Determinants of Piggery Business in Kaduna State, Nigeria

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Abstract: **The objective of the study was to examine pig business in Kaduna State, Nigeria. Multi stage and purposive sampling techniques were used in selecting a random sample size of hundred (100) pig producers for the research. A structured questionnaire was administered on respondents for information. Data were analysed using descriptive statistics such as percentages, frequency, gross margin model and Cobb Douglas production function. The result revealed that majority (57%) of respondents involved in pig business were females.Pig business was profitable with a return per naira invested of 0.69 kobo and gross margin of ₦8,426.30 per pig. The t- test confirmed that pig business was profitable and significant at 1% level. Pig business operated at stage ii of the production function, indicating a decreasing return to scale with summed coefficients of 0.823. The study recommended that government should intervene through the provision of extension services and access to credit facilities.**

Keywords: **pig, business, return to scale, gross margin, Cob Douglas, rate of return**

I. INTRODUCTION

Pigs have been described as one of the most prolific and fast growing livestock species that can convert food waste to valuable products Vicente et al. (2011). Piggery is one of the few profitable business ventures you don't have to babysit; it allows you to have a life and career elsewhere. It is very lucrative because once you sow in it your stock continues to expand forever unlike fishery and poultry where you need to restock after every session. The start-up cost is low and profit margin impressive. Pigs are capable of reproducing at least twice in a year. A female can produce an average of 16.9 piglets in a year. They are fast growers within 6months they attain good weights and you can make your first sale. Pigs can eat almost anything as long as it's fresh. Security is a reduced concern because people hardly steal pigs due to their noise and other social reasons (Oluwaseun, 2015). Pig business policy could be promulgated for poverty reduction and sustainable economic diversification in Nigeria.

The indigenous pigs in Nigeria have been recommended as a good alternative source of cheap and high quality animal protein that suits the escalating human population. They have relatively low cost of production and their growth rate is fast, (Osaro, 1995; Onwujiariri and Okoronkwo, 2007). Their anal droppings are also used to fertilize backyard farms and vegetable gardening in fadama (Holmes, 1991 and Osaro, 1995). Nigeria is yet to become self-sufficient in animal protein intake. The intake of protein of livestock origin is estimated at 3.3g – 3.5g/head/day as against the recommended Food and Agriculture Organization (FAO)(2000) figure of 27.2g/head/day (Tewe 1999; Aromolaran and Bamgbose, 1999 and Ajayi and Chukwu, 2008).

1.1 Statement of the problem

Phiri (2012) posited that pigs are tools to enhance households income and food security among vulnerable small holder resource poor households. Sequel to this, there are many unemployed young men and women with various qualifications who could cash on this unexploited area for their livelihood. Pigs business could be encouraged and enhanced through the careful and deliberate attempts of inculcating business traits in pig production.

In the light of the above observations, there is a need to understand the fundamentals of the present parameters of pig business in the country. The inability of government to come up with a policy on pig business that would encourage and motivate entrepreneurs to diversify the economy over the years is lacking. Therefore, production policies appropriate with the socio-economic characteristics of the producers should be evolved. Furthermore, most small scale farmers use only family labour to produce (Adegeye and Dittoh, 1995). Therefore, it becomes difficult to assign costs in the production process to enable them know exactly the amount expended. As a result of this the production process is not operated in a business manner.

1.2 Objective of the study

The broad objective of the study is to analysis pigbusiness in Kaduna State, Nigeria.

The specific objectives are:

i.   to describe the socio-economic characteristics of pig producers in the study area
ii. to determine the costs and returns in pig production in the study area and
iii. to determine the elasticity of swine production and return to scale in the study area;

The hypothesis that was tested is that pig business is not profitable in the study area.

II. METHODOLOGY

Kaduna State occupies about 46,016 square kilometers which represents about 5% of the land area of the 923,768 square kilometers of Nigeria. The State is made up of twenty three (23) Local Government Areas. The state lies between latitude 11° 32' and 09° 02' north of the Equator and longitude 80° 50' and 06° 15' east of the Greenwich meridian (Kaduna State Bureau of Statistics, 2017).

2.1 Sampling Technique

A multi-stage sampling procedure was adopted. The first stage was the purposive selection of four Local Government Areas (LGAs) known for their prominence in pig business namely: Jema'a, Zango-Kataf, Kaura and Kachia. The second stage was the purposive selection of five villages in each of these LGAs. The third stage involved the random selection of 10% producers from each village obtained from the extension list of Samaru Zone of the Kaduna State Agricultural Development Project. A total of one hundred (100) pig producers were selected from the sampled villages. Primary data were collected for the study through the use of a structured questionnaire and administered through oral interviews. The primary data for the study were collected based on the 2016 production season.

2.2 Analytical Techniques

Descriptive statistics was used to analyse farmers and farm specific characteristics.

The gross margin analysis was applied to determine the cost and returns of pig business. The Cobb-Douglas production function was used to determine the return to scale.

2.3 Gross Margin Model

The model was used to compute the gross margin for pig producer's. The model is expressed algebraically as:

GM= $\sum$GFI - $\sum$TVC ----------------------------- 1

GM = $\sum_{t=1}^{n} PiQi - \sum_{t=m}^{m} PjQj$ ---------------- 2

Where: $\sum$ = Summation sign

Pi = Price of unit of ith output

Qi = Quantity of ith output

Pj = Price of unit of jth input

Qj = Quantity of jth input

n = Number of output

m = Number of inputs

2.4 Cobb-Douglas production function.

The empirical specification of the model according to Oguniyi and Omoteso

(2011) is: $Y = \beta_o X_i^{\beta 1} \varepsilon i$ ------------------------------------ 3

Where:

Yi = quantity of pork produced in kilogram

β_o= intercept of the function

X_i= explanatory variables (i =1....5)

εi = Error term

In Logarithms, the equation is:

Log Yi = log β_o + $\beta_I$logX_I + $\beta_2$logX_2 + $\beta_3$logX_3 + $\beta_4$logX_4 + $\beta_5$logX_5 +log εi----------- 4

Where:

X_I = quantity of feed consumed in kilogram

X_2 = labour employed in Mandays

X_3 = medication in grams

X_4 = mating in numbers

X_5 = Number of piglets

εi = error term

The regression coefficients are all expected to have positive signs *a priori*. A study by Timer (1994), revealed that there are some problems in using Cobb-Douglas in production function estimation such as constant elasticity of substitution and separability of each factor of production. However, its primary characteristics such as ease of handling, suitability for direct estimation of production elasticities and provision of good fit have informed its usage in this study. Ogunniyi and Omoteso (2011), employed the use of this model to determine the return to scale in pig production.

III. RESULTS AND DISCUSSION

3.1 Socio- economic characteristics of pig producers

The result in Table 1 revealed that majority (57%) of the respondents were females.This agrees with Adekanye (1998) who reported that women play a dominant role in agricultural production and processing activities of developing countries, including Nigeria. This further suggests that females who are often at home, cleaning, watering and feeding pigs for their husbands have gone into full ownership. This may increase productivity and subsequently profit. This result agrees with findings by Duniya *et al.* (2013) that pig's production was dominated by females and contrary to findings by Ogunniyi and Omoteso, (2011), Osondu *et al.* (2014) and Irekhore *et al.*(2016) who reported that pig production was dominated by males.

This result also indicated that majority (60%) of the pig producers were within the ages of 40 – 60 years. The average age of pig producers was 44 years. This implies that majority of the pig producers were in their youthful age and were strong enough to perform the labourious and productive activities. This further reinforces the fact that age may

increase productivity and profit. This agrees with findings by Irekhore *et al*. (2016), who reported that age enables farmers to accumulate resources and experience over the years, but disagreed with Oguniyi and Omoteso (2011); Banta *et al*. (2012), that younger people were engaged in pig business.

The study further revealed that majority (89%) percent of the respondents were married. The high percentage of married respondents conforms to Ogunniyi and Omoteso (2011) that majority of the adult respondents were married. Married people in the society are perceived as more responsible when it comes to management issues than their single counterparts. The implications of this is that these large family sizes may translate into use of family labour which may enhance productivity and profit.

The result further showed that the literacy level of respondents in the study area was very high, 89% of them had attended formal education ranging from primary to tertiary

level while 11% had no formal education. This finding agrees with Ogunniyi and Omoteso (2011) and Irokhore *et al*. (2015) that literacy level of respondents was very high for pig producers. The average years spent in education was 8.68 years. Education is an avenue through which knowledge and technology is impacted significantly in every human endeavour. Literacy is an important asset in obtaining information relevant to pig production. This probably implies that pig production requires certain level of education in order to increase managerial ability that would enhance productivity and profit.

Majority of the households (63%) had between 6-10 members. The average household size of the respondents was 8. This is higher than the national average of 6 persons per household (World Data Atlas, 2012). This large household size agrees with Umeh *et al*. (2015) and Abah *et al*. (2016) that large household size may translate to higher usage of family labour. This implies that the pig producers may not spend more resources on hired labour as family labour will readily be available, on the other hand, it may increase feeding, educational funding and other activities that would compete for the household resources.

The distribution of respondents according to years of experience in pig business revealed the average value to be13 years. This experience enabled the respondents to have adequate knowledge of pig production techniques. This agrees with findings by Dauda and Ndanitsa, (2009) that the length of experience of a working population in any occupation determines its performance and enables managers overcome problems previously encountered in the production process. The result showed that 48% of the respondents had less than or ten years of experience, while 52% had more than ten years of experience. The implication is like the maxim 'that experience is the greatest teacher' comes to play as respondents have had long years of pig production, well specialized and greater productivity. Majority of respondents

75% had 3-5 herd size. The mean herd size was 4. This small herd size agrees with findings by Ironkwe and Amefule (2008), Petrus *et al*. (2011) and Duniya *et al*. (2013), that pig production in Rivers State, Etayi Constituency of Namibia and Kaduna State respectively was primarily small scale production. This implies that as small scale farmers a concerted effort needs to be put in place to achieve profit.

The result further revealed that 40% of the respondents were engaged in pig farming as their primary occupation, while 60% were engaged in other career activities. This conforms to Oluwaseun (2011) that pig production is one of the few profitable business ventures you don't have to babysit, it allows you have a life and career elsewhere. This implies that entry into pig production is unlimited irrespective of other engagements and could be described as a veritable tool for increased family income and standard of living. It is also shown in table 2 that majority (93%) of the source of labour was the family. This agrees with findings by Banta *et al*. (2012), that the family is the dominant provider of manpower for pig production in small scale farms.

The result showed the distribution of membership of co-operative society. Majority (73%) of the respondents did not belong to any co-operative society while (29%) were members of co-operative societies. This is contrary to findings by Adeola *et al*. (2011), that majority of farmers in Kaduna State were members of co-operative societies and this enabled them interact with other farmers and that it was an avenue through which innovations were diffused among farmers. It was also very important to state that pig production has both social and religious limitations as such there were no deliberate government policies to encourage farmers form co-operative societies that would encourage pig production.The result also revealed that 50% of the respondents used cement zinc pens, 40 % used mud corrugated iron pens, 6% tethered pigs under trees/ old buildings and 4% used thatched mud pens. Pigs are known to have the characteristic of burrowing habit. They can easily pull down their housing units with their snouts. It therefore requires that their housing units are reinforced with concrete. This is in consonance with the findings by Irekhore *et al*. (2016) that the use of different types of pens can make production and management efficient as well as leave the animals in good body condition since overcrowding and or competition for food, water and space will be avoided. These pens had an average life span of 8.01 years. Majority (78%) of the pens were between the 1-10 years. Pigs need housing to keep them warm during cold temperatures and to shelter them from excessive heat (Bond and Peterson, 1958). When housed indoors, temperature conditionsmust be well regulated. Controlled temperature conditions can help maximize pig productivity (Myer and Bucklin, 2009). The average piglets per sow per year were 13.89. Fifty-eight percent (58%) of sows' parturated between 11-20 piglets, 40% had 1-10 piglets; this implies that they were producing below the expected capacity as they were small scale produce in Table 1.

Table 1:   Socio – economic characteristics of pig farmers

Farmer Characteristics	Freq.	%	Mean	Std. Dev.	.
Gender					
Male	43	43.0			
Female	57	57.0			
Age (Years)					
21-40	38	38.0	**43.78**	**8.236**	
41-60	60	60.0			
≥ 61	2	2.0			
Marital Status					
Not Married	1	1.00			
Married	89	89.0			
Widowed	10	10.0			
Educational Status					
No formal Education	11	11.0	**8.68**	**5.079**	
Primary Education	29	29.0			
Secondary Education	43	43.0			
Tertiary Education	17	17.0			
Co-operative M/ship					
Non-members	73	73.0			
Members	27	27.0			
Primary Occupation					
Farming	40	40.0			
Civil Servant	26	26.0			
Trading	24	24.0			
Craftsman	10	10.0			
Labour Source					
Self	6	6.0			
Family Labour	93	93.0			
Hired Labour	1	1.0			
Household Size					
≤ 5	19	19.0	**8.16**	**3.287**	
6-10	63	63.0			
11-15	16	16.0			
≥ 16	2	2.0			
Years of Experience					
≤ 10	48	48.0	**12.72**	**7.293**	
11-20	42	42.0			
21-30	9	9.0			
≥ 31	1	1.0			
Herd Size					
≤ 2	16	16.0	**3.72**	**1.264**	
3-4	75	75.0			
6-8	9	9.0			
Piglets/Sow/Year	40	40.0	**13.89**	**12.547**	
≤ 10	47	47.0			
11-20	12	12.0			
21-30	1	1.0			
≥ 31	3	3.0			
Pen Age					
≤ 5	39	39.0	**8.01**	**4.877**	
6-10	39	39.0			
11-15	17	17.0			
≥16	5	5.0			
Housing Type					
Tethering under tree	6	6.0			
Thatched mud pens	4	4.0			
Corrugated mud pens	40	40.0			
Corrugated Cement pens	50	50.0			

3.2 Costs and returns of pig producers

The average yearly cost and returns from pig production was computed and presented in Table 3.The average total variable cost of production was ₦ 13,627.41 per pig of 50 kilograms (kgs), while the total revenue per pig of 50 kgs was ₦ 22,053.67. This gave an average gross margin of ₦ 8,426.30 per 50 kgs pig. The rate of return (ROR) on investment was 0.69kobo.This implies that for every naira invested in pig production, ₦ 0.69 kobo was received as profit by the producers. However, this profit level was lower than findings by Giroh *et al.* (2010), Ogunniyi and Omoteso (2011) and Duniya *et al.* (2015), who recorded ROR for pig production of ₦ 1.32, ₦ 1.57 and ₦ 1.38 respectively. Giroh, *et al.* (2010) stated that the rate of return is usually the undiscounted cost benefit ratio of a project and is similar to marketing efficiency.These differences could be attributed to a number of factors like inflationary trends, distance to the market and the time the data were collected. Between the months of August and October, there is usually scarcity of pigs in the markets due to the terrible bad state of rural roads making such areas inaccessibility, thereby creating demand to be greater than supply while during other months, the prices used to drop due to increased pigs supply, thereby affecting the profit margin.

The result obtained from the t-testin Table 3 revealed a significant difference between the costs and returns of pig producers. The calculated t-value (15.126) was found to be greater than the Table value (2.390) at 1% probability level. This implies that the null hypothesis should be rejected and the alternative hypothesis accepted that pig business is profitable in the study area.

Table 2: Costs and returns of pig production in the study area

A. Variable Costs	Quantity	Unit Cost ₦	Value ₦
Feed cost	656.3kg	4,500.00	29,533.50
Piglet cost	4	4.200.00	16,808.00
Stock transport cost	4	215.05	860.20
Labour for feeding (man days)	12.5	368.83	4,425.96
Labour for watering "	8	368.83	2,950.64
Labour for cleaning "	11	368.83	4.057.13
Clipping and castration	4	310.75	1,243.00
Drug cost	4	813.50	3,254.00
Mating	1	3,885.02	3,885.02
Veterinary service	1	1,467.00	1,467.00
Disease treatment	1	950'00	950.00
Transport to the market	4	737.53	2,950.10
Total Variable Cost (TVC)			**67,916.60**
B. Fixed Cost			
Depreciation of pens	2	1,430.00	2,860.00
Depreciation of wooden feeding troughs	2	372.20	744.40
Depreciation of rubber buckets	2	210.00	420.00
Depreciation of iron containers	2	221.00	442.00
Depreciation of iron bucket troughs	1	180.00	180.00
Total Fixed Cost (TC)			**72,663.10**
Total variable cost/Pig			13,627.41
C. Returns			
Sale of Piglets	8	5,000.00	40,000.00
Sale of spent sows	2	22,750.00	45,500.00
Sale of old boars	1	27,765.00	24,650.00
Total Returns			**110,265.00**
Total Returns/Pig			22,053.00
Gross Margin			42, 348.40
Gross Margin/Pig			8,426.30
Rate of Return (ROR)			0.69

Table 3:T-test showing difference in Total Revenue and Total Variable Cost

Variables	TR	TC	GM
Minimum	22000.00	29500.00	42330.00
Maximum	288000.00	153000.00	
Mean	42330.40	26718.73	
Std. Dev.	40171.93		
t	15.126		

*** *t-ratio at 1% significant*

3.3 Production elasticities and return to scale

The result of the Cobb- Douglas production function on Table 4, showed that the coefficient of multiple determination (R^2) was 0.650. This implied that 65% of total variation in the total number of pigs produced were explained by the explanatory variables while the remaining 35% not explained was attributed to those variables not included in the model but captured by the stochastic term. The results also showed that all the independent variables (X_1, X_2, X_3, X_4, and X_5) have positive signs and were significant at 1% level. The positive signs implied that the variables were positively related to the quantity of pigs produced. The result showed that feeds in kilogram has a coefficient of 0.219,number of piglets 0.216, number of times for breeding/mating 0.013, quantity of medication in grams 0.154 and labour in man-days 0.221. This implied that a unit increase of these variables would lead to an increase in output by the magnitude of their coefficients.

The total sum of the regression coefficient was 0.823.This was found to be less than one (<1) indicating, a positive decreasing return to scale. By this, producers were operating in stage two (ii) of the production function popularly referred to as the rational stage of production (Olukosi and Ogungbile 1989). The sum of the coefficients of Cobb- Douglas production function indicated decreasing return to scale (Koutsoyannis 1977). The implication of this to pig business in the study area is that it was at the optimum level. It

therefore means that the producers must improve on their management in order to sustain the tempo. The a priori expectation was met since all the independent variables, feeds, labour, number of piglets, mating and medication were positive and significant at 1%.

Table 4: Cobb- Douglas Production Function Estimates

Variable	Coefficient	Standard Error
Constant	3.845 (6.367)***	.604
Feeding	0.219 (3.771)***	.058
Piglet	0.216 (3.943)***	.055
Mating	0.013 (3.882)***	.003
Medication	0.154 (2.796)***	.055
Labour	0.221 (3.316)***	.067
R^2	0.668	
Adj. R^2	0.650	
F-Value	37.816	
DW.	2.00	

RTS- Return to Scale = 0.823
***= t-ratio at 1% Significant in parenthesis

IV. CONCLUSION AND RECOMMENDATIONS

The result of the study revealed that majority (57%) of respondents engaged in pig business were females. Pig business was found to be profitable in the area with 0.69 rate of return on capital invested. The result further showed that pig producers were operating at the rational stage (stage II) of the production function. The study recommends that there should be a deliberate effort by government to introduce extension services and loans to these pig producers to assist them in modern management practices to boast productivity and higher profits.

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