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Original Article

Effect of agricultural cooperatives on pig farmers' profitability in central agroecological zone of Delta State, Nigeria

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ABSTRACT

Pig production is economically viable due to its high survival rate, efficient feed utilization, prolificacy, and ability to farrow twice per year. Despite these advantages, its production remains the least in terms of meat supply due to several limitations such as insufficient capital, high feed costs, poor extension services, and high medication costs. Thus, the study examined the effect of agricultural cooperatives membership on pig farmers' profitability in Central Agro-ecological Zone of Delta State, Nigeria. A multi-stage sampling procedure was used to select 80 cooperative and 80 non-cooperative pig farmers. Data were collected using a well-structured questionnaire and analysed using descriptive statistics, profitability analysis, multiple regression analysis, and the Likertrating scale. The results showed that the majority of the cooperative (68%) and non-cooperative (85%) pig farmers were male with a mean stock size of 199 and 105 pigs, respectively. Cooperative societies provided credit to pig farmers (84%), with an average credit amount of ₦ 64,381.08. Farmers also received piglets (36%), transportation services (52%), and relevant information (63%), which were vital in reducing farmers' risk as part of the services rendered by cooperative societies. Pig production is profitable in the study area with net profits of ₦ 1,260, 364.31, and ₦ 612,924.74, a return on investment of 0.74 and 0.67 for cooperative and non-cooperative farmers respectively. The cost of pig stocked (0.546) and cost of transportation (-0.536) had a significant effect on the farmers' profitability. Inadequate finance (mean = 3.66 and 4.07) and high transportation costs (mean = 3.66 and 4.07) were significant constraints for both cooperative and non-cooperative farmers. Non-cooperative farmers faced other constraints, however not limiting cooperative farmers which included high incidence of disease (mean=3.06), stealing(mean=4.13), and inadequate customers (mean= 4.43). The study concludes that pig production in the study area was profitable with cooperative societies having a positive effect on its profitability. Transportation and stock costs were significant determinants of profitability in pig farming. It is therefore recommended that Cooperative societies should continue to enhance and expand their services to address the diverse needs of pig farmers, including providing access to timely and adequate finance, transportation services, market linkages, and input supplies.

HIGHLIGHTS

- Cooperatives provide credit, transportation, and information services.
- Cooperatives boost pig production profitability, yielding higher returns.
- Transportation and stocking costs determine pig farmers' profits.
- The farmers face finance and transportation challenges.

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1. Introduction

Agriculture is very important to the Nigerian economy; this is because it provides both food and raw materials needed for the survival and growth of the nation (FAO, 2014). Agriculture accounts for 33 percent of GDP and employs more than 60% of the population (FAO, 2016). The livestock sub-sector is an important and integral component of Nigeria's agriculture and is a major source of household wealth and food security (FAO, 2016). Pig, a monogastric animal has been identified to be an important aspect of the livestock sub-sector in the overall agricultural sector which is derived from the fact that pigs possess high fecundity, high feed-to-meat conversion efficiency, early maturity, and short gestation period (Ezeibe, 2010). In Nigeria, pigs have been recommended as a good alternative source of cheap and high-quality animal protein. The importance of animal protein and its inadequacy in the diet of most households in developing countries of Africa has been noted (Okolo, 2011; Ume, et al; 2016). This animal protein could be acquired in Nigeria through cattle, pigs, poultry, goat, and sheep (Ajala, et al; 2007). The importance of pig production and marketing in the livestock industry cannot be over-emphasized. It represents about 4% of the total domestic livestock in Nigeria (Ajala et al, 2006). Pig has some unique characteristics that have made its production more economically viable compared to other farm animals. They include a high survival rate, very good efficiency of feed utilization which brings better returns per unit of inputs, high prolificacy, having 10-15 piglets per litter, and the

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ability to farrow two times per annum (Akinyosoye, 1999). Despite these advantages, its production remains the least in terms of meat supply when compared to other livestock such as poultry, goat, and cattle (Central Bank of Nigeria, 2008). The lack of growth in pig production could be linked to several limitations such as insufficient capital, high feed costs, poor extension services, excessive medication costs, and so on (Anukwu and Ebong, 2011). However, it has been reported that establishing intensive pig production in developing nations such as Nigeria is very simple if capital is available and sufficient feed supplies are secured (Ogunniyi and Omoteso, 2011).

A cooperative society is defined as a collection of individuals who have come together willingly to achieve a common objective by establishing a democratically run firm, contributing somewhat to the capital required, and accepting a fair share of the risks and benefits (Helms, 2005). Cooperatives are critical to the growth of agriculture because they provide farming necessities, market agricultural goods, and provide services such as storage, transportation, and information amongst others.

Cooperatives play a vital role in agricultural growth by supplying farming necessities, marketing agricultural goods, and offering services such as storage, transportation, and information. This is because agricultusre in the rural areas of Nigeria is mainly dominated by smallholder farmers who face multiple production and marketing challenges ranging from limited access to productive inputs, output markets, extension services, and credit facilities to unavailability of improved agricultural technologies (Olagunju etal., 2021). Farmers' cooperatives, founded on the concepts of social cohesion and social capital, give farmers economies of scale by providing farmers with cheaper and more efficient access to resources, improved production techniques, and market knowledge (Oladejo, 2013). Cooperatives provide several services to their members, including access to resources, information, production input and output markets, technology, and training. Farmers obtain market power and better prices on agricultural supplies and other essentials by using practices such as cooperatives. Farmers' cooperatives provide economies of scale to smallholder farmers by facilitating cheaper and more efficient access to inputs, production technologies, and markets (Gamba and Komo, 2009). Agricultural cooperatives thus, have helped rural farmers gain access to certain benefits that otherwise would have been difficult to obtain by the members if they were non-members (Anigboguet al., 2017).

Previous research has pointed out that successful agricultural cooperatives have been effective in satisfying the economic and technical needs of rural farmers in terms of access to land, and agricultural inputs among others. For example, Olagunju et al., (2020) reported that agricultural cooperatives enhance the technical efficiency of farmers through the provision of improved agricultural technologies, land management practices, and finance among others to their members. Obasi et al. (2022) concluded that cooperative societies had a positive and significant effect on the level of efficiency of rural farmers in Enugu State, Nigeria.

Furthermore, available literature suggests a significant positive increase in the profit and output of cooperative farmers over non-cooperative farmers (Ibezim et al, 2010). Olatinwo, Yusuf, and Bamidele, 2023 opined that cooperative societies contributed positively to agricultural production in Kwara State, Nigeria through the procurement of farm inputs and provision of storage facilities. Michalek et al., (2017) showed that farmers that belong to producer organisations have higher value-added, profitability, labour productivity, and employment than non-members. Could this be true for pig farmers in the Central Agroecological Zone of Delta State? The study is therefore designed to examine the effect of agricultural cooperative membership on pig farmers' profitability in the Central Agro-ecological Zone of Delta State, Nigeria with such specific objectives as to; describe the socio-economic characteristics of cooperative pig farmers and non-cooperative pig farmers, identify the various services provided by the farmer cooperative society to pig farmers in the study area, estimate and compare the cost, returns, and profit of pig production among cooperative and non-cooperative fish farmers, examine the effect of the co-operative on profit level of pig farmers, and identify the constraints faced by pig farmers in the study area.

2. Methodology

This study was conducted in the Central Agroecological Zone of Delta State, Nigeria. A multi-stage sampling procedure was used in selecting the respondents for the study. The first stage involved the purposive sampling of two Local Government Areas (LGAs) from the study area. This was based on the level of pig production and the existence of cooperative societies based on the information on active cooperative societies from the Ministry of Commerce and Industry. The selected LGAs were Udu and Ethiope East LGAs. The second stage involved the simple random sampling of 3communities from each selected local government area namely Ubogo, Ugbisi, and Oghior for Udu LGA and Ekpan, Emakpo, and Oguma for Ethiope East LGA, the third stage involved the simple random sampling of 4 cooperative societies from each selected communities, from the list obtained from Ministry of Commerce and Industry. 5 pig farmers were then randomly selected from the selected active cooperative societies giving a total of 60 cooperative farmers. For non-cooperative

$$\pi = GFI - TVC \quad (1)$$

where π *= profit,* GFI = gross farm income and TC = total cost of production (₦).

$$TC = TFC + TVC \quad (2)$$

where TVC = total variable cost (₦), covering expenses on (feed, medication, piglets cost, transportation, labour, etc) and TFC = total fixed cost in naira (₦) which is the depreciated cost of all fixed inputs (land, building, borehole, and machinery), calculated using the straight-line method.

$$Depreciation = \frac{C_O - S_V}{U_l} \quad (3)$$

where C_o = original cost of the fixed input (₦), S_v = savage value/ scrap value (₦) and U_l = useful life (years).

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, \mu) \quad (4)$$

$$\mathrm{InY} = b_0 + b_1 InX_1 + b_2 InX_2 + b_3 InX_3 + b_4 InX_4 + b_5 InX_5 + b_6 InX_6 + b_7 InX_7 + b_8 InX_8\, v + b_9 InX_9 + \mu \quad (5)$$

where *Y = profit of ith farmers (₦),* X_1*= cost of feeding (₦),* X_2*= cost of maintenance (₦),* X_3*= cost of piglet (₦),* X_4*= cost of medication (₦),* X_5*= cost of transportation (₦),* b_0–b_6*= parameters to be estimated, and μ= Error term assumed to have zero mean and constant variance.*

farmers, 10 farmers were randomly sampled from each of the selected communities which gives a total of 60 farmers, and a total of 120 respondents.

The data for the study were collected through personal interviews using a structured questionnaire. Several analytical techniques were adopted in this study which included the following:

Descriptive statistics such as frequency counts means percentages, and standard deviation were used to describe the socio-economic characteristics of cooperative and non-cooperative pig farmers, to identify the various services provided by the farmers' cooperative society, and to describe the level of satisfaction of members with the various services provided by the cooperative society.

The profitability analysis was used to estimate the costs and returns of pig production among cooperative and non-cooperative pig farmers in the study area.

Cost and Return Analysis

Multiple regression analysis was used to determine the influence of some explanatory variables on the profitability of the pig farmers. The model for this analysis is given implicitly in Equation 4. The explicit Functional Form is given in Equation 5. The constraints were examined using the results that will be obtained from a 5-point Likert Scale. The responses to various constraints were scored in a way that the response indicating the most serious constraint was given the highest score. As a point scale, the responses were grouped into five categories which are very serious (5), serious (4), moderately serious (3), least serious (2) and not serious (1). A score above the mean is considered very serious while that below the mean is considered less serious.

3. Results and Discussion

3.1. Socio-Economic Characteristics of Pig Farmers in the Study Area

The socio-economic characteristics of cooperative and non-cooperative pig farmers in the study area are presented in Table 1. The results showed that the majority of the cooperative pig farmers (68%) and non-cooperative Pig farmers (85%) in the study area were males. This suggests that there are more male pig farmers than female fish farmers in the study area. This is probably because of the ability of men to handle the stress involved in pig farming. This is in line with the findings of Abiodun et al. (2017) and Onyekuru et al. (2020), that most of the pig farmers were male (73.3%) in Ogun state and Udi LGA of Enugu State respectively. On the educational level, the majority of the cooperative (65.90%), non-cooperative (55.30%), and entire pig farmers (60.44%) had tertiary education in the study area. This suggests that most pig farmers in the study area are educated people and education is expected to make the farmer more innovative. The results showed that most of the cooperative pig farmers (43.20%) were within the age bracket of 41- 50 years with a mean age of 47 years. The majority of the non-cooperative pig farmers (34.00%) were between the ages of 41 and 50 years old with a mean age of 47 years This suggests that most of the farmers, both cooperators and non-cooperators were within the economically active age (47 years). This is consistent with the findings of Onyekuru et al. (2020) that pig farmers are in their economically active age in Enugu State, Nigeria. On farming experience, a large number (34%) of the cooperative farmers had been in the pig production business for between 12 to 15 years. For the noncooperative

Table 1. Socio-economic characteristics of respondents

Variables	Cooperative			Non-cooperative			Total	
	Frequency	Percentage	Mean	Frequency	Percentage	Mean	frequency	percentage
Sex								
Male	30	68.2		40	85.1		70	76.92
Female	14	31.8		7	14.0		21	23.08
Educational level								
Primary				5	10.6		5	5.49
Secondary	5	11.4		4	8.5		9	9.89
Tertiary	29	65.9		26	55.3		55	60.44
Age								
<30				1	2.1		1	1.10
31-40	12	27.3		15	31.9		27	29.67
41-50	19	43.2		16	34.0		35	38.46
>50	13	29.5		15	31.9		28	30.77
Mean			47.05			46.62		
Farming experience								
>5	4	9.1		12	25.5		16	17.58
5-8	13	29.5		9	19.2		22	24.17
9-11	7	15.9		21	44.6		28	30.76
12-15	15	34.1		2	4.3		17	18.68
>15	5	11.4		3	6.4		8	8.79
Mean			9.68			12.45		11.07
Membership in cooperative								
Average years of membership			5					
Stock size			198.9			105.2		

Table 2. Services provided by the cooperative society

Services Provide	F	%	Mean
Credit facility	37	84.1	₦ 64381.08
Piglets	16	36.4	20.08
Information services	28	63.6	-
Transportation services	23	52.3	-
Marketing Services	9	20.5	-

farmers, the majority (45%) had pig farming experience of between 9 to 11 years. The majority (31%) of the entire sample farmers had between 9 to 11 years of pig farming experience with a mean of 11 years. The findings suggest that the farmers were well-established in their pig production activities. This finding is consistent with the finding of Osondu et al. (2014) that pig farmers in Abia state, Nigeria were observed to have a mean farming experience of 7 years.

The cooperative pig farmers had an average stock size of 199 pigs while the non-cooperative farmers had about 105 pigs as average pig stocked. This suggests that the cooperative farmers produced a larger number of pigs than the non-cooperative farmers in the study area.

3.2. Services Provided by Cooperative Societies

The results in Table 2 shows show that the majority (84.1%) of pig farmers received credit facilities from cooperative societies with a mean loan amount of sixty-four thousand, three hundred eighty-one naira and eight kobo (₦ 64,381.08). This suggests that the cooperative farmers had access to adequate finance needed for pig production and as such this aids pig farmers in acquiring inputs and could make the overall production process efficient. About (63%) of pig farmers received relevant information from the cooperative societies and this could help reduce the risk to the farmers and enable farmers to make informed decisions, adopt best practices, and enhance productivity and profitability. According to Nehra, Jangra, and Kumar (2018), access to reliable and timely information can significantly help farmers reduce risks and uncertainty. This result conforms with that of Olatinwo et al. (2023) that activities carried out by cooperative societies were the provision of crop production information, credit facilities, and procurement of farm inputs.

3.3. Profitability of Pig Production among Cooperative and Non-Cooperative Fish Farmers in the Study Area

The profitability analysis for pig production of cooperative and non-cooperative farmers is presented in Table 3. The results showed that total variable cost had the larger share of the total cost among cooperative (57.50%) and noncooperative (60.51%), farmers in the study area. Among the variable costs incurred, the purchasing cost of the piglet accounted for the greatest proportion of the total cost pig farming among the cooperative and noncooperative farmers was profitable with a net profit of ₦ 1,260,364.31 and ₦ 612,924.74 and a return on investment of 0.74 and 0.67 for cooperative and noncooperative farmers respectively. This suggests that for every ₦ 1.00 invested in pig production in the study area by cooperative and noncooperative pig farmers, about 74k and 67k, respectively, are received as earnings from the business. The results for both groups show that pig production is profitable, however, pig farmers in cooperative societies had a higher profit margin than pig farmers that were not in cooperative societies. This finding is in line with that of Obasi et al. 2022, that cooperative and non-cooperative rural farmers in Enugu State, realized a net return of ₦ 56,667.66 and ₦ 40,978.83 respectively.

3.4. Factors that influence Profitability of Pig Production in the Study Area

The result of the analysis of the factors that influence the profitability of pig production in the study area is presented in Table 4. The results showed that the F-value of the double-log model was 15.7 and a significant 1% level of significance. This shows that there exists a significant relationship between the profitability of pig production and the production costs. The value of the R-square (0.66) represents the proportion of the variance in the profitability of pig farmers that is predictable from the independent variables. The result shows that approximately 66% of the variance in the profitability of the farmers is explained by the independent variables in the model (cost of transportation, feed, labour, maintenance, stock, and medication). This could suggest that the

Table 3. Profitability analysis of pig production among cooperative and non-cooperative farmers

Cost/Revenue	Cooperative		Non-Cooperative	
	Mean (Per year)	Percentage (of TC)	Mean (Per year)	Percentage (of TC)
Piglet Cost (₦)	495,909.23	29.51	289,336.58	31.60
Feed cost (₦)	161,730.70	9.62	85,865.22	9.38
Medication cost and veterinary service (₦)	31,718.18	1.89	17,036.59	1.86
Labour cost (₦)	92,882.26	5.53	34,835.94	3.80
Transportation cost (₦)	75,697.67	4.50	52,139.53	5.69
Maintenance cost (Clipping, castrating, mating, etc) (₦)	108,314.29	6.45	74,948.21	8.18
Total variable Cost (₦)	966,252.33	57.50	554,161.96	60.51
Fixed Cost (₦)	714,274.06	42.50	361,594.74	39.49
Total cost (₦)	1,680,526.39	100	915,756.81	100
Total Revenue (₦)	2,940,890.60		1,528,681.55	
Profit (₦)	1,260,364.21		612,924.74	
Profit per pig (₦)	7,877.26		5,107.71	
Return on Investment	0.74		0.67	

Table 4. Regression analysis

Model	Unstandardized Coefficients		Standardized Coefficients	T-value	Significance
	Coefficient	Standard Error	Beta		
(Constant)	1666729.983	2693984.044		0.619	0.540
Transportation	57.856*	22.845	-0.536	-2.532	0.016
medication cost	39.814	40.835	0.210	0.975	0.337
labour cost	52.737	167.525	0.042	0.315	0.755
Feeding	5.586	12.195	0.078	0.458	0.650
Maintenance cost	1.742	1.006	0.063	1.731	0.008
Stock cost	4.738*	1.084	0.546	4.371	0.002

*Sig at 5%

R = 0.81

R^2 = 0.66

F= 15.7

explanatory variables in the model are close to perfectly explaining the variation in the profit level of pig farmers in the study area. The selected predictors were the cost of transportation, feed, labour, maintenance, stock, and medication. These were analyzed using the ordinary least square regression model, two out of the regressors in the model were observed to be statistically significant. The cost of transportation (-57.856) was negatively significant at 0.05 level suggesting that for every unit increase in transportation cost, profitability decreases by approximately N57.86. The cost of pig stocked was positively significant at 0.05 level indicating that an increase in stock size will increase the profit of the farmers. This indicates that higher investments in acquiring or maintaining pig stocks are associated with higher profitability. This suggests that efficient management of pig stocks could positively impact profitability. Medication Costs, Labour Costs, Feeding, and Maintenance Costs had positive coefficients, suggesting that an increase in these costs is associated with higher profitability. However, none of these coefficients were observed to be statistically significant as indicated by their high p-values.

3.5. Constraints Faced by Pig Farmers

The production constraints of pig farmers in the study area are presented in Table 5. The table provides a comparison of constraints observed by cooperative and non-cooperative pig farmers, along with their respective mean scores. Both cooperative (mean = 3.66) and non-cooperative farmers (mean = 4.07) identified inadequate finance as a significant constraint. This suggests that although the farmers had access to credit from the cooperatives, the credit may not be adequate or timely.

Both cooperative (Mean = 3.66) and non-cooperative farmers (Mean = 4.07) perceive high transportation costs as a constraint, but non-cooperative farmers rate it slightly higher. This could be due to differences in transportation arrangements or access to cooperative transport services available to cooperative members. Cooperative farmers may benefit from collective transportation arrangements, such as shared transport vehicles or negotiated rates, reducing individual transportation costs. Non-cooperative farmers (Mean = 3.06) perceive high disease incidence as a significant constraint while it was not a constraint limiting cooperative farmers (Mean = 2.23). This difference could be attributed to variations in disease management practices, access to veterinary services, or information from cooperative societies promoting disease prevention and control. Non-members (mean 4.13) identified stealing as a significant constraint while it was not a significant constraint for cooperative members (mean =2.06). This suggests that the cooperative societies may provide some security services or practices such as fencing for members. The low rate of customers was also identified as a significant constraint by non-members (4.43) which was not a constraint limiting cooperative members. Cooperative members may benefit from

Table 5. Production constraints for cooperative and non-cooperative members

Constraints	Cooperative	Non-Cooperative
	Mean	Mean
Inadequate finance	4.14*	4.70*
High Transportation cost	3.66*	4.07*
High Disease incidence	2.23	3.06*
lack of information	1.66	2.57
High-cost feed	2.61	2.15
Pollution	1.95	3.66*
High cost of the pig pen	3.64*	1.98
Religious beliefs	1.33	3.83*
Improved breed	3.89*	1.66
Stealing	2.06	4.13*
Low rate of Customers	2.26	4.43*

*Mean ≥ 3.0 = Serious, this means that the average score for each constraint was compared with a benchmark of 3, and any score above 3 will indicate a serious constraint.

collective marketing efforts or access to wider markets facilitated by the cooperative societies. The result shows that the non-cooperative farmers face a higher number of constraints than the cooperative members.

Conclusion and Recommendation

The study established that cooperative societies play a crucial role in supporting pig farmers by providing essential services such as credit facilities, piglet supply, information, transportation, and marketing services. Pig production was profitable. Cooperative societies had a positive effect on the profitability of pig farming in the study area as there was a significant difference between the income of cooperative and non-cooperative farmers. The regression analysis identified transportation cost and stock cost as significant determinants of profitability in pig farming. Both cooperative and non-cooperative pig farmers face constraints such as inadequate finance and high transportation costs, However, non-cooperative farmers have additional constraints such as disease incidence, stealing, and a low rate of customers It is therefore recommended that Cooperative societies should continue to enhance and expand their services to address the diverse needs of pig farmers, including providing access to timely and adequate finance, transportation services, market linkages, and input supplies. Non-cooperative pig farmers are encouraged to join cooperative societies to benefit from the services of cooperative societies. Cooperative societies should be encouraged to invest in transportation infrastructure to reduce the transportation costs of pig farmers. The government should also support cooperatives with finance so that they in turn can provide adequate credit facilities to members.

CRediT authorship contribution statement

OI: Conceptualization, data curation, writing original draft, review and editing; JE: Review and

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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