.00
N06o33.991 E004o33.711	Ayila	Waterside	1	8	95.71	2,500.00	239,275.00
N06o32.231 E004o17.971	Ibiade	Waterside	1	10	96.34	2,500.00	240,850.00
N06o31.051 E004o17.521	Ibiade	Waterside	1	14	120.25	2,500.00	300,625.00
N06o31.471 E004o17.511	Ibiade	Waterside	1	4	40.75	1,700.00	69,275.00
N06o50.101 E003o41.031	Ikenne	Ikenne	1	5	80.52	2,500.00	201,300.00
N06o50.081 E003o40.851	Ikenne	Ikenne	1	11	140.23	2,500.00	350,575.00
N06o50.341 E003o40.971	Ikenne	Ikenne	1	6	80.54	2,400.00	193,296.00
TOTAL			**10**	**83**	**899.83**		**2,208,921.00**

Source: Calculated from field survey, 2017

In 2012, data collection began through 2017 from the selected/demonstration apicultural farms on number of hives, average yields of honey per annum from the 10 farms and the revenue generated from the sales of honey by the respondent farmers. The data collected were analysed using both descriptive inferential statistical tools. Gini-Coefficient was used to examine the income distribution from sales of honey among the selected farmers, while regression model was used to establish the factorial relationships between revenue generated and the exogenous factors of honey production in the area.

Output and Revenue generation: Information on the ten selected rubber farmers' total number of hives, annual output of honey yield and the revenue generated from the sales of the honey are depicted in Table 1. A total of 899.83 litters of honey were produced by the ten apiculturists in the study area. They also generated total revenue of ₦2, 208,921. The Table also indicates an increase in number of hives among the respondents from a total of 10 hives in 2012 to 84 hives in 2017. This implies that the farmers were interested in the business and are willing to continue with the honey beekeeping. This implies that were empowered and financially alleviated from the revenue accruing to the honey venture with just minimal inputs (mainly the hives).

Income Distribution among the Respondents: Gini-Coefficient was used to determine the distribution/variation in revenue generated from sales of honey among the respondents (Table 2).

The results revealed that from the total of ₦ 2, 208,921.00 generated from sales of honey by the respondents, those with sales ranges between ₦ 200,000 - ₦249,000 contributed the highest proportion to the total sale (₦894,050.00). coincidentanly also, this group have the highest proportion number of salers (40.47%). This was followed by those with sales range between 350,000 – 390,000, contributed to the total sale by 350,575.00 which was 15.87% of the total volume of sales. The Gini-Coefficent calculated was 0.374, which is far away from unity (1). This indicates a high level of variation in the rvenue distribution among the respondents. The possible major factor responsible for this might be the market location and prices variation among the respondents. This also impliess that the market was not saturated and there was no monopoly.

Regression Results. Table 3 depicts the regression analysis results of honey production in the

study area. In the analysis, R^2 was 0.992. this implies that up to 99.2% of the variation in the dependent variable (Revenue) was jointly explained by the independent variables (farm location, number of hives, honey yield, age of respondents, householdsize and education). The remaining 08% (100 – 99.2%) not explained/captured in the analysis might be due to non inclusion of important variavle (s) or error in the model estimation.

Table 2: Income Distribution from sales of Honey among the Respondents

Sales Range (₦)	No. of Salers	Proportion of Salers (X)	Cummulative Proportion of Salers	Total value of Sales (₦)	Proportion of total Sales	Cummulative Proportion of Total Salers (Y)	XY
50,000 – 99,000	1	0.0314	0.0314	69,275.00	0.0316	0.0314	0.0010
100,000 – 149,000	0	0.000	0.0314	0.000	0.000	0.0314	0.000
150,000 – 199,000	2	0.1558	0.1870	344,096.00	0.1558	0.1872	0.0292
200,000 - 249,000	4	0.4047	0.9917	894,050.00	0.4047	0.5919	0.2424
250,000 – 299,000	1	0.1133	0.7050	250,300.00	0.1133	0.7052	0.0799
300,000 – 349000	1	0.1361	0.8411	300,625.00	0.1361	0.8413	0.1145
350,000 – 399,000	1	0.1587	1.00	350,575.00	0.1587	1.00	0.1587
TOTAL	**10**	**1.00**	**1.00**	**2,208,921**	**1.00**	**1.00**	**0.6257**

Source: Calculated from field survey, 2017.
GC = 1 - ∑XY= 1 – 0.6257= **0.374**

The result for age (X_1) has positive coefficient (2207.5) and is significant at 1% level of probability. This implies a direct relationship with the honey/revenue generated among the respondents in the study area.

Table 3: Regression Result of Honey Production in Ogun State

Model	Unstandardized coefficients	t- Value	Significant levels
Constant	-21452.447	- 1.976	0.095**
Age (X_1)	2207.455	2.140	0.050**
H.holdsize (X_2)	-2106.197	-0.612	0.551
Educational level (X_3)	18355.435	2.529	0.024**
Farm Location (X_4)	-2754.307	- 1.128	0.302*
No. of Hives (X_5)	300.669	0.222	0.832
Yield (Lt) (X_6)	2743.704	18.393	0.000**
R^2	**0.992**		
F – Value	**246.834**		

Revenue = Dependent variable.
= sign at 1% lvel of prob;*= sign at 5% lvel of prob. **Source: Calculated from field survey, 2017

In other words, this can be linked to experiences of respondents. Statistically, it means that an increase in age/experience of the respondents, will lead to an increase in the volume of revenue equvalant to the age coefficient in this analysis, that is ₦ 2207.5. This result corruburate the information depicted in Table 1, whereby in three years the number of beehives grew from 10 to 84 due to emanse retuns from the business. On the other hand, the coefficient result of Household size (X_2) in the analysis was negative, though not significant (- 2106.197). This means that a proportionate volume of revenue of about ₦2106.197 is lost due to an increase in household size of the respondents. It thus implies that the larger the household size of the respondent is, the more he loses revenue from the production. This is logically realistic because honey is a delicious food that is directly consumed by people for many reasons. The family consumption from the honey produced reduced the quantity available for sale, hence reduce the revenue generated from the business.

The cofficient value for educational level (X_3) of the respondents in the analysis was positive (18355.435) and significant at 5% level of probability. This implies that education was directly proportional to the volume of revenue generated among the respondents. This education could be the skill, technical know-how in the honey business. In this

analysis therefore, it implies that an increase in knowledge of the technical know-how of honey business will increase in the revenue generation from honey production by ₦ 18355.435. This buttressed the finding of Umar (2014), where revealed in his study on gum arabic marketing in North-Eastern Nigeria that education is an important factor for it to thrive.

The result for Farm Location (X_4) in this study (-2754.307) was negative and significant at 5% level of probability. This means that propare place or location of the behive is very necessary and recommendable in order to have good honey production revenue. Statisticaly, this result in this study implies that about ₦ 2754.307 was lost due to inadequate location of the beehives by the respondents. During the time of data collection, I will say this result has proven true as some of the beehives visited were either not colonizied by the bees or colonizied and absconed which were mainly due to poor location of the hives.

The number of Hives (X_5) has positive coefficient (300.669), though not significant. This however statistically implies that an increase in the number of beehives will increase revenue generation by ₦ 300.669 in the study area. This result indicates that number of beehives is insignificant in the study. This is technically true if other factors like good location and technical know-how were not regarded. Thus, number of hives in determining the volume of honey production and revenue, is subject to location and technical know-how of apicultural business.

The coefficient for Yield (Lt) (X_6) of the revenue generation in this study was positive (2743.704) and significant at 1% level of probability. This implies that an increase in volume of honey produced will lead to an increase in revenue proportional to the coefficient ₦ 2743.704. This is also in agreement with the a priori expectations, that with higher quantity of honey bee produced will lead to higher or increase in revenue.

4. Conclusion and Recommendations

Conclusion: A pilot study on apiculturing farming system was carried out among rubber farmers in Ogun State, Nigeria,**.** The findings revealed that the respondents were highly enthosiatic with the venture of beekeeping. This is because the ten randomly selected rubber farmers who were given one beehive each (totaling 10 hives), have increased the total beehives to 84 in 5 years. This implies that the study has effectively inculcated the apicultural farming system among the farmers. Also, most of the production variables considered in the study had positive coefficients and had a high R^2 value, implying an increase in output with increase in inputs (ceteris paribus). This means that beekeeping has the potential of enhancing the economic status of the respondents and benefits go a long way in alleviating the challangies of their financial needs.

Recommendations:

The study recommends further encouragement of the rubber farmers to engage in apiculturing farming system. This can be done through the commetment of the three tiers of Goververnment to go into advocacy campgain on the economic benefits derived from beekeeping. The governments should endevour to supply the necessary inputs at subsidised rates affordable by any interested farmer in beekeeping. This will help in diversifying the economy and increase Nigeria Gross Domestic Product (GDP) from agriculture.

Fig. 1: An apiculturist receiving training on how to harvest his honey by a technical officer from RRIN

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