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Comparative Analyses of Modern and Traditional Bee Keeping Entrepreneurships in Abia State, Nigeria

Onwumere J., F. Onwukwe., C.S. Alamba
Department of Agribusiness and Management
Michael Okpara University of Agriculture, umudike ,Abia State, Nigeria.
Email: onwumere.joseph@mouau.edu.ng

Abstact
The study examined the comparative analyses of modern and traditional bee keeping in Abia State, Nigeria. It considered as objectives the comparative analyses of costs and returns, technical and profit efficiencies and evaluation of the major constraints associated with both bee keeping practices. A sample size of 120 bee keepers comprising 80 modern and 40 traditional bee keepers were examined respectively in this study. The tools of data collection were structured questionnaire and oral interviews. Analytical tools used included Cobb Douglas production function, descriptive statistics and income statement analysis. The result shows that modern bee keeping generates more income than traditional bee farming despite its production cost. Investment in bee keeping, especially with respect to modern bee keeping approach increased tremendously with expanded access to cheap and flexible credit which is presently a limiting factor in traditional bee keeping. Further, man days of labour and quantity of baiting materials increased the production of modern bee keepers while expenses on labour and apiaries limited their profitability even among traditional bee keepers. Thus, it is recommended that the modern bee keepers should be encouraged with financial incentives that will help them boost number of labourers and local policies which will reduce labour cost and other inputs should also be encouraged.
Key words: comparative, analyses, modern, traditional, bee-keeping

Introduction

Bee keeping constitutes the cline of productions that makes up agribusiness. It is also referred to as apiculture. Bee keeping or apiculture entails the rearing or keeping of bees with the aim of exploiting its products which includes honey, pollen grain, propolis, and comb. The climate of the Nigeria is characteristically tropical and humid all the year around (World Bank 2006) especially in the study area, this thus supporting the survival of bees. Bee keeping has significant economic importance to both primary and secondary agribusiness. Some areas of significance are of note. According to Carter (2004) scientific tests carried through agricultural research, have shown that, that the yield of fruit is considerably increased when powerful stock of bee is allowed access to the tree. Honey and pollen grain also has significant nutritive value. Arabian travelers during the middle age (100-1500AD) used honey in the preparation of meals(honey wine)(Lewicki 1974).The earliest practices of bee keeping was characterized by individuals putting on trees as many as 100 hives, made of straws, in a season.(Taylor 1942).Further improvement was made with the use of pots so as to achieve honey separation. Bee keeping also has some constraint facing it. The use of fire in harvesting in the traditional bee keeping usually result in destruction of trees (Crane 2004). There is also a marked supply deficit of honey given the fact that a great proportion of the honey in the market is from the traditional hive (Ntenga, 2000).The initial capital required in the establishment of modern bee keeping has hampered efficient honey production (Bradbear, 2000). The practice of bee keeping is as old as any other agricultural practice. It has been an alternative source of income to farmers especially in rural communities. Old or traditional bee keeping differs from modern bee keeping in management style. This has ineluctably influence output in terms of quality and quantity per annum. Both methods of apiculture are somewhat alternatives since the apiculturist or farmer is availed with the knowledge of both methods. Apiculture - being an agribusiness enterprise - requires that the most suitable management practice (considering other environmental factor) to maximize output be applied. It has been found to be profitable with little investment made in it (Gurung 2005).

This study basically seek to identify the social – economic characteristics of the bee keepers; determine the cost and returns associated with modern bee keeping and traditional bee keeping; examine the factors affecting the technical efficiency of modern and traditional bee keepings; examine some performance indicators and the determinants of the enterprise profit of the two practices and identify the constraints to profitable bee keeping.

Methodology

The study was conducted in Abia State, Nigeria. The state is made up of seventeen (17) local governments. It is bounded by Ebonyi, Enugu, Rivers, Imo and Anambra State. The state lies between longitude $04^0\,45^0$ and $06^0\,17^0$ north and latitude $07^0\,00^0$ and 08^0 100 east. According to the 2006 population census result, Abia State had a total

population of 2, 845,880 consisting of about 1,430,098 males and 1,415,082 females recording a population growth rate of about 3.18 percent compared to the 1991 population census (Federal Republic of Nigeria: Official Gazette 2009). The state has temperature of between 20^0 c and 36^0 c. The main occupation of the people is agriculture and the state is divided into three agricultural zones – Ohafia, Umuahia and Aba.

Simple random sampling technique was used to select 120 farmers involving 80 modern bee keepers and 40 traditional bee farmers. The sampling was carried out during the 2010 cropping season in two local government areas (Bende and Ikwuano) of Abia State. The decision was informed by the fact that the aforementioned L.G.As are the major location of apicultural practice in the state. Data was sourced from both primary and secondary sources. Basically, a well-structured questionnaire was used to collect information on sex, age, farm size, income, revenue, and cost of inputs and profit of bee keeping in Abia State.

Analytical tools employed in the study includes: descriptive statistics involving tables and simple percentage (for objective one); income statement (for objective two); Cobb Douglas production function (objective three and four). The farm budgeting model for objective two is stated as:

$$NI = GR - TC$$

Where: *NI = Net Income, GR = Gross Return, TC = Total Cost.*

The Cobb Douglas production function model for analysis is

$$ln\gamma_i = f(x_i, \beta)\ exp(v_i - u_i)\ ;\ i = 1,2,..,n$$

Where: ln = represents the natural logarithm

γ = represents the value of output in monetary unit (Naira)

x = represents the quantity of inputs used in production by the ith enterprise and varies between i and n inputs

v_i = are assumed to be independent and identically distributed random errors having $N(0,\sigma^2)$ distribution independent of the u_s

u_i = technical efficiency effects, which are assumed to be non-negative random variables.

The technical efficiency of the individual firm is defined in terms of ratio of observed output to the corresponding frontier output given the levels of inputs used by the firm. Hence the technical efficiency of firm i is expressed as:

$$Te_i - ln\gamma_i ln^* = f(x_i,\beta)\ exp\ (v_i - u_i)$$
$$If\ (x_i,\beta)\ exp\ (v_i) = exp\ (-u_i)$$

Where In = represents the natural logarithm

y^* = represents the frontier output

γ = value of output from bee keeping in litres

x_i= vector of the independent variable which includes $x_1 \ldots x_n$

x_1= labour in man days

x_2= rent in naira

x_3= quantity of baiting materials used in kilogram

x_4 = number of apiaries

x_5 = distance covered in day by day operations in kilometer.

The variance ratio gamma (Y) explaining the total variation in output from the frontier level of output attributed to technical efficiencies was computed as:

$$Y = \sigma^2 u / \sigma^2 v.$$

The stochastic frontier profit function equation for the analyses of profitability is given as:

$$ln\ \pi = lnr_o + r_1 ln\ h_1 + r_2 ln\ h_2 + r_3 ln\ h_3 + r_4 ln\ h_4 + r_5 ln\ h_5 + v_i - u_i$$

Where π = normalized profit in naira per farm defined as gross revenue less variable cost divided by the price of the output.

h_1= depreciation allowance of the firm measured in Naira

h_2=expenses on labour in Naira

h_3=expenses on apiaries in Naira

h_4= cost of transportation measured in Naira

h_5= other expenses measured in Naira

The determinant of economic efficiency is as follows:

$$E\ [exp\ (-u_i)] = \beta_0 + \beta_1 w_1 + \beta_2 w_2 + \beta_3 w_3 + \beta_4 w_4 + \beta_5 w_5 + \beta_6 w_6 + \beta_7 w_7 + \beta_8 w_8 + e_i$$

Where: w_1 = age of the processor (in years)

w_2 = level of education (number of years in schooling)

w_3 = household size (number of per)

w_4 = farming experience (in years)

w_5 = credit access (access = 1, no access = 0)
w_6 = membership to a cooperative society (member = 1 nonmember = 0)
w_7 = labour (in money)
e_i = error terms

Results and Discussions

The result of the data analyses are presented here. The discussion follows suit considering such area as the socio economic characteristics of the bee keepers, comparative analyses of cost and return from bee keeping, technical and profit efficiencies analyses and the presentation of the bee keeping constraints.

Socio – economic Characteristics of Bee keepers

Analyses of bee keepers according to age, gender, education level, marital status, family size, farm size, and years of experience

The analyses of the age, gender, education level, marital status, family size, farm size, and years of experience are presented in table I

Table I Distribution of bee keepers according to age, gender, education level, marital status, family size, farm size, and years of experience

Variables	Modern		Traditional	
	Frequency	%	frequency	%
Age (years)				
0 – 20	15	19	5	12
21 – 40	40	50	10	15
41 and above	25	25	25	63
Gender				
Male	60	75	30	75
Female	20	25	10	25
Education level				
No school	10	13	20	50
Primary	10	13	8	20
Secondary	35	43	12	30
Tertiary	5	6	0	0
Incomplete	20	25	0	0
Marital status				
Single	5	6	10	25
Married	40	50	20	50
Divorced	10	13	10	25
Widow	15	19	_	_
Widower	10	12	_	_
Family size				
0 – 4	30	38	10	25
5 – 9	38	48	18	45
10 – 14	10	12	8	20
15 & above	2	2	4	10
Farm size (ha)				
0 – 4	20	25	10	25
5 – 9	45	56	23	57
10 – 14	10	13	5	13
15 & above	5	6	2	5
Years of Experience				
1 – 5	30	38	15	38
6 – 10	45	56	22	55
11 and above	52	6	3	7

Source: Field Data 2010

The frequency distribution in table I shows that a good number (30%) of middle aged farmers (21-40 years) are involved in modern bee keeping while a large proportion of traditional bee keepers (63%) constitute the aging population (i.e. 41 and above).We can deduce that the gradual exposure of modern techniques of bee keeping to the young influence their choice of the method while the aging population remained loyal to the method they

long understood. The gender distribution showed that the practice of bee keeping is somewhat gender sensitive given the larger (75%) proportion of male than females (25%) bee keepers who practiced both traditional and modern bee keeping respectively. Bee keepers without basic education constitute majority (50%) of bee keepers in the traditional bee keeping system. This can be adduced to the simplicity of bee keeping material which is locally available. The need for basic educational knowledge so as to learn the intricacy of modern bee keeping was evidence in high proportion of secondary school leavers (43%) who practiced the modern bee keeping. The distribution of bee keepers according to marital status revealed that the largest proportion (50%) of bee keepers both modern and traditional is married. Result of the distribution of farmers according to family size shows that the largest proportion (45% and 48%) of traditional and modern bee keepers respectively has fairly large family. The result also reveals that the size of family really determines participation in bee keeping both in the modern or traditional technique. The distribution of bee keepers according to farm size shows that farmers having 5 – 9 hectares constitute the largest proportion (57% and 56%) of traditional and modern bee keepers respectively (compared to farmers having 10 ha and above). It can hence be deduced that majority of the bee keepers have large land holdings. The reason may be because returns from bee keeping can be used to buy more landed property which in turn will be used as good site for bee keeping. Result from the distribution of bee keepers according to farming experience shows that farmers with 6 – 10 years of experience constitute the largest proportion (55% and 56%) of traditional and modern bee keeping respectively. This result shows that large proportion of the bee keepers in the study area have a good experience in bee keeping practices.

Distribution of bee keepers according to initial capital, source of labour, source of fund, visit of extension farmers, rent on farm land, apiary size and product price

The analyses of the initial capital, source of labour, source of fund, visit of extension farmers, rent on farm land, apiary size and product price are presented in table II

Table II Distribution of bee keepers according to initial capital, source of labour, source of fund, visit of extension farmers, rented farm land, apiary size and product price

Variables	Modern		Traditional	
	Frequency	%	Frequency	%
Initial capital				
0 – 6000	20	25	10	25
6000 – 10000	45	56	23	51
10000 – 15000	10	13	5	13
15000 – above	5	6	2	5
Source of labour				
Hired	10	13	10	25
Family	22	27	15	12
Both	48	60	25	63
Source of fund				
Personal savings	60	75	23	57
Bank loan	13	16	10	25
Informal loan	7	9	7	18
Visit of extension farmers				
Yes	20	25	10	25
No	60	75	30	75
Rented farm land				
Yes	10	10	10	25
No	70	70	30	75
Apiary size				
$27cm^2$	10	12	10	25
$64cm^2$	60	75	20	50
$125cm^2$	10	13	10	25
Product price (₦)				
500 – 700	12	15	5	12
701 – 900	43	60	22	55
901 – 1200	12	15	10	25
1201 – Above	8	10	3	8

Source: Field Data 2010

The study analyzed the socio – economic characteristics of the respondents with respect to age, gender, education level, marital status, family size, farm size, years of experience, initial capital, source of labour, source of funds, visit of extension farmers, and rented farm land, apiary size and product size.

Given the result of the distribution of bee keepers according to their initial capital, the largest proportion of bee keepers (56% and 51%) of modern and traditional bee keeper respectively –employed an initial capital of 6000-10000 naira indicating that the entrepreneurs are operating as micro business owners. Result from the distribution of bee keepers' source of labour shows that the largest proportion of labour source comes from both hire and family labour (63% and 60%) for traditional for modern bee keeping respectively .The distribution of bee keepers according to source of fund shows that the largest proportion of 75% modern bee keeper and 57% traditional bee keepers respectively depended on personal savings especially for initial capital .Most bee keepers, modern (75%) and traditional(75%) hadn't the privilege of being visited by extension worker. This explains why most bee keepers are not well informed on ways of exploiting other potentials of bee keeping such as brand marketing of the product and other production intricacies. A large proportion of bee keepers comprising modern (70%) and traditional (75%) were found to occupy unrented farm land. We can deduce that the bee keepers have to land and land is not a problem, hence they depended on family or inherited land. Apiary size of $64cm^2$ as against $125cm^3$ characteristically constitutes the largest proportion of apiary size employed by both modern (75%) and traditional (50%) bee keeping. This result indicates that low economic status of the bee keepers baulks them from increasing apiary size giving the attendant operation cost. The result of the distribution of bee keepers according to their product price shows that 60% of modern bee keepers and 55% of traditional bee keepers respectively sold their honey at the range of 701 – 900 naira. These, thus, constituted the majority of respondent in both methods of bee keeping. This result indicates that the price of honey product is moderate in the market despite its socio cultural, medical and other perceived importance.

Comparative analyses of cost and return of modern bee keeping and traditional bee keeping

The comparative analyses of the cost and returns of the Modern and Traditional bee keeping is presented in table III

Table III Presentation of the cost and return of modern and traditional bee keeping

	Amount	
Items	**Modern**	**Traditional**
Returns (Revenue)		
Honey	11 798 580	8776 500
Bee wax	4 128 240	2128 200
Bee pollen	1 824 440	1023 800
Total Revenue (TR)	17 751 220	11 928 500
Expenditure		
Variable cost (VC)		
Land clearing	392 000	200 000
Land preparation	617 700	300 000
Labour cost	2 977 900	1 934 600
Harvesting	2 192 000	2 000 000
Miscellaneous	1 222 500	1 000 000
Total variable cost	7 402 100	5 435 100
Fixed cost (FC)		
Rent	936 230	537 200
Baiting cost	535 600	
Depreciation charge	1 715 530	163 320
Tax	1 000	1 050 000
Total Fixed Cost (TFC)	3 188 360	1 750 520
Total Production Cost (TC)	10 590 460	7 185 620
Profitability indicators		
Net Income (TR – TC)	7 160 760	4 742 880
Gross Margin (TR – TVC)	10 349 120	6 493 400
Gross Return/Naira invested	1.676	1.66

Source: Field Data 2010

The costs and returns of bee keeping analyzed are Total Revenue (TR), Total Variable Cost, Total Fixed Cost, Total Production Cost, Net Income, Gross Margin, and Gross Return/naira invested. The results of the income statement analyses showed that the total production cost of modern bee keeping was N10, 590,400 while that of traditional bee keeping was N7, 185,620. The result also showed that the bee keepers earned an average of N7, 160, 760 for modern bee keeping and N4, 742,880 for traditional bee keeping. The analyses revealed that despite the high cost of modern bee keeping, the practice is more profitable than that of traditional bee keeping

Determinants of technical efficiency of bee keeping using Cobb Douglas Frontier Production function

The table IV below showed the result of the analyses of the technical efficiency of modern and traditional bee keeping

Table IV Estimation of the determinants of technical efficiency of bee keepers

		Modern			Traditional		
Production function	**Parameter**	**Coeff**	**Standard error**	**t- value**	**Coeff**	**Standard error**	**t- value**
Constant	x_0	6.448	0.987	6.534***	0.037	0.997	0.037
Labour in man days	x_1	0.453	0.073	6.232***	1.031	0.208	4.956***
Rent	x_2	0.048	0.052	0.928	0.147	0.380	0.388
Quantity of baiting Material	x_3	0.027	0.048	5.596***	-0.163	0.421	-0.387
Number of Apiaries	x_4	-0.009	0.011	-7.847***	0.073	0.043	1.707*
Distance of apiaries from homes	x_5	0.006	0.011	5.264***	-0.017	0.346	-0.049
Efficiency Value							
Age	w_1	-0.003	0.004	-0.871	-0.006	0.110	-0.051
Level of Education	w_2	-0.000	0.006	-0.148	0.011	0.158	0.069
Household size	w_3	0.011	0.022	4.923***	-0.038	0.471	-0.081
Farming Experience	w_4	0.011	0.012	9.464***	0.008	0.100	0.081
Credit Access	w_5	-0.002	0.087	-0.014	0.012	0.940	0.013
Membership of co operative	w_6	-0.034	0.069	-4.899***	0.033	0.942	0.035
Labour cost	w_7	-0.333	0.076	-4.357***	0.026	0.407	0.063
Sigma square	σ^2	0.043	0.010	4.501***	0.142	0.878	0.162
Gamma	Y	0.961	0.042	22.62***	0.040	0.892	0.042
Log Likelihood	n	27.726			-16.147		
Level of significance		1% (***)	5% (**)	10% (*);	Coeff = coefficient		

Source:Field Data 2010

The result of the Cobb Douglas production function showed goodness of fit correctness of the the specified assumption of the composite error given that total variance is significant at 1%. Also, the variance is ratio is 96.1% which implied a high level of significance for modern bee keepers but the result of the parameter is contrariwise (40%) in the analyses of traditional bee keepers. The result implied that variation among the bee keepers is mainly due to differences in management practices rather than random variability. The results indicate individual management inefficiency and sided error. Labour in man days is positively related with technical

efficiency at 1% probability level of significance. This implies that more labour tends to improve technical efficiency of the beekeepers, that implying higher productivity in both the modern and traditional bee keeping practices. Quantity of baiting material increased productivity only in the case of modern keepers. The parameter is significant at 1% probability level and also signed positive, but is not significant in the case of traditional bee keepers. The result is in agreement with current practices in bee keeping given the reason that baiting is not used in the traditional management practices but only modern method. Number of apiaries inversely related to technical efficiency at 1% probability in modern bee keeping management practice. This implies that as number of apiaries increases less attention is paid in terms good management especially in the modern bee keeping practices. The result is actually against a- priori expectation of positive relationship. Thus, there is high need for man power to enhance technical efficiency level. The result for traditional method shows a positive relationship at 10% significant level. This implies that as number of apiaries increases, efficiency level increases. Distance between apiaries and the home of the bee keeper is positively related to technical efficiency at 1% risk level. The shorter the distance, the more prone the apiaries become to predators and fire attack but its products and equipments are preserved if they are located far from homes or from people.

The result of socio economic factors affecting the technical efficiency of both modern showed household size and experience in modern bee keeping is positively related to technical efficiency level at 1% risk level while membership of cooperative and gender is inversely related to technical efficiency at 1% risk level. None of these variables was significant in the case of traditional bee keepers. Experience improves farmers' technical efficiency in the business. However, the peculiar problem associated with cooperative societies in the study area (such as fund mismanagement and inadequate funding) affects the farmer cum level of technical efficiency.

Estimation of the determinants of profit efficiency of bee keeping using Cobb Douglas production function

The Table V below shows the result of the analyses of the profitability efficiency of Modern and Traditional bee keeping

Table V Estimation of the determinants of profit efficiency of bee keepers

		Modern			Traditional		
Production Function	**Parameter**	**Coeff**	**Standard error**	**t-value**	**Coeff**	**Standard error**	**t-value**
Constant	h_0	10.481	1.045	10.034***	1.131	1.405	7.921***
Depreciation allowance	h_1	-0.006	0.069	-0.085	-0.125	0.069	-1.803*
Expenses on labour	h_2	-0.228	0.087	-2.630***	-0.170	0.085	-2.010**
Expense on apiaries	h_3	-0.027	0.065	-4.183***	-0.157	0.082	-1.911*
Cost of transportation	h_4	0.016	0.088	0.183	0.124	0.088	1.405
Other expenses	h_5	-0.300	0.12	-2.496***	-0.264	0.074	-3.548***
Efficiency value							
Age	w_1	-0.017	0.007	-2.330***	-0.008	0.020	-0.431
Education	w_2	0.015	0.011	13.230***	-0.152	0.054	2.807
House hold size	w_3	0.016	0.018	8.694***	-0.334	0.106	3.162***
Experience	w_4	0.028	0.017	1.645*	0.115	0.087	1.311
Credit access	w_5	-0.066	0.104	-0.639	-1.294	0.413	-3.132***
Membership of cooperative	w_6	-0.124	0.114	-10.890***	0.727	0.541	1.344
Gender	w_7	0.022	0.032	7.027***	-0.090	0.191	-0.470
Sigma square	σ^2	0.192	0.036	5.332***	0.277	0.065	4.238***
Gamma	Υ	7.89▫-7	1.04▫-5	0.076	0.667	0.078	8.551***
Log likelihood	N	-47.84			-13.23		
Level of Significance	*1% ****	*5% ***	*10% **				

Source:*Field Data 2010*

Result from the above table shows that depreciation is positively related to profit efficiency at 10% risk level in traditional bee keeping practice. The coefficient of expenditure on labour both modern and traditional bee keeping are inversely related to profit efficiency at 1% and 5% risk levels respectively Expenditure on apiaries in both bee keeping practices are inversely related to profit efficiency at 1% and 10% risk levels in modern and traditional bee keepings respectively. Higher expenses in traditional or modern practice culminate to lower profit efficiency. Coefficient of other expenditures in modern and traditional bee keeping practices signed negative but significant at 1% risk level.

The analyses of effects of socio economic variables on efficiency showed that age and membership of cooperative societies negative relationship with efficiency whereas, education status, household size, expenditure on apiaries and gender of the bee keepers were positively related to efficiency in both modern and traditional bee keeping practices. Access to credit in traditional method of bee keeping is negatively related to profit efficiency at 1% risk level. This means that poor access to credit is a serious restriction to the profitability of the traditional bee keeping.

Comparative analysis of distribution of modern and traditional bee keeping constraints

The presentation of bee keepers' constraint is shown in table VI below

Table VI Distribution of modern and traditional bee keeping constraints

	Modern		Traditional	
	Frequency	**Percentage**	**Frequency**	**Percentage**
Fire outbreak	10	12.5	6	15
Deforestation	8	10	4	10
High cost of labour	8	10	5	12.5
Shortage of space	6	7.5	4	10
Adulterated product	25	31.25	4	10
Inadequate experience	10	12.5	4	10
Distance to market location	4	5	4	10
Poor market for production	3	3.75	3	7.5
Irregular extension visit	3	3.75	3	7.5
Lack of credit facilities	3	3.75	3	7.5
Grand total	80	100	40	100

Source:*Field Data 2010*

The table above shows the comparative distribution of constraint of modern and traditional of bee keepers. The result shows that major problem encountered in modern keeping management is that of adulterated product which accounted for 31.25% of the constraints. Other seemingly significant constraints are fire outbreak (12.5%), deforestation (10%), high cost of labour (10%) and shortage of space (7.5%) respectively. On the other hand, the major constraint as reveal from the distribution of traditional bee keepers is fire outbreak. Other seemingly significant constraints are deforestation (12.5%), shortage of space (10%), while poor market situation, irregular extension visit and lack of credit facilities account for 7.5% constraints respectively.

Conclusion

Giving conscientious analyses of the efficiency of both modern and traditional bee keeping, it was evidenced from the study that both bee keeping practices are profitable, technically and profitably efficient in the study area. The challenges facing bee keepers included credit access, poor cooperative organization, fire outbreak, deforestation and high cost of labour. However, to enhance the profit and technical efficiencies the practioners should maximize labour man days while reducing the cost of labour respectively. Credit should be made available to the operators through appropriate policies and costs of inputs should be regulated to the minimum level.

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