Profitability of Pig Farm Enterprises under Intensive System for Economic Recovery among Farmers in Enugu State, Nigeria

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Abstract

This study analysed the profitability of pig farms in Enugu State, Nigeria. Three research questions and two hypotheses were formulated based on the specific purposes of the study. Survey research design was adopted for the study. The study covered the registered pig farms in the study area. The population for the study was 519 respondents comprising 162 rural pig farmers, 135 urban pig farmers and 222 agricultural extension workers in Enugu State. Purposive sampling of 55 pig farms was carried out and used to answer research question 1. Data was collected using structured questionnaire, pig performance recording sheets, and available farm records. The data collected was analysed using mean scores to answer the research questions while t-test statistic was used in testing the null hypotheses at 0.05 level of significance. It was found that pig production business was highly profitable in the study area with mean profit margin of N3, 689, 267.98 per farm per year. The productivity constraints such as diseases and parasites attack, high cost of animal feeds and veterinary drugs were identified. Strategies for improving profitability of pig farms were ascertained such as sound livestock extension services and farmer education for pig farmers and employment of skilled and proficient pig farm managers and attendants. It is concluded that pig production in Enugu State is highly profitable. It is recommended that pig farmers and stakeholders in pig production should be assisted by the Ministry of Agriculture, philanthropists and non-governmental organizations with technical, financial and material aids.

Keywords: Profitability, pig farm enterprises, intensive system, economic recovery.

1. INTRODUCTION

There has been global economic recession in recent years resulting to fall in Gross Domestic Products (GDP) and malnutrition among low income earners especially in developing countries. Different countries and governments have made efforts to ensure speedy economic recovery so as to reduce hardship among the citizens. Nigeria is among the countries that experience economic recession. Different innovations, programmes and policies aimed at achieving economic recovery in Agriculture and other sectors of the economy have been pursued by Nigerian government. Innovations and improvements in animal production have been identified by experts to revampe the economy of Nigeria if properly harnessed (Ezeibe 2010). Pig production is among the farm enterprises that can contribute immensely to Nigeria's economic recovery. The level of animal protein intake by Nigerians is inadequate as they consume more of plant protein than other sources of protein (Food and Agriculture Organization (FAO), 2011). Owing to the acute shortage of animal protein in the diet of average Nigerian, there is the need to increase domestic production of animals such as pigs. This will help to fill or at least narrow the animal protein deficit among Nigerian consumers. Animal production has suffered a great set back in the recent years due to disease outbreak, high cost of feeds, inclement weather condition and insufficient government assistance. This resulted to insufficient supply of meat and other animal products which supply protein to man. Nigeria and Enugu State in particular have conducive environment for keeping farm animals such as sheep, cattle, horses, donkeys, rabbits, camels, poultry and pigs (swine). Pigs in this study are chosen because of the attendant benefits in the study area.

Pigs have high survival rate, high feed conversion efficiency and high prolificacy (Karol and Krider, 2013). Pigs are known to be prolific having 20 to 30 piglets from 2 litters per year (Akinyosoye, 1999). They have short gestation period of 3months, 3weeks and 3 days. Pigs are good and efficient feed converters. They are able to reach slaughter weight of about 80 – 90kg in 7 to 8 months under efficient management and balanced nutrition (Adesehinwa, Aribido, Oyediji and Obiniyi, 2003). The good qualities and inherent high productive potential of pigs make their production to be economically viable (John, 2007).

Pigs produce meat (pork) and fats (lard) which are highly consumed in non-moslem areas of the world (Serres, 1999). Apart from pork and lard, pigs give other economically important produce such as pig skin as raw materials for making valuable leather materials. Bristles from pigs are used for making brushes, hooves for making gelatin and glue products are also obtained from pigs (Holness, 2007). Pigs also provide good source of animal feeds from blood and inedible meat tissues. The pigs provide blood, intestines and offals for making sausage and delicacies for man and animal consumption. The faeces and effluents serve as manure to increase the fertility of farm land and to produce biogas used in domestic cooking (Rogerio and Laura, 2006). All the pig products and by-products are potential income earners for the pig farmers.

In Nigeria, pig production is the lowest of all livestock sub-sector in terms of meat supply when compared with poultry, goats, sheep and cattle (Central Bank of Nigeria (CBN), 2012). Many pig farmers and investors are not willing to enter into swine (pig) production business and those who manage to enter easily quit. There is need to ascertain the reason for the downward trend in swine production. Research studies have shown that pig production in Nigeria is inadequate and requires drastic measures for its improvement and sustainability. When compared with poultry and other farm animals slaughtered and consumed daily in Nigeria, pigs represented less than 1 percent (FAO., 2006). In Enugu State, pork is demanded more in urban centres than in rural areas (Nwobodo, 1997). Apart from location, other disparities exist among pig farmers in the study area such as literacy, gender, experience and scale of production.

There are two major systems of pig production namely; the traditional/extensive system and the intensive system (Ezeibe, 2010). The pigs under the traditional system are left to scavenge and roam about searching for feeds. This system is characterized by the use of indigenous, unimproved breeds, low quality feeds and poor management resulting to low productivity (Akinyosoye, 1999). The extensive system appears to be the simplest and cheapest method adopted by the farmers since the pig farmer does not spend much money on feeds and housing. It is usually practiced by peasant, small-scale, subsistent pig farmers who are not ready to actor into intensive system.

The intensive pig production system involves total confinement of the pigs which requires huge capital investment. Intensive system is characterized by the use of improved exotic breeds, proper housing, adequate feeding and veterinary services coupled with good management practices (Ezeibe, 2010). The housing comprises of modern, permanent structures which encourage easy disposal of faeces and effluent, providing maximum comfort and security for the pigs. Both the extensive and intensive pig production systems have many constraints militating against high productivity and profitability of pig farms.

1.1 Statement of the Problem

Anukwu and Ebong (2011) identified many pig production constraints in Akwa Ibom State to include: high cost of feeds, inadequate capital, high cost of medication and drugs, poor extension services, high cost of transportation, scarcity of skilled labour and poor breeding stock. Adesehinwa, Aribido, Oyediji and Obiniyi (2003) also identified some problems facing livestock production which included; weather fluctuation, diseases and parasites attack, religious beliefs, illiteracy, poverty and insufficient animal feeds. These problems are likely to affect the productivity of pig farms if strategies are not put in place to overcome them.

In Nigeria, the daily animal protein consumption is declining due to high poverty rate, rapid population growth and the ban on importation of foreign meat since the year 2001 (Federal Office of Statistics (F.O.S), 2015). The World Health Organisation (WHO) (2013) recommended quantity of protein (85g/person/day) to be consumed by an individual which Nigerians have not attained. There is inadequate supply and intake of animal protein as more of plant protein are consumed. There is the need to increase domestic production of animals such as pigs to narrow the animal protein deficit among Nigerian consumers and increase both national and personal income.

Moreover, Nigerian economy currently depends mainly on petroleum products which are ready to fall in both supply and price in international market. This may result to further national economic mess. Therefore there is the need to revitalize agricultural sector through livestock production such as pigs to increase national as well as personal income. The question then is how profitable is animal production especially pig production enterprise under intensive system to guide in decision making.

1.2 Theoretical Framework

All theories or models relating to production seek to reduce negative production externalities and greater productivity and profitability (Monica, 2003). Two models were used in this present study on the profitability of pig farm enterprises under intensive system for economic recovery among farmers in Enugu State, Nigeria. They include Context Input, Process and Product Evaluation Mode (CIPP) and Programme/Project Evaluation Model.

The Context, Input, Process and Product Evaluation Model developed by Stufflebeam, Daniel, a Professor at Western Michigan University, United States of America, in 1971 propounded the model, for the appraisal of projects and programmes from the beginning to the end of each cycle (Stufflebeam, 2007). This model has four main stages of evaluation namely: context evaluation, input evaluation, process evaluation and product evaluation. Context evaluation helps in the diagnosis of the programme problems in relation to the determination of programme objectives (Olaitan and Ali, 1997).

The specific objectives of context evaluation include; definition of relevant environment, identification of unmet needs and unused opportunities, problem identification and solution to such problems.

The methodology of context evaluation utilizes conceptual analysis, empirical studies and decision making, inference or judgment (Stufflebeam, 2007).

Input evaluation provides information on how resources are used to achieve project objectives. Its specific objectives include identification of relevant strategies and assessment of project designs so as to be able to achieve stated objectives. Process evaluation provides project implementation and monitoring services so as to obtain feedback for interpreting project outcomes. The specific objectives include instrument and design validation, collection and analysis of information, undertaken throughout the period of evaluation. Methodology involves the use of evaluators and assistant evaluators (staff) and professionals who discuss on the subject matter and distribute instrument for data collection. The overall purpose of product evaluation is to measure and interpret attainments at the end of a project cycle (Olaitan and Ali, 1997). The specific objectives include providing information for decision making, using set standards which may result to continuation, termination or modification of project activities. The achievement of stated objectives with the cumulative information from context, input and process. This is the evaluation of programme outcome.

The present study shares many features in common with the CIPP model of evaluation of projects in terms of specific objectives, scope, and methodology. This study titled, Profitability of Pig Farms in Enugu State, has the main purpose and specific objectives expected to be achieved at the end of the research work. Just like the evaluator and other personnel, the researchers and the assistants designed instruments, distributed them to the pig farmers and agriculture extension agents, collected, analysed data based on laid down standards. The population of the study is also determined to have a limited number of people to be served. There is also clearly observed problems existing in pig production in the state which need to be solved and improvement strategies mapped out. Farm inputs are used in the production process and their costs determined. At the end of the production cycle, pig products were obtained and sold to get revenue. The total costs and total revenue were analysed to determine profit or loss. The answering of research questions and testing of research hypotheses helped in verifying whether the set objectives were achieved or not. The CIPP evaluation model was employed in this study to analyse the existing pig farms in Enugu state with a view to determining farm inputs, production performance, profitability, constraints and strategies for improvement of pig production.

Programme/Project Evaluation Model is used for determining the value of a project or enterprise. It helps in determining whether the enterprise is productive and profitable or not. In this model, all costs and all revenue are identified and compared (Olaitan, Ali, Eyo and Sowande, 2000). There is break-even point if the Total Cost (TC) is equal to Total Revenue (TR). There is profit if the Total Cost (TC) is less than Total Revenue (TR) while loss is incurred when the Total Cost (TC) is greater than Total Revenue (TR). Project Evaluation Model is also used to determine the worth of a farm and is therefore used in this research study to achieve end results.

The programme/project Evaluation model was suitable for determining the productivity and level of profit made in pig farms in Enugu State of Nigeria. It helped to a large extent in the realisation of the main purpose of this research work. The model was used to analyse the production performance and profitability of pig farms in Enugu State of Nigeria. This helped to

determine their physical productivity and amount of profits realized in these farms. The role of the pig farmers and agricultural extension agents in the production process were equally examined.

The design of this present study was such that could be analysed using this model. All necessary data were collected and analysed appropriately. The questionnaire and recording sheets were prepared to collect the required data from the farmers in their farms through six-monthly visits by the researchers and other research assistants. All data on input application, production costs and output (revenue) of the farms were collected and compared accordingly. This helped to determine the productivity and profitability of pig farms. The result showed that pig production was viable in the state.

The findings of this study were in line with the application of this project evaluation model. Effective use of this project evaluation model in this study resulted in full realization of the major purposes of this research work, especially in the area of amount of profits realized by pig farms in Enugu State. In view of the similarities existing between this model and this present study on profitability of pig production, programme/project evaluation was employed in the study.

1.3 Purpose of the Study

The main purpose of the study was to determine the profitability of pig farm enterprises under intensive system for economic recovery among farmers in Enugu State. Specifically, the study sought to:

1. determine the profitability of pig farms in Enugu State,

2. determine the constraints to profitable pig farm enterprises and

3. determine strategies for improving profitability of pig farms in Enugu State.

1.4 Research Questions

Three research questions were answered in line with the specific purpose of the study as follows:

1. What profit margins are realized by pig farms in Enugu State?

2. What are the constraints to profitable pig farm enterprises?

3. What are the strategies for improving profitability of pig farms in Enugu State?

1.5 Research Hypotheses

The following null hypotheses were formulated to guide the study at 0.05 level of significance.

Ho1: There is no significant difference between the mean ratings of urban and rural pig farmers on the constraints to profitable pig farm enterprises.

Ho2: There is no significant difference between the mean ratings of pig farmers and Agricultural Extension workers on the strategies for improving the profitability of pig farms in Enugu State.

2. Methods

Survey design was used in this study. The area of the study was Enugu State of Nigeria. The state is located in the South-East geo-political zone of Nigeria. Most of the residents of Enugu State are Christians whose religion does not forbid the rearing of pigs and consumption of pork. Enugu State is made up of three senatorial zones with 17 Local Government Areas. The senatorial zones are Enugu North, Enugu East and Enugu West.

The population for this study comprised 297 registered pig farmers in Enugu State and 222 agricultural extension workers of Enugu State Agricultural Development Programme (ENADEP) totaling 519 respondents. In Part 2, Section 1, there was purposive sampling of 55 out of 265 Pig farmers were sampled for the purpose of responding to research question one who were able to respond correctly to the instruments for data collection. The sample of 265 pig farmers were thereafter used for collecting data for the study.

A structured questionnaire, pig performance recording sheets, and farm records available in piggeries were the instruments used for data collection. The questionnaire was divided into two parts. Part 1 of the questionnaire was on background information and Part 2 was made up of three sections, I, II, III, designed mainly to elicit information from pig farmers and Agricultural extension workers to answer the research questions and to test the null hypotheses.

The instrument for data collection was subjected to face validation by three experts, and their observations, comments, recommendations and suggestions were used to improve the instrument of data collection. The internal consistency of the instrument was determined using Cronbach alpha Reliability Method in sections II and III, while Pearson Product Moment Correlation Coefficient was used to determine the reliability in Section I. The reliability indices were determined separately for each of the three sections as follows: section I = 0.70, section II = 0.50, and section III = 0.78. The overall reliability index of the instrument was 0.66, showing that the instrument was reliable.

The questionnaire was administered to the respondents by the authors through direct personal contacts. The pig performance recording sheets and available farm records were used to obtain data from pig farmers for determining profitability. The sheets were sent to the pig farmers in advance to enable them fill in the required data about the performance of their pig farms. The researchers visited the pig farms every six months for data collection to collect data from pig farmers on physical productivity of pigs, inputs, production costs, output, and revenue for a period of two years (2018-2019). This period covered more than two production cycles. A total of 297 copies of the questionnaire and pig performance recording sheets for pig farmers were distributed and 265 copies returned out of which 142 were located in the rural areas and 123 were located in the urban areas. A total of 222 copies of questionnaire for agricultural extension workers were distributed and 200 copies returned. Data for answering Research Question I was collected from a sample of 55 out of 265 pig farmers who supplied the required data correctly.

The data collected for the study was analysed using the budgeting technique (TFC + TVC = TC, Total sales = TR, Profit = TR - TC) and amount of profits realized by pig farms to answer Research Question I. The mean scores were used to answer research questions II and III, while t-test statistic was used in testing the hypotheses, Ho1 and Ho2 at 0.05 level of significance.

In sections II and III, the real limits were used in the determination of scale point of the rating statements. In section II of the instrument, any item that had a mean of 4.50-5.00 was interpreted as very serious problem (VSP), 3.50-4.49 as serious problem (SP), 2.50-3.49 as moderate problem (MP), 1.50-2.49 as little problem (LP) and 1.00-1.49 as Not a problem (NAP). For section III, any item that had a mean score of 3.50-4.00 was interpreted as strongly Agreed (SA), 2.50-3.49 as Agree (A), 1.50-2.49 as Disagree (D) and 1.00-1.49 as strongly Disagree (SD)

The null hypothesis of no significant difference was accepted for any item whose p-value was greater than or equal to 0.05 level of significance ($p \geq 0.05$) and rejected when otherwise.

3. Results

Research Question 1: What profit Margins are realized by pig farms in Enugu State?

Data for answering research question 1 is presented in Table 1

Table 1: Mean Profit Margins of Pig Farms

S/N	Pig Farms	Yr 1 Profit (₦)	Yr 2 Profit (₦)	Total Profit (₦)	Mean Profit for the yrs (₦)
1	Mustard seed	2715943	5246298	7962241.67	3981120.83
2	Sopuruchukwu farm	3117369	5931484	9048852.86	4524426.43

3	Udoka farm	1620033	3075887	4695920	2347960
4	Nwaji farm	2058199	3891478	594967.67	2974838.33
5	God's own farm	1444875	2741300	4186175	2093087.5
6	Idu farm	2787782	5269227	8057008.33	4028504.17
7	Charly farm	1608125	3058237	4666361.67	2333180.83
8	Chukwudi farm	1825450	3468902	5294351.67	2647175.83
9	Chiamaka	1248153	2372588	3620740	1810370
10	Uchenna	3822462	7248458	11070920	5535460
11	Ayara ogu	4275386	8123583	12398968.6	6199484.29
12	Emily piggery	3153246	5982276	9135521.67	4567760.83
13	Hilson	1907527	3624767	5532293.33	2766146.67
14	Onyeze farm	3442202	6529170	9971371.9	4985685.95
15	City farm	1792592	3401423	5194014.93	2597007.46
16	Nwaeke farm	1744592	3317495	5062086.86	2531043.43
17	Okechukwu	1251950	2373619	3625568.81	1812784.41
18	Francis Chukwu	1768872	3359549	5128420.71	2564210.36
19	Chime and Co.	4256609	8086162	12342771.4	6171385.71
20	Onah and Co.	3633041	6907146	10540186.9	5270093.45
21	First farm	1571216	3010699	4581914.76	2290957.38
22	Gofra farm	1635298	3110998	4746296.67	2373148.33
23	Peace farm	2479045	4706767	7185811.67	3592905.83
24	Okechukwu farm	3153918	5995002	9148919.17	4574459.58
25	Chukwuemeka	3871759	7366688	11238446.7	5619223.33
26	Enechi farm	1208522	2285061	34935882.5	1746791.25
27	Tony farm	422057.6	786985.5	1209043.1	604521.55

S/N	Pig Farms	Yr 1 Profit (₦)	Yr 2 Profit (₦)	Total Profit (₦)	Mean Profit for the yrs (₦)
28	Hypo-Belly	3192906	6077846	9270751.67	4635375.83
29	Nwangwu farm	1632157	3098299	4730456.19	2365228.10
30	Barth piggery	1101177	2087987	3189163.33	1594581.67
31	Igwebuike piggery	1624212	3084763	4708975	2354487.5
32	Ngene piggery	2309710	4358020	6697730	3348865
33	Abugwu farm	763058.3	1436667	2199725	1099862.5
34	Eze farm	1256952	2388480	3645431.67	1822715.84
35	Alloy farm	1967825	3714018	5681843.33	2840921.67
36	Charly piggery	3631353	6893480	10524833.3	5262416.67
37	Nwaobodo	3808254	7206811	11015064.6	5507532.32
38	Nze farm	2109878	4002233	6112111.67	3056055.83
39	Edems farm	3692199	7038729	10730927.4	5365463.69
40	Eziokwu bu ndu	3301536	6278452	9579987.71	4789993.86
41	Marist Brothers	4649606	8830586	13480192.4	6740096.22
42	Obinwanne	328223.3	614465	942688.33	471344.17
43	Akaama farm	1720734	3272565	4993299.29	2496649.69
44	Chukwuasokam	11850477	22522258	34372735.1	17186367.56
45	C. E. Ogwomba	3361889	6414355	9776243.82	4888121.91
46	Ngozika Association	3420421	6512307	9932728.1	4966364.05
47	Ekperechi	322630.6	603205.1	925835.73	462917.86
48	God is Great	323709.2	598004.2	921713.33	460856.67
49	Agbedo farm	697070.8	1305673	2002744.17	1001372.08
50	Sopuruchuwku	3262760	6188431	9451190.48	4725595.24
51	Ike farm	1430971	2723921	4154891.85	2077445.92
52	Kris farm	3229786	6122796	9352582.14	4676291.07
53	Mike Agro	3140937	5954032	9094968.33	4547484.17
54	Royal piggery	3454743	6574409	10029152.6	5014576.3
55	Vital farm	4554715	8659328	13214043.3	6607021.67

Table 1 showed that the mean profit margin per farm per year was N3,689,267.98. All the 55 pig farms studied in Enugu State made reasonable profits. Chukwuasokam pig farm made the highest mean profit per year of N17,186,367.56. God is Great pig farm made the lowest mean profit per year of N460856.67.

Research Question 2 and Hypothesis 1

Table 2: Mean ratings and t-test analysis of the responses of urban and rural Pig Farmers on productivity constraints of pig farms.

Item No	Productivity Constraints of Pig Farms	$\overline{X}$ Column1	SD Column2	Decision Column3	$\overline{X_1}$ Column4	SD_1 Column5	$\overline{X_2}$ Column6	SD_2 Column7	t-cal. Column8	P-value Column9	Decision
1	Limited Land	2.59	0.93	SP	2.41	0.98	2.79	0.84	-3.37	0.00	S
2	Unfavourable weather condition	3.32	0.81	SP	3.32	0.78	3.31	0.84	0.15	0.88	NS
3	Poor housing	3.42	0.71	SP	3.38	0.65	3.46	0.78	-0.85	0.39	NS
4	Religious beliefs	1.57	0.90	LP	1.47	0.89	1.68	0.90	-1.84	0.07	NS
5	Inadequate livestock extension and farmer education services	3.38	0.87	SP	3.37	0.86	3.38	0.87	-0.08	0.93	NS
6	Ignorance of right feeding system	3.30	0.82	SP	3.21	0.83	3.38	0.81	-1.69	0.09	NS
7	High cost of animal feeds	3.57	0.76	VSP	3.66	0.66	3.47	0.84	2.06	0.04	S
8	Diseases and parasites attack	3.65	0.67	VSP	3.68	0.67	3.62	0.67	0.71	0.48	NS
9	Huge capital investment required	3.31	0.81	SP	3.28	0.78	3.34	0.85	-0.67	0.51	NS
10	Poor farm management	3.37	0.70	SP	3.30	0.82	3.45	0.76	-1.56	0.12	NS
11	Poor agricultural research on pigs and pig production	3.23	0.67	SP	3.32	0.60	3.13	0.74	2.36	0.02	S
12	High cost of veterinary drugs	3.57	0.74	VSP	3.61	0.68	3.52	0.80	1.01	0.31	NS

13	Poor knowledge of pig waste treatment and recycling	2.26	0.76	LP	2.19	0.75	2.33	0.75	-1.54	1.12	NS
14	Use of local, unimproved breeds as stock	1.36	0.97	NAP	3.16	0.88	3.42	0.83	-2.47	0.02	S
15	Shortage of competent farm labour	3.06	0.85	SP	2.89	0.79	3.27	0.87	-3.74	0.00	S
16	Unskilled pig farmers	3.13	0.85	SP	3.00	0.84	3.28	0.83	-2.68	0.01	S
17	Insufficient credit facilities and subsidies	3.45	0.74	SP	3.39	0.73	3.51	0.75	-1.29	0.24	NS
18	Low application of modern and innovative production technologies in pig farming	3.44	0.85	SP	3.42	0.84	3.46	0.87	-0.46	0.65	NS
19	Scarcity of water during dry season	3.12	0.84	SP	3.03	0.79	3.23	0.88	-1.95	0.06	NS
20	High poverty rate among farmers	3.51	0.72	VSP	3.43	0.74	3.60	0.69	-1.96	0.06	NS

VSP = Very Serious Problem; SP = Serious Problem; LP = Little Problem; NAP = Not A Problem.

N1 = 142; N2 = 123; = Mean scores of rural pig farmers; = Mean scores of urban pig farmers; SD1 = Standard Deviation of rural pig farmers; SD2 = Standard Deviation of urban pig farmers; S = Significant ($P < 0.05$); NS = Not Significant ($P > 0.05$); df = 263.

Table 2, Column I showed that four items had the mean scores ranging from 3.51 – 3.65 which were within the real limit of 3.50 – 4.00 and were therefore regarded as very serious problems facing pig production in Enugu State. The analysis shows that high cost of animal feeds, diseases and parasite attack, high cost of veterinary drugs and poverty were among the productivity constraints of pig farms in Enugu State.

Table 2, Column I also showed that 13 items had their mean scores ranging from 2.59 – 3.45 which were within the real limit of 2.50 – 3.49. This implied that the 13 items were serious problems facing pig production in Enugu State.

Table 2, Column I also revealed that items 4 and 13 had mean values of 1.57 and 2.26 respectively which were within the real limit of (1.50 – 2.49) indicating that these items were little problems facing pig farms. Item 14 had a mean score of 1.36 showing that it was not a problem in pig production in Enugu State.

The t-test results in Table 2 column 8 showed that the p-values in 14 items were greater than 0.05, level of significance. This indicated that there was no significant difference between the mean responses of rural and urban pig farmers on the productivity constraints of pig farms with respect to these 14 items. The stated null hypothesis was therefore accepted in the 14 items. On the other hand, t-test results in Table 2 column 8 also showed that in six items, the P-values were less than the 0.05 level of significance ($P < 0.05$). This implied that there was significant difference between the mean responses of rural and urban pig farmers on the productivity constraints of pig farms in these six items.

Research Question 3 and Hypothesis 2

Table 3: Mean Responses and Calculated t-value of Pig Farmers' and Agricultural Extension workers' Mean Responses on the Strategies for Improving the Profitability of Pig Farms ($p \leq 0.05$).

Item No	Strategies for Improving Profitability of Pig Farms	$\overline{X}$ Column1	SD Column2	Decision	$\overline{X_1}$ Column3	SD_1 Column4	$\overline{X_2}$ Column5	SD_2 Column6	t-cal. Column7	P-value Column8	Decision
1.	Enforcement of land laws in Enugu State and making land available for farms by government agencies.	3.48	0.74	A	3.42	0.73	3.56	0.75	2.09	0.04	S
2.	Effective application of meteorology and Hydrology in pig production and use of wallow to reduce heat stress during dry season.	3.29	0.88	A	3.39	0.77	3.16	0.98	2.83	0.01	S
3.	Proper housing with adequate ventilation	3.34	0.82	A	3.43	0.78	3.22	0.87	2.75	0.01	S
4.	Rearing pigs within Christian communities and outside Muslim-dominated communities.	3.35	0.81	A	3.51	0.75	3.15	0.83	4.52	0.00	S
5.	Sound livestock extension services and farmer education for pig farms.	3.49	0.78	A	3.51	0.75	3.47	0.81	0.61	0.54	NS
6.	Organizing workshops, seminar, conferences and intensive training programs by extension agents for pig farmers on right feeding system for pigs.	3.24	0.74	A	3.22	0.65	3.26	0.85	-0.59	0.56	NS
7.	Use of cheap, nutritious local feeds such as cereals, legumes, roots, tubers, kitchen wastes and brewers' spent grain.	3.29	0.83	A	3.42	0.75	3.13	0.90	3.84	0.00	S
8.	Effective prevention and control of pig diseases and parasites.	3.36	0.83	A	3.38	0.83	3.32	0.83	0.79	0.43	NS
9.	Encouragement of personal savings and borrowing from money lenders.	2.11	0.86	D	1.98	0.72	2.28	0.98	-3.71	0.00	S
10.	Use of experienced labourers and effective supervision and monitoring of pig farms.	3.49	0.77	A	3.52	0.75	3.41	0.80	1.55	0.12	NS
11.	Effective agricultural research for pigs and pig production and	3.47	0.77	A	3.50	0.74	3.44	0.81	0.80	0.42	NS

	dissemination of research results to the pig farmers.									
12.	Supply of veterinary drugs by donor agencies and veterinary institutes.	3.25	0.93	A	3.35	0.84	3.12	1.02	2.69	0.01	S
13.	Recycling of pig wastes to produce biogas.	1.78	1.01	D	1.68	0.90	1.96	1.11	-3.01	0.00	S
14.	Use of improved, exotic breeds of pig which also conform to the taste of consumers as stock.	3.27	0.85	A	3.35	0.80	3.17	0.89	2.36	0.02	S
15.	Employment of sufficient number of competent farm labourers.	3.33	0.88	A	3.43	0.84	3.19	0.92	3.04	0.00	S
16.	Employment of skilled and proficient pig farm managers and attendants.	3.53	0.78	SA	3.53	0.80	3.54	0.75	-0.14	0.89	NS
17.	Financial aids from government and commercial banks in form of incentives subsidies, and interest-free loan to pig farmers.	3.28	0.86	A	3.37	0.81	3.18	0.91	2.39	0.02	S
18.	Adoption and use of modern and innovative pig production technologies by pig farmers.	3.47	0.80	A	3.56	0.77	3.35	0.83	2.79	0.01	S
19.	Provision of adequate water supply in piggeries.	3.46	0.81	A	3.57	0.80	3.32	0.82	3.38	0.00	S
20.	Assisting pig farmers through financial aids, payment of less tax and sale of pig wastes.	3.34	0.85	A	3.42	0.80	3.23	0.92	2.42	0.02	S

= Mean; SD = Standard Deviation; SA = Strongly Agree;

A = Agree; D = Disagree.

N1 = 265; N2 = 200; = mean response of pig farmers; = mean response of agricultural extension workers; SD1 = Standard Deviation of pig farmers; D2 = Standard Deviation of agricultural extension agents; S = Significant ($p < 0.05$); NS = Not Significant ($p > 0.05$); df = 463.

Table 3, Column I showed that item 16 (use of skilled and proficient pig farm managers and attendants) had a mean score of 3.53 which was within the real limit of 3.50 – 4.00 indicating that it was strongly agreed by respondents as a strategy for improving profitability of pig farms in Enugu State. Seventeen items had the mean scores ranging from 3.24 – 3.49 which were within the real limit of 2.50 – 3.49. It implied that the respondents agreed that the 17 items are strategies for improving profitability of pig farms. Items 9 and 13 had the mean scores of 2.11 and 178 respectively which were within the real limit of 1.50 – 2.49 showing that the respondents disagreed that items 9 and 13 are among the strategies for improving profitability of pig farms.

The t-test results in Table 3 column 8 showed that there was no significant difference between pig farmers and agricultural extension workers in their respective opinions on strategies for improving profitability of pig farms in these six items. The null hypothesis was accepted in six items. The t-test results in Table 3 column 8 also showed that there was significant difference between the mean responses of the pig farmers and agricultural extension workers in their opinion on strategies for improving the profitability of pig farms in 14 items. The null hypothesis that there is no significant difference between the two groups was therefore rejected.

4. Discussion of Findings

The mean profit margin for all the pig farms studied in Enugu State was N3,689,267.98 per farm per year. This showed that pig business in Enugu State was highly profitable. This finding is in line with the findings of Ezeibe (2010) and Nwobodo (1997) who earlier reported that swine business in Enugu State was viable and very profitable. It is now clear that the perceived exit of many pig farmers from pig production business in the state is not due to unprofitability of the business but may be due to other circumstances such as personal decision to invest in other business enterprises.

Productivity Constraints of Pig Farms

The productivity constraints of pig farms in Enugu State as found in this study were: unfavaourable weather condition, poor housing, inadequate livestock extension and farmer education services, ignorance of right feeding system, high cost of animal feeds, diseases and parasites attack, poor farm management, high cost of veterinary drugs, shortage of competent farm labourers, insufficient credit facilities and subsidies, low application of modern and innovative production technologies in pig farming, scarcity of water during dry season and high poverty rate among farmers. These findings are in agreement with the findings of Anukwu and Ebong (2011) who stated that inadequate capital, high cost of feeds, high cost of foundation stock, poor extension services, high cost of medication, disease outbreak, scarcity of skilled labour, high wages, low product demand, high cost of transportation and high percentage mortality were pig production constraints affecting pig farmers in Uyo, Akwa-Ibom State. Ajala and Adesehinwa (2008) also identified similar problems facing pig farmers in Zango-Kataf local government area of Kaduna State. These aforementioned constraints may have contributed to the exit of many pig farmers in Enugu State as reported earlier. Despite all these identified challenges in pig industry, the enterprise is still profitable in the study area. Pig farmers in the study area are creative and apply a lot of improvisations in pig production in respect of housing, feeding and health care services.

Strategies for Improving Profitability of Pig Farms

The strategies identified for improving profitability of pig farms in Enugu State were: employment of skilled and proficient pig farm managers and attendants, use of improved, exotic breeds of pigs which also conform to the taste of consumers as stock, financial aids from government and commercial banks in form of incentives, subsidies and interest-free loans to pig farmers. Other strategies are: use of experienced labourers and effective supervision and monitoring of pig farms, sound livestock extension services and farmer education for pig farmers, enforcement of land laws in Enugu State and making land available for pig farmers, effective agricultural research for pigs and pig production adoption and use of modern and innovative pig production technologies by pig farmers. Also identified as strategies include: provision of adequate water supply in piggeries, effective prevention and control of pig diseases and parasites, rearing pigs within Christian communities and outside moslem-dominated communities, proper housing with adequate ventilation, use of cheap, nutritious local feeds such as cereal, legumes, roots, tubers, kitchen wastes and brewers' spent grain, assisting pig farmers through financial aids payment of less tax and sale of pig wastes, effective application of meterology and hydrology in pig production and use of wallow to reduce heat stress during dry season. Both the pig farmers and agricultural extension agents agreed that all these strategies help to improve the profitability of pig farms in Enugu State. This is in support of earlier findings from the studies carried out by Emenyonu, Odii, Chilaka, Onyemauwa and Anaeto (2006); Gekara, Garner and Dunbar (2009) and Lewis (2007) who found that use of improved breeds of pigs as stock, improved management and feeding, sale of pig wastes, technical and financial aids from government will increase farm profit. However, the pig farmers and agricultural extension agents disagreed that encouragement of personal savings and borrowing from money lenders and recycling of pig wastes to produce biogas were strategies for improving profitability of pig farms in Enugu State. The respondents did not see any reason why these two strategies would improve the profitability of pig farms. This finding is contrary to an earlier report by Oguniyi and Omoteso (2011) in which they found that personal savings and borrowing from other sources of farm financing will go a long way in improving the profitability of pig farms in Ibadan Zone of Oyo State of Nigeria. Recycling of pig wastes to produce biogas was disagreed by the respondents as a strategy for improving profitability of pig farms in Enugu State. This may be due to the fact that the study area is not highly industrialized coupled with the fact that Nigeria is not yet a developed nation like Brazil where Rogerio and Laura (2006) reported that pig farms in Brazil made a lot of money through recycling of pig wastes (manure) to produce biogas for both domestic and industrial uses.

5. Conclusion and Recommendations

The conclusion was drawn based on the findings of the study as follows:

Pig production business in Enugu State was found to be highly profitable. Many pig production constraints of pig farms identified in Enugu State include diseases and parasites attack, high cost of animal feeds, high cost of veterinary drugs, high poverty rate among farmers, poor housing, insufficient credit facilities and subsidies and low application of modern and innovative production technologies in pig farming. These constraints must have affected pig production negatively in the state. Profitability of pig farms could be improved by sound livestock extension services and farmer education for pig farmers, use of experienced labourers and effective supervision and monitoring of pig farms, effective agricultural research and use of innovative techniques on pigs and pig production, financial aids from government and commercial banks in form of incentives, subsidies, and interest-free loans to pig farmers, use of skilled and proficient pig farm managers and attendants. Adoption and use of modern and innovative pig production technologies by pig farmers, enforcement of land laws in Enugu State and making land available for pig farmers, proper housing with adequate ventilation and use of cheap nutritious, local feeds such as cereals, legumes, roots, tubers, kitchen wastes and brewers' spent grain could be strategies for profitable pig production in Enugu State, Nigeria.

From the findings of this study, the following recommendations were made:

1. All stakeholders in pig production, Ministry of Agriculture and non-governmental organizations such as United Nations Development Programme (UNDP) should join hands in reducing the productivity constraints of pig farms to the barest minimum by providing human and material resources to pig farmers in order to improve physical productivity and profitability of pig farms.

2. Government through the Ministry of Agriculture and non-governmental organizations should assist pig farmers and beneficiaries of National Directorate of Employment (NDE), new investors, Fadama III and agricultural loan beneficiaries through financial aids, provision of equipment, technical support and organizing workshops, seminars, and conferences on investment opportunities and strategies for improving the profitability of pig farms to boost pig production and increase farmers' income in the state.

Competing Interest Statement

The authors declare that there are no competing or potential conflicts of interest.

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