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PROFITABILITY OF APICULTURE AS A BUSINESS VENTURE IN IKWUANO LOCAL GOVERNMENT AREA OF ABIA STATE, NIGERIA

GANANCIAS DEL RUBRO APÍCOLA EN EL GOBIERNO LOCAL DE IKWUANO, ESTADO DE ABIA, NIGERIA

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ABSTRACT

The study examined the profitability of commercial honey bee production as a business in Ikwuano Local Government of Abia State, Nigeria. Purposive and multi-stage random sampling techniques were used to select 60 honey bee farmers. Instrument for data collection was a pre-tested and structured questionnaire. Results of the net return analysis showed that honey bee production in the study area was profitable, posting a gross margin and net income of ₦ 131,033.28 (US$ 873.56) and ₦ 125,512.12 (US$ 836.75), respectively (1 US$ = ₦ 150). The multiple regression analysis using linear functional form as the lead equation revealed that all the significant variables (variable cost, quantity of honey and price of product) had positive influence on the profitability of commercial honey bee production in the area with a coefficient of multiple determination (R^2) of 0.923 and F-ratio 53.818. It was recommended that the government should encourage bee farmers through the provision of incentive such as credits to enable the farmers expand production since the enterprise was found profitable.

Key words: profitability, business enterprise, apiculture.

RESUMEN

Este estudio analizó la rentabilidad de la producción comercial de miel de abeja en el Gobierno Local de Ikwuano del estado de Abia, Nigeria. Se usaron técnicas dirigidas y de muestreo al azar de niveles múltiples para seleccionar 60 agricultores productores de miel. Se recogió la información con un cuestionario bien estructurado que fue previamente pre evaluado. Los resultados de análisis de retornos netos mostraron que la producción de miel era rentable, con un margen bruto y un ingreso neto de ₦ 131,033.28 (US$ 873.56) y ₦ 125,512.12 (US$ 836.75), respectivamente (1 US$ = ₦ 150). El análisis de regresión múltiple usando la forma lineal funcional como la ecuación principal reveló que todas las variables importantes (costo variable, cantidad de miel y precio del producto) tenían influencia positiva en la rentabilidad de la producción comercial de miel en el área, con un coeficiente de determinación múltile (R^2) de 0,923 y un valor F 53,818. Se recomendó que el gobierno debería estimular a los productores a través de la entrega de incentivos tales como crédito para permitir que los agricultores aumenten la producción puesto que la empresa es rentable.

Palabras clave: rentabilidad, empresa comercial, apicultura.

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INTRODUCTION

Forest and woodlands play a critical role in the survival of human population. They have been direct providers of shelter and food for people and their livestock. Honey as a product of forests and woodlands is formed when honey bees (*Apis mellifera*) suck nectar, sweet juices and pollen from different plant species (Duruson, 2011).

Bee keeping (apiculture) is the act of keeping bees for the purpose of providing or producing honey and other byproducts. It is the practice of bee rearing which combines the knowledge of the biology and behavior of bees with that of the surrounding environment, and the use of suitable equipment to produce honey and other bee hive product for the benefit of man. Apiculture is one of the important agricultural sectors in Nigeria that uses natural resources that otherwise would be wasted (Obialor, 2003). Bee keeping is an agro based enterprise, which farmers take up for additional income generation, which neither affects other agricultural sectors nor causes environmental disturbance. It allows for flexibility and can be done on part time or full time basis with no gender restriction.

The growing market potential for honey and its products has resulted in bee keeping emerging as a viable business enterprise for the development of farm household, and it is profitable, providing self-employment and economically rewarding vocation for Nigerians (Anyaegbulam et al., 2006). Honey and wax being the two economically important products of bee keeping, both products represent an important source of revenue because of its versatile use in food, cosmetic and pharmaceutical industries in the country (Ogundele et al, 2005).

Honey is not exported from Nigeria in large quantities but there are some exports, often of a 'one-off' or experimental nature. Exports are low because suitable quality Nigerian honey is not available in sufficiently large quantities at competitive world prices. It tends to be produced on a relatively small scale, making for a longer marketing chain. Although the quality produced by the bees is as good as anywhere else in the world, there is a tendency for Nigerian honey to be mishandled either by the producer or the middlemen during or after harvesting (Peterson, 2006).

The growth and development of bee keeping industry in the study area had been threatened by lack of improved bee management system, low quality of hive products and lack of skill by beekeepers. Majority of Nigerians cannot afford to consume the required amount of honey due to high cost of the product. The few farmers involved in this enterprise cannot meet up with the demand of the product (Ogubunka, 2010).

Deforestation resulting from over exploitation, bush fallow system of farming, honey hunting, uncontrolled bush burning has directly led to destruction of honey bees and drastically declined the quantity of honey displayed for sale in the local markets and along roadsides in the last three decades (Onyekuru, 2004). Many beekeeping businesses have gone extinct because of the adoption of poor technique and poor maintenance culture that will give the investors the target profit. Access to credit, cost of production (variable cost), scale of production and quality of product have been identified as the major factors that influence the profitability of bee keeping industry in the study area and Nigeria as a whole (Anyaegbulam et al., 2005; Duruson, 2011).

To date, many Nigerians still doubt the domestication of bees, while some still operate under traditional method, implying the need for modernization (Eluagu and Nwali, 1999).

Therefore the objectives of the research were to describe the selected socio-economic variables of honey bee farmers, access the profitability and financial strength of commercial honey bee production, and to determine the factors affecting honey bee profitability in the study area

MATERIALS AND METHODS

The study was conducted in Ikwuano Local Government Area (50°28' and 50°30' North of the equator; 70°32' and 70° 45' East of the Greenwich meridian) of Abia state, Nigeria. The Local Government Area (LGA) of Abia State was purposively selected because of the predominance of agricultural activities and involvement of bee keeping enterprise carried out as an occupation by the people in the area. It is characterized by evenly distribution of rainfall with relative humidity that favors cassava (*Manihot esculenta*), yam (*Dioscorea* sp.), plantain (*Musa paradisiaca*) and oil palm (*Elaeis guineensis*) production. It has a population of over 137,993 people, who are predominantly rural farmers (NPC, 2006).

Purposive and multi-stage random sampling techniques (Anyiro, 2010) were used to select farmers. Due to the limited number of farmers involved in honey production in Ikwuano Local Government Area, a total of 60 respondents (honey bee farmers) were randomly selected across the study area which formed the sample size and constituted about 75% of bee farmers in the study.

The data collection instrument was a well structured and pre-tested set of questionnaires,

aimed to get information on the socio-economic variables of the bee farmers, such as age, gender, educational level, working experience, scale of production, access to credit; the component of investment in beekeeping which includes bee-hive, smokers, baiting materials, bee suits, hive tools to mention but a few; profit obtained from the investment such as quantities of honey produced and sold, sales of other bee produce apart from honey, and pollination service practices.

Descriptive statistics, such as percentages and tables, was used to analyze the socioeconomic variables that affect farmers. The net return analysis, financial success, and capital position tools were used to draw conclusion on the profitability and financial strength of commercial honey bee production, while multiple regression analysis with four functional forms was used to analyze determinants of profit.

Model specification

Net return analysis

$GMi = \sum PiQi - Epxixi$ (i)

where GM_i is the Gross margin of the i-th farmer; $\sum$ = Summation of ……; P_i is the unit price of output (honey and bee wax); Q_i = Quantity of each output; px_i = Unit price of input; x_i = Input (variable)

$NR = GM - TFC$ (ii)

where

NR = Net return; GM = gross margin; TFC = Total fixed cost derived by depreciating fixed assets.

The financial success, capital position (Olukosi and Erhabor, 2005) tools were used in this research work to determine the financial strength and weakness of the commercial honey production. It was therefore necessary to examine other measures of financial success such as:

$$\text{Return per capital invested} = \frac{\text{Net farm income (NFI)}}{\text{Total cost of production (TCP)}} \quad \text{(iii)}$$

$$\text{Rate of return on equity (RRE)} = \frac{\text{Net income}}{\text{Capital invested}} \times \frac{100}{1} \quad \text{(iv)}$$

In the multiple regression analysis, the functions are implicitly stated as follows:

$Y = b_0 + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_qx_q + ei$ (v)

where Y = Profit (Naira) (dependent variable);
b_0 = intercept (or constant)
$b_1, b_2, \ldots b_q$ = ith coefficient corresponding to $x_1, x_2, \ldots x_q$
x_1 = Location of enterprise (Dummy; rural =1, urban =0)
x_2 = Production cost (Variable cost)
x_3 = Scale of production (number of bee hives)
x_4= Management (Proxy by level of education)
x_5 =Price of product per liter (Naira)
x_6 = Quality of honey per harvest
x_7 = Access to credit (Yes = 1, No = 0)
x_8 = Household size (Number)
ei = Error term

Four functional forms (Linear, Exponential, Semi-log and Double-log function) of the specified model were tried in this regards and the best fitted line was chosen as the lead equation. The choice of the best functional form was based on the values of R^2 coefficient, the magnitude of the F-ratio as well as their conformity to *a priori* expectations of signs of coefficient and the number of significant parameter.

The four functional forms used are specified as follows;

Linear form:

Y = bo + b1X1 + b2X2 + b3X3 ... ... bqXq + ei bqXq + ei

Semi-logarithmic form:

Y = Lnbo + b1LnX1 + b2LnX2 + b3LnX3 ... ... bqLnXq + ei

Exponential form:
$LnY = bo + b1X1 + b2X2 + b3X3 \ldots \ldots \ldots \ldots \ldots + bqXq + ei$

Double-logarithmic form:
$LnY = Lnbo + b1LnX1 + b2LnX2 + b3LnX3 \ldots \ldots \ldots \ldots \ldots bqLnXq + ei$

where Ln = Natural logarithms; b_o = Intercept; ei = error term; b_1- b_q = Regression coefficients; X_1-X_q = Independent variables (factors)

Independent variable description

Profitability determinants in apiculture (explanatory variables) were used to examine the factors that affect the profitability of honey bee enterprise. For this study we focus on eight of the explanatory variables adopted by Duruson (2011), which include;

Location of the enterprise

Beehive sited where honey bee forage plant species are not available (urban area) will affect the quantity of honey produced per hive. This agrees with the economic perspective of farm location. According to Wilhelm and Eva (2000) the main factors determining the location of an enterprise were historically the easy access to raw material (nectar), availability of suitable power supplies and skilled labor, the proximity to major markets, and transport advantages. Business located in these areas provided investors higher levels of income.

Farm management (proxy by educational level)

A farm management is the deliberate and regular decision making within the farm aimed at achieving the set objectives of the farm firm. The primary objective of commercial beekeeping business is to maximize profit. . The level of literacy would enable the farmer to be able to adopt modern method of better farming. This agrees with Ezeh (2007) who indicated that the ability to read and write would enable farmers to utilize effectively and efficiently available farm resources. Poor management of beehive will result in low yield of honey, which in turn results in low income (Onyebinama, 2004).

Scale of production

Scale of production in bee keeping is measured in terms of the number of hive used (Duruson, 2011). This is another serious factor that affects income generation in apiculture. The key profitability of commercial beekeeping is the yield per hive. This indicates that an increase in the scale of production will lead to gains known as economie of scale (Onyebinama, 2004).

Cost of production

Costs of production are usually measured in monetary terms. They are expenses incurred in organization and production process. Onyebinama (2004) indicates that a high cost of production of a commodity will limit the supply of the commodity hence the income generated from it. The lower the production cost of any enterprises the higher the return and vice versa.

Prices of products

Prices of products affect the quantity sold and bought. It also affects total revenue. If the price is relatively high, it will bring about reduction in sale but the impact on the total revenue will depend on the elasticity of demand for the product (William et al., 2007). Price must be such as to guarantee a firm enough returns over production cost (Onyebinama, 2004). Similarly, higher price means higher profits.

Quality of product (honey)

Quality is an important factor that affects consumer's preference. High quality product commands higher prices that result in higher profit (Umberger et al., 2003).

Access to credit

Access to credit is regarded as one of the key element in raising agricultural productivity. Availability of adequate and timely credit will help in expanding the scope of bee keeping operation and consequently higher profit (DSBA, 2005).

Household size

This has implication on labor supply to the farm. The higher the family size, the more the availability of potential labor, minimizing the cost of hired labor (variable cost) and maximizing profits (Okolo, 2007)

RESULTS AND DISCUSSION

The socio-economic variables (age, sex, education level, years of working experience, scale of production and access to credit) are shown in Table 1. The result shows that 35% of honey bee farmers were in the age range between 41 and 50 years of age. This implies that farmers were within the productive workforce that can effectively

withstand the rigors involved in bee farming. This indicates that the bulk of the respondents were still energetic and reasonably enterprising. The risk bearing abilities and innovativeness of a farmer, as well as his mental capacity to cope with the daily challenges and demands of bee product decrease with advancing age (Dama, 2001).

The majority (90%) of the respondents (honey bee farmers) were males. This disagrees with Onyebinama (2004) who noted that although more males were involved in honey bee production, the gender differences were not significant.

The household size of the respondents showed that 46.67% of the farmers had families made up of 6-10 persons. This indicates moderate household size. This had implication on the provision of labor for farm work (Okolo, 2007). The result on the educational level of the respondents also revealed that the majority (86.67%) of honey bee farmers had one form of formal education or other. This result is in tandem with Ezeh et al. (2009) who indicated that educated farmers are willing and amenable to take risk, invest and accept possible changes than those without formal education.

The distribution of the respondent according to their scale of production and years of working experience with honey bee production revealed that a large proportion (70%) of the respondents had < 5 and between 6 and 10 number of bee hives. Farm size has a possible positive relationship with output and profit in honey bee production. According to Duruson (2011), the key profitability is the yield per hive, together with the availability of nectar and pollen resources. The farming experience of the respondents revealed that 36.67% of the farmers had between 6 and 10 years of farming experience. This result had positive implication for increased productivity and sustainability because the number of years a farmer spends in the honey bee business may give an indication of

Table 1. Socio-economic variables of honey bee farmers in Ikwuano Local Government Area of Abia State, Nigeria. 2010.

Tabla 1. Variables socioeconómicas de productores de miel del Gobierno Local de Ikwano del estado de Abia, Nigeria. 2010.

Variables	Frequency	Percentage
Age (Years)		
21-30	18	30.00
31-40	14	23.33
41-50	21	35.00
Above 50	7	11.67
Gender		
Male	54	90.00
Female	6	10.00
Household size (number)		
1-5	15	25.00
6-10	28	46.67
11-15	15	25.00
15-20	2	3.33
Educational level		
No formal education	8	13.33
Primary	14	23.33
Secondary	17	28.34
Tertiary	21	35.00
Working experience (years)		
1-5	12	20.00
6-10	22	36.67
11-15	17	28.33
Above 15	9	15.00
Scale of production (N° of bee hives)		
< 5	21	35.0.
5-10	21	35.0.
11-15	18	30.0
Access to credit		
Yes	13	21.67
No	47	78.33

the practical knowledge he had acquired on how to overcome certain inherent problems in apiculture (Okolo, 2007). Data in Table 1 also show that about 78.33% of the respondents had no access to agricultural credit. Only about 21.67% of farmers who were mostly male respondents received agricultural credit. Lack of access to credit facilities constitutes a constraint in purchasing farm inputs and leasing more land for farming (Agwu et al., 2008).

The costs and returns associated with commercial honey bee production in Ikwuano Local Government Area of Abia State, Nigeria, are shown in Table 2. The cost components were divided into variable and fixed costs. The variable cost components include wages for capital labour, baiting materials, smoker fuel, bottles for packaging, to mention but a few, while fixed cost components include depreciation cost of hives and other equipment. The total revenue per farmer per season was pooled at ₦ 408,616,67 (US$ 2,724.11) with gross margin ₦ 131,033.28 (US$ 873.56) (1 US$ = 150 Nigeria Naira ₦). The revenue was obtained from sales of bee honey and bee wax. Based on the net return profile in Table 2, it can be seen that the net income per farm per season was ₦ 125,512.12 (US$ 836.75). Thus this research revealed that honey bee production in Ikwuano Local Government Area of Abia State, Nigeria, was profitable. The profit level is valuable hence bee keeping can be used as a poverty alleviation measure especially for the unemployed youths. This result is consistent with Duruson (2011) who obtained a similar net income value on the honey bee farmers in Ikwuano LGA of Abia State. The result also conforms with Igbokwe and Mbanaso (2006), who obtained a net profit of ₦ 13,546.41 per farm per season solely from honey production in Abia state. However higher profit is possible when other bees produce are equally harnessed for sales. Ogubunka (2010) affirms that beekeeping is very profitable in the tropics due to excellent fauna and flora.

Table 2. Net return analysis of bee honey production per farm per season in Ikwuano Local Government Area of Abia State, Nigeria. 2010.

Tabla 2. Análisis de ingresoso netos de la producción de miel por predio por estación en el Gobierno Local de Ikwuano, estado de Abia, Nigeria. 2010.

Item	Unit	Unit cost (₦)	Quantity	Value (₦)
(A) Total value from honey sales	Bottle[1]	907.55	295	267,727.25
Total value of bee wax sales	kg	1118.17	126	140,889.42
Total revenue				408,616.67
(B) Variable cost				
Labour/man-day		2296.08	51	117,100.08
Baiting materials		501.45	69	34,600.05
Smoker fuel		79.55	22	1,750.10
Bottles		17.32	6913	119,733.16
Gallons		275	16	4,400.00
Total variable cost (TVC)				277,583.39
(C) Gross margin (A-B)				131,033.28
(D) Fixed cost				
Depreciation on (Fixed) assets (such as hives and other equipment)				
Total fixed cost (TFC)				5,521.16
Net income (C-D) (Profit)				125,512.12

[1]: bottle capacity = 1000 mL
Return/Naira invested = 11.0
Rate of Return on equity = 9.0%
1 US$ = 150 Nigerian Naira (₦)

The return per naira invested by the respondents (11.0) was greater than zero indicating that for every ₦1.00 (USD 0.01) invested in bee honey production, ₦ 11.0 (USD 0.07) was generated. In addition, the rate of returns on equity was 9%, indicating that for every Naira invested into honey bee production, there was 9% returns on equity. This implies that there is a relatively high return hence the payback period on borrowed funds is expected to be short. These results are in agreement with the findings of Igbokwe and Mbanaso (2006) that obtained ₦ 1.80 on return per naira invested in honey bee production with 8% returns on equity above the investment and expenses incurred. These findings are also in agreement with those of Olukosi and Erhabor (2005).

Result of the multiple regression analysis models on the factors that influence the profitability of bee honey producers in Ikwuano Local Government Area of Abia State, Nigeria, are shown in Table 3. Results show that all the functional forms were statistically significant at 1.0% probability level, implying that any of the functional forms is adequate in estimating and explaining the variations in the profitability equation of bee honey production in the study area. However, the profitability equation was best estimated and explained using the linear functional form that explained 92.3% of the total variation at 1.0% risk level. Furthermore, other statistical and econometric considerations such as the number of significant coefficients and the a priori expectations were in favor of the linear functional form. Specifically, the coefficient of variable cost (-5.261) was negative and statistically significant at 10.0% alpha level. The sign is in accordance with a priori expectation. This implies that the higher the price of the variable costs, the lower the use of input in order to maximize profit. This result supports the findings of Nwaru and Ekumankama (2002)

Table 3. Estimate of factors that affect profits of commercial bee honey production in Ikwuano Local Government Area of Abia State, Nigeria. 2010.

Tabla 3. Estimación de los factores que afectan las ganancias de la producción comercial de miel en el Gobierno Local de Ikwuano, estado de Abia, Nigeria. 2010.

	Functional forms			
Independent variable	**Linear**	**Exponential**	**Double log**	**Semi log**
Constant	-75155.514***	9.961***	0.260	-1154296.1***
	(-3.381)	(30.200)	(0.109)	(-4.377)
Location (x_1)	-447.226	0.012	0.069	-14752.070
	(-0.490)	(0.377)	(0.373)	(-0.723)
Variable cost (x_2)	-5.261***	-8.603E-5***	0.080	-1167.185
	(-7.327)	(8.075)	(-0.726)	(-0.096)
Scale of production (x_3)	-3718.756	-0.088*	-0.233	-15261.477
	(-1.064)	(-1.703)	(-0.751)	(-0.444)
Educational level (x_4)	138.464	-0.014	0.025	1096.034
	(0.191)	(-1.270)	(0.102)	(0.040)
Price of bottled honey (x_5)	75.489***	0.000	0.838**	123679.396***
	(4.833)	(1.323)	(2.812)	(3.744)
Quality of honey (x_6)	1102.844***	0.017***	1.291	95457.077***
	(5.035)	(5.108)	(4.653)	(3.105)
Credit access (x_7)	-5480.396	-0.122	-0.161	-17975.296
	(0.870)	(-1.302)	(-0.650)	(-0.654)
Household size (x_8)	1247.974	-0.022	-0.024	16692.227
	(0.895)	(-0.872)	(-0.199)	(1.232)
R square (R^2)	0.923	0.872	0.910	0.854
Adjusted R^2	0.906	0.844	0.876	0.798
F-ratio	53.818***	30.656***	26.678***	15.361***

***, **, * indicate variables are significant at 1.0%, 5%, and 10% risk level, respectively.

Figures in parenthesis are the t-ratio

who indicated that as the input prices increases, reduced inputs are used.

The coefficient of the price of bottled honey (75.489) was positive and statistically significant at 1.0% alpha level. This suggests that the profit arising from the sale of bottled honey would increase as the price of the product increases. This is in agreement with the findings reported by Kadurumba (2008), who obtained similar results in his study of economic efficiency of processed palm oil in Imo state, Nigeria.

The coefficient of quality of honey (1102.444) was positive and statistically significant at 1.0% probability level. High quality products command higher prices hence higher profits. This result is in agreement with the findings of Umberger et al. (2003) who found that quality is an important factor for the consumer preference and willingness to consume any food item.

The coefficients of location (-447.226), scale of production (-3718.756) and access to credit (-5480.396) were negative and not statistically significant. This implies that these variables have negative influence on the profitability of honey bee in the study area. Perhaps, increase in scale of production, access to credit and location of the beehives may not stir up increased profit. This finding is contrary to a priori expectation even though it was not statistically significant.

However the positive coefficient of educational level (138.464) and household size (1247.974) were not statistically significant. This implies that as literacy levels improve in farmers with large family size, there will be proper management of beehive and availability of farm labor, resulting in higher yields of honey and in turn result in higher income (Onyebinama, 2004). These results conform to a priori expectation.

Based on the findings, the following recommendations were made;

i. Since the enterprise was found to be profitable, government should encourage bee farmers through the provision of incentives such as credits to enable the farmers expand production and serve as a poverty alleviation outfit.
ii. Policies aimed at integrating, encouraging and incorporating the female farmers into honey bee production should be embarked upon by state and local Governments. This would increase production.
iii. Based on the population of bee keepers in Ikwuano Local Government of Abia State, Nigeria, it can be inferred that there is little knowledge of commercial honey production in the study area. In this regards, policies aimed at facilitating and enhancing public awareness should be encouraged via the services of agricultural extension workers. This would ensure efficient dissemination of information in order to improve profitability.

CONCLUSIONS

The research revealed that the bulk of honey bee investors were young (41-50 years), energetic males (90.0%) with household size ranging between 6-10 members, with formal education (86.67%) or other, with 6-10 years of farming experience, and farm size less than 5 and between 6 to 10 bee hives, and with limited access to credit (78.33%). The result of this study posted the total revenue per farm per season as ₦ 408,616.67 with gross margin of ₦ 131,033.28 while the net income per farmer per season was ₦ 125,512.12.

The result on the financial strengths and weakness of commercial bee honey production indicated that for every ₦ 1.00 invested in bee honey production, ₦ 11.0 was generated with 9.0% return on equity.

The result of the multiple regression analysis with linear functional form as the lead equation shows that the critical determinant of profitability in honey bee keeping were variable cost (X_2), price of product (X_5), and quantity of honey (X_6). However, a combination of all the variables explained 92.23% of the variation in the profitability of honeybee keeping at 1.0% probability level.

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