

PROFITABILITY, TECHNICAL EFFICIENCY AND CONSTRAINTS TO PIG PRODUCTION IN OGUN STATE, NIGERIA

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The pig is a prolific livestock whose potentials have not have not been fully harnessed in Nigeria despite the current level of animal protein deficiency and income poverty among farmers in the country. This study therefore examines the economics of pig production in Ogun State, Nigeria. The data were collected from 80 respondents through a multi-stage sampling technique. The analytical tools employed were descriptive statistics, net farm income analysis and stochastic frontier model. The study reveals that pig production is a male-dominated enterprise in the study area and most practised by young married individuals whose main source of finance is personal savings. The net farm income, operating ratio, gross ratio and rate of return to investment by the respondents were ₦393,123.36/annum (2,036.91 US Dollar), 0.324, 0.457 and 1.189 respectively, indicating that pig production is a profitable venture in the study area. The technical efficiency of the farmers ranged from 11.2% to 99.2% with a mean of 76.5%. The challenges facing the farmers were high cost of feed, high cost of medication, poor market for pig and pig products, inadequate capital, disease outbreak, inadequate equipment and high price of improved breeds. The study therefore calls for participation of the Government and private sectors in provision of credit facilities, suitable extension services, improved breeds and veterinary drugs.

Key word: Animal protein deficiency, pig production, profitability, technical efficiency, challenges

The livestock subsector is an important component of agriculture of any nation. The livestock sub-sector is equally vital to the

national economy since it is the main supplier of the highly essential animal protein. The relevance of this sub-sector is in line with recommendation of the F.A.O (2003) that on an average basis, a man's daily protein intake should be between 65-72grams and 53% (about 35 grams) of this should be animal based.

Animal protein is essential in human nutrition because of its biological significance. In realization of this the various governments in Nigeria have been pursuing programmes at national, state and community levels to boost the mass production of food and livestock. Some of the programmes include the Farm Settlement Scheme, Agricultural Development Project (ADP), Better Life Programme, and micro credit scheme for livestock parent/foundation stock and community level in Nigeria (Muhammad-Lawal *et al*, 2009; Daneji, 2011). In this vein, efforts have been geared towards improving livestock productivity through adequate nutrition, breed development specifically through cross-breeding with superior exotic breeds (Ladokun *et al*; 2006). One of such livestock is the pig.

The potentials of pigs towards food security and improving the livelihoods of the Nigerian farmers cannot be underestimated. Pigs are known to be prolific realizing 20 to 30 piglets at 2 to 3 liters per year and yield quick returns on investment (Adesehinwa *et al*, 2003). Besides, pigs are not only a source of protein but can also serve as an investment alternative and source of additional income to farmers. Thus, the pig production could be an avenue for employment generation and a means of eradicating poverty among farming households. All these potential benefits,

however, depends on how well pigs are being produced and how profitable the venture is.

From the foregoing, this study examined the economics of pig production in Kwara State, Nigeria. The specific objectives were to (i) describe the socio-economic characteristics of pig farmers in the study area, (ii) analyze the profitability of pig production by the farmers, (iii) assess the technical efficiency of the farmers, and (iv) identify the constraints to efficient pig production by the farmers. The study is expected to inform policy makers and relevant stakeholders on how pig production could be improved upon while still serving as a profitable enterprise in Nigeria.

MATERIALS AND METHODS

Study Area

The study was carried out in Ogun State of Nigeria. The state is situated between Latitudes 6.2°N and 7.8°N and Longitudes 3.0°E and 5.0°E and is located in the Southwest Zone of Nigeria with a total land area of 16,409.26 square kilometers. It is bounded on the West by the Benin Republic, on the South by Lagos State and the Atlantic Ocean, on the East by Ondo State, and on the North by Oyo and Osun States. Ogun State comprises twenty Local Government Areas (LGAs). About 20 percent of its total area is constituted of forest reserve suitable for livestock. The major livestock reared in the state include poultry birds, small ruminants, swine, rabbits and fish.

Sampling Procedure and Data Collection

A three-stage sampling method was used for the study. The first stage involved a purposive selection of Ewekoro and Ifo LGAs of the state because of the larger population of pig farming in those areas. The second stage involved random selection of four (4) villages from each of the two LGAs. The final stage involved the purposive selection of ten (10) pig farmers from each of the selected villages making a total sum of eighty (80) respondents.

Both primary and secondary data were used for this study. Primary data were collected with the aid of structured questionnaires and personal interview schedule. Data collected covered socio-economic profile of the

respondents, production data, constraints to swine production by the respondents. Secondary data were also obtained from the internet, journals and textbooks and grey literature.

Analytical Techniques

Data collected were analyzed with descriptive statistics, cost and returns analysis and the stochastic frontier model. Descriptive statistics was used to analyze the socio-economic characteristics of the farmers.

Analysis of cost and returns was carried out to evaluate the profitability of swine production by the farmers. This involved comparing cost incurred in pig production with revenue earned to determine the profit (loss). This was estimated as follows:

$$\text{NFI} = \text{TR} - \text{TC} \dots\dots\dots (1)$$

Where NFI = Net farm income (₦)
TR = Total revenue (₦), and
TC = Total cost (₦)

$$\text{TC} = \text{TVC} + \text{TFC} \dots\dots\dots (2)$$

Where TVC = Total variable cost (₦), and
TFC = Total fixed cost (₦)

The items of revenue considered include income from the sale of dressed and live pigs as well as income from the sale of the droppings. The variable cost includes costs of feed, labour and veterinary services (drugs, disinfectant and medication). The fixed cost includes depreciation on equipment, rent on land and security charges.

The profitability ratios were computed also from the above specifications in order to know the performance or economic worth of swine enterprise in the study area. The ratios considered were the gross ratio (GR), operating ratio (OR) and rate of return to investment (RRI).

$$\text{Gross Ratio, GR} = \text{TC} / \text{TR} \dots\dots\dots (3)$$

$$\text{Operating Ratio, OR} = \text{TVC} / \text{TR} \dots\dots\dots (4)$$

$$\text{Rate of Returns to Investment, RRI} = \text{NFI} / \text{TC} \dots\dots\dots (5)$$

The stochastic frontier model by Battese and Coelli (1995) was used to analyze the

technical efficiency of the respondents. The model is specified in the implicit form as follows:

$$Y_i = f(X_i, \beta) + (V_i - U_i)$$

Where: Y_i is the output of the i th farm

X_i is a $k \times 1$ vector of input quantities of the i th farm

β is a vector of unknown parameters estimated

V_i are random variables which are assumed to be normally distributed $N(0, \delta v^2)$ and independent of the U_i . It is assumed to account for measurement error and other factors not under the control of the farmer.

U_i are non-negative random variables, called technical inefficiency effects (Aigner *et al.*, 1977).

A Cobb-Douglas Production form of the frontier used for this study is presented as follows:

$$\ln Y = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + V_i - U_i \dots \dots \dots (6)$$

Where: Y = Gross income from pig production per annum.

X_1 = Feed intake (kg)

X_2 = Number of pigs stocked

X_3 = Cost of veterinary services

X_4 = Depreciation

X_5 = Labour in man-day

$\beta_0, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5$ = Parameters to be estimated.

The inefficiency model is represented by U_i which is defined as follows:

$$U_i = d_0 + d_1 z_1 + d_2 z_2 + d_3 z_3 + d_4 z_4 + d_5 z_5 + d_6 z_6 + d_7 z_7 \dots \dots \dots (7)$$

U_i = Technical inefficiency

z_1 = Age (years)

z_2 = Household size

z_3 = Educational status

z_4 = Extension visit

z_5 = Cooperative membership (Yes = 1, No = 0)

z_6 = Pig production as main source of income (Yes = 1, No = 0)

z_7 = Farming experience (years)

$d_0, d_1, d_2, \dots, d_7$ = Parameters to be estimated.

Since the dependent variable of the inefficiency model represents the mode of inefficiency, a positive sign of an estimated parameter implies that the associated variable has a negative effect on efficiency but positive effect on inefficiency and vice versa (Yao and Liu, 1998; Rahji, 2005).

RESULTS AND DISCUSSION

Socio-economic Characteristics of the Pig Farmers

The socio-economic characteristics of the pig farmers are presented in Table 1. The Table shows that the majority (85%) of the pig farmers were male while just 15% were female. Thus, it can be inferred that pig farming is mostly carried out by the male in the study area. This is probably due to the stressful nature of pig rearing. This is in line with findings by Oni and Yusuf (1999) that pig farming is a male-dominated enterprise. It should be noted, however, that this does not mean that females were not involved in pig production in the study area. Investigations during the survey revealed that the female serve as suppliers of labour in light farm operations such as serving of feed, water and/or cleaning of the piggery.

Table 1: Socio-economic Characteristics of the Respondents (N = 80)

The majority (91.2%) of the respondents were married. This suggests that pig production is a means of income generation for catering for the family in the study area. Most (38.9%) of the respondents were within the age range of 50-59 years. A mean age of 51.51 years was obtained in the study. This indicates that the pig farmers were relatively young and thus still active and agile with vigor required in pig farming.

About 65% of the respondents had a household size of about six to ten persons. A mean household size of about seven persons was obtained in the study. This indicates that the pig farmers had a relatively large household size, which may serve as a cheap source of family labour to the farmers.

Distribution of the respondents according to their educational status shows that all the farmers had one form of formal education or the other. Also, about 57.5% of the farmers had tertiary education, 32.5% had secondary education while just 10.0% had primary education. This implies that most of the pig farmers were well-educated and this may assist them in term of management to ensure high productivity. As regards the religion of the respondents, the table shows that most of them were Christians (97.5%) while 2.5% were Muslims.

Table 1: Socio-economic Characteristics of the Respondents (N = 80)

Variables	Category	Frequency	Percentage
Gender	Male	68	85.0
	Female	12	15.0
Marital status	Single	7	8.8
	Married	73	91.2
Age (years) Mean age = 51.51 years	30 – 39	10	12.3
	40 – 49	23	28.7
	50 – 59	31	38.9
	60 and above	16	20.0
Household size Mean = 6.63	1 – 5	25	31.3
	6 – 10	52	65.0
	11 – 15	3	3.7
Educational Status	Primary education	3	10.0
	Secondary education	26	32.5
	Tertiary education	46	57.5
Religion	Christianity	78	97.5
	Islam	2	2.5
Farming experience (years) Mean = 6.81 years	1 – 5	47.6	47.6
	6 – 10	38.8	38.8
	11 -15	7.6	7.6
	16 – 20	2.4	2.4
	21 – 25	3.8	3.8
Pig farming as major source of income	Yes	23	30.0
	No	57	70.0
Other sources of income	Civil service	28	35.0
	Trading	10	12.5
	Crop farming	9	11.2
	Fishing	3	3.8
	Poultry	26	32.5
	Others	4	5.0
Access to extension services	Had access	49	61.2
	Had no access	31	38.8
Source of capital	Personal savings	64	80.0
	Cooperative societies	9	11.2
	Friends and relatives	2	2.5
	Banks	3	3.8
	Others	2	2.5

Ssource: Field survey

The mean year of farming experience of the farmers is 6.81 years. About 61.2% of the farmers had access to extension services. Table 1 further shows that 61.2% of the farmers were members of cooperative society while 38.8% of them did not belong to any cooperative society. Seventy percent of the respondents were part-time pig farmers, combining pig farming with other enterprises as well as paid jobs. The majority (80%) of the respondents fund their

production with personal savings while just 30% source their capital from cooperative society, relatives, friends and banks.

Cost and Returns to Swine Production by the Respondents

Table 2 shows the analysis of costs and returns to pig production by the respondents. On the average, the total cost incurred by a farmer in the study area was ₦330,761.64 per annum (note: 1 US Dollar = ₦195). The total variable cost incurred by the farmer

was ₦234,185.40 per annum and this accounts for 70.8% of the total cost. The total fixed cost of production of the farmer was ₦96,576.24 per annum, representing about 29.2% of the total cost. The total revenue was ₦723,885.00 per annum. Thus, the net farm income earned by the farmer was ₦393,123.36 per annum. This translates to ₦32760.28 per month. It is worthy of note that this value is above the current Minimum Wage of ₦18,000.00 per month which is being earned by the civil servants in Nigeria (including the study area).

The gross ratio obtained was 0.457,

implying the total cost is about 45.7% of the total revenue. Also, the rate of return in pig production by the farmers was 1.189% (1.189). This means that for every one naira invested in pig production, about ₦1.19 is gained by the farmer. The operating ratio was 0.324, indicating that the total variable cost is about 32% of the total revenue. Overall these results show that pig production in the study area was a profitable venture.

Analysis of Technical Efficiency of the Farmers

Table 3 shows the summary of the technical

Table 2: Costs and Returns to Pig production in the Study Area

Variables	Value
A. Revenue	
Sales of dressed pigs	₦165,700.00
Sales of live pigs	₦552,775.00
Droppings	₦ 5,410.00
Total revenue	₦ 723,885.00
B. Variable costs	
Cost of feed	₦150,514.32
Cost of veterinary services	₦21,742.56
Cost of labour	₦61,928.52
Total variable costs	₦234,185.40
C. Fixed costs	
Depreciation on equipment	₦14,783.40
Rent	₦21,792.84
Security charge	₦60,000.00
Total fixed cost	₦96,576.24
D. Total cost (B + C)	₦330,761.64
E. Gross margin (A – B)	₦489,699.60
F. Net farm income (A – D)	₦393,123.36
G. Gross ratio (D/A)	0.457
H. Operating ratio (B/A)	0.324
I. Rate of return on investment (F/D)	1.189

Source: Field Survey.

Note: 1 US Dollar = ₦195

Table 3: Technical Efficiency of the Respondents

Technical Efficiency	Frequency	Percentage	Minimum	Maximum	Mean
≤0.500	8	10.0	0.112	0.497	0.363
0.501 - 0.600	5	6.3	51.1	0.598	0.582
0.601 - 0.700	11	13.8	61.9	0.698	0.647
0.701 - 0.800	15	18.8	0.702	0.798	0.735
0.801 - 0.900	19	23.8	0.804	0.896	0.873
>0.900	22	27.5	0.901	0.992	0.938
Sample	80	100.0	0.112	0.992	0.765

Source: Field Survey

efficiency of the respondents. The minimum estimated efficiency of the farmers was 11.2% while maximum efficiency was 99.2% and the mean technical efficiency was 76.5%. This mean value indicates that if input usage is increased by 23.5% (100 – 76.5)%, the farmers will be operating on the production frontier. Analysis of the result further showed that 41.3% of the farmers fall below the 76.5% mean efficiency level while 58.7% of the farmers had their technical efficiency greater than the mean technical efficiency. Thus, opportunity still exists for increasing productivity and income through increased efficiency in resource utilization by adopting the technology and techniques used by the best-practiced pig farmers.

Determinants of Technical Efficiency of the Respondents

The result of the analysis of the technical efficiency of the respondents is presented in Table 4. The estimated variance (δ^2) was statistically significant at 5% indicating the goodness of fit and correctness of the specified distribution assumption of the composite error term. The gamma (γ) was

estimated at 1.00 and was significant at 1% for the respondents. This implies that 100% of the total variation in the total value of pig farm output by the respondents is due to technical inefficiency.

As revealed in Table 4, two variables (cost of veterinary services and labour) were significant in determining the gross income from pig production by the respondents. These variables were negatively related to farm output of the respondents, signifying that an increase in these variables results in reduced value of farm output. The decrease in the gross income of pig production with increase in the cost of veterinary services is in consonance with *a priori* expectation, as the farmers might not have enough fund to cope with any increase in pig production more so that 80% of the farmers fund their production with personal savings (Table 1). This might consequently impair the managerial ability of the farmers and result in reduced income from pig production. Meanwhile, the negative relationship between labour and technical efficiency of the farmers indicates the presence of disguised unemployment in pig production

Table 4: Maximum likelihood estimates of the stochastic frontier production function for Swine Production in the study area

Variables	Parameters	Coefficient	Standard error	T-ratio
Stochastic Frontier				
Constant	b ₀	13.437	0.981	13.697
Feed intake	b ₁	0.020	0.106	0.189
Number of pigs stocked	b ₂	-0.043	0.030	-1.433
Cost of veterinary services	b ₃	-0.317***	0.106	-2.991
Depreciation	b ₄	0.047	0.030	1.567
Labour	b ₅	-0.310**	0.142	-2.183
Inefficiency model				
Constant	d ₀	-0.801	1.006	-0.796
Age	d ₁	-0.483	0.572	-0.844
Household size	d ₂	-0.491	0.864	-0.568
Educational status	d ₃	-0.417	0.894	0.466
Extension services	d ₄	1.036***	0.345	3.003
Membership of cooperative	d ₅	-0.034	0.160	-0.213
Pig production as the primary source of income	d ₆	1.118	0.883	1.336
Farming experience	d ₇	-1.511**	0.603	-2.506
Variance Parameters				
Sigma-squared	δ^2	0.765*	0.410	1.866
Gamma	γ	1.000***	0.008	125.0

* Significant at the 0.1 level; ** at the 0.05 level; *** at the 0.01.

Source: Field survey

Table 5: Problems encountered by the Pig Farmers

Problem	*Frequency	Percentage
Disease outbreak	36	45.0
High cost of feed	77	96.3
High cost of improved breeds	18	22.5
Inadequate capital	39	48.8
Lack of equipment	22	27.5
High cost of medication	58	72.5
High cost of labour	11	13.8
Poor market for pig and pig products	53	66.3
Others	20	25.0

Source: Field Survey

*Note: Multiple responses allowed

in the study area. A similar finding was reported by Rowland *et al.* (1998) on the technical efficiency of swine farmers in Kansas.

The estimated values of inefficiency model in Table 4 also show that extension services and farming experience were the significant factors influencing the technical efficiency of the farmers. Access to extension services was positively related to the technical inefficiency of the farmers. This implies that rather than increasing the efficiency with which the pig farmers carried out their activities, extension contact actually reduced the efficiency of the farmers. This may be due to lack of trust on the potency of extension services received by the farmers as posited by Muhammad-Lawal *et al.* (2009). Besides, Raphael (2008) was of the opinion that this may be due to bureaucratic inefficiency and some generic weaknesses in information dissemination to Nigerian farmers.

Years of experience in pig production was negatively related to the technical inefficiency of the respondents. This implies that the higher the farming experience of the farmers, the better their technical efficiency was. This is logical, as experience improves farmers' skills and enhances their ability to manage production activities in a way that increases their actual output (Mejeha and Nnana, 2010).

Problems Encountered by the Respondents

The problems militating against the activities of the respondents are presented in Table 5. Most (96.2%) of the farmers faced the problem of a high cost of feed. Investigations during the survey conducted

revealed that the high cost of feed was as a result of high cost of feed ingredients and difficulty in procuring the feed.

About 72.50% of the respondents had the problem of high cost of medication. The respondents lamented that this problem resulted from high cost of drugs, limited availability and apparent difficulty in getting health care services to the farmers at the right time.

Sixty-two percent of the respondents had the problem of a poor market of pigs and pig products. This, according to the respondents, was due to inadequate buyers of pigs at the right time.

About 48.80% of the respondents suffered from the problem of inadequate capital. The respondents affirmed that the problem was due to lack of financial assistance and access to formal credit facilities. This could result from the fact that just 15% of the farmers had access to credit facilities from banks and cooperatives which could provide the farmers with adequate fund (See Table 1).

Forty-five percent of the farmers faced the problem of disease outbreak (45%) while 27.50% encountered inadequate equipment. Other problems highlighted by the respondents were high cost of improved breeds, high cost of labour, lack of electricity and water supply.

CONCLUSION

From this study, it can be inferred that pig production is a profitable enterprise but its prospects are limited by certain challenges which need to be addressed for increased profitability. The mean technical efficiency of 76.5% obtained in this study also shows

that the farmers were highly efficient but still have the opportunity to increase their productivity through increased efficiency in resource utilization by adopting the technology and techniques used by the best practiced pig farmers.

Based on the findings of this study, therefore, there is need by the government, NGOs, credit institutions and other agricultural development agencies to assist pig farmers with credit facilities. This may be through the provision of soft loan to the farmers. This will not only help the farmers in solving the problem of inadequate capital but also assist them to afford cost of labour and veterinary services, thereby improving their efficiency. Besides, Ministry of Agriculture and other agricultural development bodies should provide pig farmers with improved breeds and veterinary services. Moreover, there is need for extension workers to provide pig farmers with extension services that suit their production.

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