

# Economics of Small Ruminant Husbandry and Marketing among Small-Holder Farmers in Abia State

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## Original Research Abstract

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This study examined the economic and marketing efficiency of small ruminant production in Isiala-Ngwa North L.G.A. of Abia State. A multistage sampling method was used to select 80 smallholder farmers across eight villages. Data were collected through structured questionnaires and analyzed using descriptive statistics, farm budget models, marketing margin analysis, and regression analysis. Results showed that 50% of respondents raised goats, while 46% kept both goats and sheep, with most practicing a semi-intensive management system. The average total production cost over eight months was ₦598,224.20, with an average revenue of ₦1,257,778.00, yielding a net income of ₦659,553.60. Profitability indicators included a benefit-cost ratio of 2.10, an operating cost ratio of 0.43, and a return on investment (ROI) of 1.10. However, marketing inefficiencies were evident, as farmers retained only 44.66% of the consumer price. Major constraints included limited veterinary services, poor infrastructure, lack of credit access, and market information asymmetry. Socio-economic factors such as age, education, access to extension services, and cooperative membership significantly influenced profitability. The study recommends improving infrastructure, establishing market information systems, and promoting farmer cooperatives to strengthen the small ruminant value chain and support rural development in Abia State and similar regions.

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## INTRODUCTION

Livestock production is a vital component of Nigeria's agricultural sector. Livestock refers to domesticated animals raised for food, fiber, and labor. Beyond food, livestock provides employment, income, and plays key roles in socio-cultural practices and human nutrition (Adam et al., 2010). It can be reared for household consumption or commercial purposes.

Globally, small ruminants—mainly sheep and goats—make up over 50% of domesticated ruminants and are a major livelihood source, especially in developing

countries (Wodajo et al., 2020). Nigeria is home to an estimated 19 million sheep and 28 million goats (KNBS, 2019). These animals contribute to food security, income, and cultural practices (Herrero et al., 2013), with their meat, milk, and manure supporting nutrition, crop production, and rural economies.

Small ruminants are well-suited to resource-poor farmers due to their adaptable diets, high reproductive rates, tolerance to harsh climates, and ability to survive on marginal lands (Kosgey et al., 2016). Nigeria has one of Africa's largest livestock populations, with agriculture supporting 47.25% of the 210 million rural residents and contributing about 41.4% of national GDP.

Small ruminants are central to this sub-sector, offering economic benefits and foreign exchange potential. Their fertility, short generation intervals, and resilience make them valuable assets and a form of financial security (Asfaw, 2017).

Despite their significance, genetic improvement programs for small ruminants in developing countries have largely fallen short. This is often due to a narrow focus on genetics, which overlooks farmers' broader needs, such as feed, health, and market access (Kosgey et al., 2016). Imported breeds also tend to underperform in tropical environments with limited inputs, discouraging their adoption. Additionally, continuous production without assured market access remains a major constraint.

Agricultural marketing—the process of moving products from farm to consumer—encompasses transportation, processing, packaging, storage, and distribution. For small ruminants, marketing is crucial for improving livelihoods, boosting income, and enhancing food security. Sheep and goats, typically raised by smallholder farmers, offer meat, milk, and manure, and serve as financial assets that can be sold in times of need (Ayalew et al., 2013).

These animals thrive in arid and semi-arid areas where crop farming is limited, making them particularly valuable to low-resource households. In many African cultures, including Nigeria, sheep and goats also have ceremonial and cultural value. As Peacock (2005) notes, goats often serve as “banks on legs” for the poor, offering both economic and social security.

Small ruminant marketing operates through multiple channels: direct sales from farmers to consumers, transactions via middlemen, and sales to slaughterhouses or processors. Local markets are vital trading points, typically held weekly or monthly, but the system is hindered by poor infrastructure, lack of standardized pricing, and inadequate veterinary services (Behnke et al., 2008), all of which lower profitability and deter investment.

Price volatility presents an added challenge. Seasonal demand shifts—especially during religious holidays like Christmas, Easter, and Islamic festivals—lead to abrupt price increases. However, many farmers lack timely market information and cannot take advantage of these peaks. As Bailey et al. (1999) observe, this information gap allows middlemen to control prices, disadvantaging producers. Limited access to credit and the absence of insurance further restrict farmers' ability to expand or invest sustainably.

Improving small ruminant marketing requires targeted strategies. Establishing Market Information Systems (MIS) can deliver real-time data on prices and demand via mobile phones or radio, helping farmers make informed decisions (Ayele et al., 2006). Creating livestock marketing cooperatives can increase farmers' bargaining power, reduce transaction costs, and enable bulk sales. Investment in infrastructure—such as roads, loading ramps, auction yards, and veterinary clinics—is vital for efficient markets. According to the Food and Agriculture Organization (FAO, 2011), such developments reduce losses and attract more buyers by

ensuring animal health and product quality. Value addition through improved slaughtering, processing, and packaging also enables farmers to secure better prices and access premium markets.

In Nigeria, small ruminant marketing remains largely informal and under-regulated. Most rural producers depend on open-air markets, exposing them to risks like theft, disease, and price exploitation. Okunlola et al. (2014) note that despite increasing urban demand for goat and sheep meat, rural producers often cannot meet this demand due to poor infrastructure, limited veterinary services, and inadequate market information. The core issue driving this study is the persistent information asymmetry that adversely affects rural farmers. The study aims to examine the economics of small ruminant production and the efficiency of marketing systems in the study area.

The objectives of this study are to;

- i. Determine the types of small ruminants kept and the management system practiced by the smallholder farmers in the area
- ii. Evaluate the cost and Returns Estimate of Small Ruminant Animals Production for 8months in Abia State
- iii. Examine the marketing Efficiency of Small ruminant husbandry marketing among smallholder farmers in Abia State
- iv. Evaluate the constraints militating against Small Ruminant Production and Marketing
- v. Investigate the socio-economic Factors Influencing small ruminant husbandry and marketing in the study area

Small ruminant husbandry is vital to the livelihoods of rural households in Nigeria, particularly for smallholder farmers who depend on these animals for income, food security, and social capital. In Abia State, sheep and goats are widely reared due to their adaptability, low maintenance needs, and rapid reproduction. Despite their socio-economic importance, small ruminant production and marketing in the region remain underdeveloped and economically underexplored.

Understanding the species reared, management systems used, and the economic viability of production is key to shaping policy and guiding investments in the livestock sub-sector. Analyzing cost and return over time offers insights into profitability, sustainability, and scalability. Additionally, assessing marketing efficiency highlights the extent to which producers access markets and receive fair value for their products. This study is further justified by the need to identify and address constraints limiting the productivity and marketing of small ruminants. These include inadequate veterinary services, poor infrastructure, limited market information, and restricted access to credit. Understanding these barriers is essential for formulating strategies that enhance production systems and improve market access.

Additionally, analyzing the socio-economic factors influencing small ruminant husbandry and marketing helps identify farmer profiles most likely to succeed. This knowledge is crucial for designing targeted interventions, support programs, and training initiatives

that promote livestock development in Abia State and similar contexts.

Overall, the study fills critical gaps in empirical data on the economics of small ruminant farming and marketing in Abia State, offering evidence-based recommendations for farmers, policymakers, development agencies, and researchers. The study is grounded in the theory of production, the theory of agricultural marketing, and the theory of value addition.

### Theory of production

The theory of production explains how inputs—land, labor, and capital—are converted into outputs, such as goats and sheep. For smallholder farmers in Abia State, production decisions are shaped by resource constraints, technology access, and climatic conditions. Efficient input use directly influences productivity and profitability in livestock systems (Akinyele et al., 2022). This theory offers a basis for assessing how farmers allocate scarce resources to optimize output and income, particularly in small ruminant husbandry, where feeding, breeding, and healthcare practices drive efficiency (FAO, 2023). Understanding the production function is key to evaluating the economic viability of these enterprises.

### Theory of agricultural marketing

The theory of agricultural marketing examines the movement of agricultural products from producers to final consumers, including transportation, storage, processing, pricing, and sales. In Abia State, smallholder farmers face limited market access, price volatility, and weak infrastructure, which hinder efficient marketing of small ruminants. Effective marketing strategies can boost income and reduce post-harvest losses (Eze et al., 2023). The theory highlights how better access to information, market institutions, and cooperatives enables farmers to secure improved prices and greater market participation (Ogunniyi & Ajao, 2024).

### Theory of value addition

The theory of value addition asserts that enhancing raw agricultural products through processing, improved practices, or branding increases their market value and profitability. In small ruminant production, this includes meat packaging, better husbandry, or disease control. For smallholders in Abia State, value addition improves income and market access. Strategic interventions such as feed enhancement and animal health management raise product quality, driving consumer preference and price premiums (Chukwu et al., 2023). The theory also underscores the role of local knowledge and innovation in improving returns from small-scale livestock farming (Nwachukwu et al., 2024).

## METHODOLOGY

This study was conducted in Isiala-Ngwa North L.G.A of Abia State, Nigeria. Isiala-Ngwa North is one of the

17 Local Government Areas (LGAs) that make up Abia State. It is located between latitudes 50 °201' and 50 °301' N of the equator and longitudes 70 °401' and 70 °501' E of the Greenwich meridian.

A multistage sampling procedure was used to select the farmers. The first stage involved purposive selection of four (4) communities from the seven in Isiala-Ngwa North: Amasa-Ntigha, Amapu-Ntigha, Umuoha, and Ihie. These were selected based on data from the State Agricultural Development Program (ADP), indicating a high number of small ruminant farmers. The second stage involved selecting two (2) villages from each community, totaling eight villages: Egbelu and Okpuala (Amasa-Ntigha); Umualata and Umuebeyi (Amapu-Ntigha); Amaekpu and Eziama-Uratta (Umuoha); and Amaogwugwu and Egbelu-Ihie (Ihie). The third and final stage was the selection of 10 small ruminant farmers from each village, totaling 80 farmers for the study sample.

Data were collected using a well-structured questionnaire and analyzed through descriptive and inferential statistics, the farm budget model, regression analysis, and the maximization of consumer satisfaction approach (MCSA). Objectives one and four were analyzed using descriptive statistics such as frequencies and percentages.

Objective two was analyzed using the Farm Budget model. The Farm Budget model was employed to estimate costs, returns, marketing margins, and net income in small ruminant production in the study area. The model is expressed as follows:

$$NR = TR - TC. \quad (1)$$

$$TR = P \times Q. \quad (2)$$

$$TC = TVC + TFC. \quad (3)$$

Where; NR = net revenue (N)

TR = Total Revenue (N)

TC = Total Cost (N)

TVC = Total variable cost (N)

TFC = Total Fixed Cost (N)

P = Unit price of the small ruminant

Q = No of small ruminant sold per week

The fixed cost aspect will include the depreciation on fixed asset. The straight-line depreciation (SLD) method was used to determine the depreciation values of each fixed asset given as:

$$D = \frac{P-S}{N} \quad (4)$$

Where D= depreciation values of fixed asset (N)

P = Original Value of Fixed Asset

S = Salvage value

N = Number of Useful years

Objective three was achieved using the profitability indices such as the benefit-cost ratio, operating ratio and return to naira invested was used to further ascertain the

profit level of the enterprises. The indices are specified as:

$$BCR = TR/TC \quad (5)$$

$$OR = VC/TR \quad (6)$$

$$ROI = NI/TC \quad (7)$$

ROI = Return on Investment

NI = Net Income

VC = Variable Cost

### Marketing margin

This was used to measure the market performance of the small ruminant in terms of profitability (and viability). Marketing margin is the difference between the prices consumers pay and the amount the producers get. The formula is given thus:

$$MM = \frac{CP - MP * 100}{CP} \quad (8)$$

Where

MM = market margin (%)

CP = Consumer Price (N)

MP = market price (N)

Objective five; Socio-economic Factors Influencing production and marketing of small ruminant husbandry production in the study area was analyzed using the OLS regression model. The multiple regression equation will be estimated using the four functional forms name linear, semi-log, double log and exponential model, the estimated model is specified in an implicit form as:

$$Y = f(x) \quad (9)$$

And explicitly given as;

$$\text{Log}Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + \dots + b_{14}X_{14} + e \quad (10)$$

Where:

Y = Net Income

$b_0$  = Constant

$b_1 - b_{14}$  = estimated regression coefficient

$X_1 - X_{14}$  = independent variable

e = error term

$X_1$  = Age (in year)

$X_2$  = Household size (number of people)

$X_3$  = Marital status (Married = 1 otherwise = 0),

$X_4$  = Sex (Male = 1, Female = 0),

$X_5$  = Initial Capital (N)

$X_6$  = Flock size (number)

$X_7$  = Farm income (N)

$X_8$  = cost of medication (N)

$X_9$  = Cost of feed (N)

$X_{10}$  = level of education (in years)

$X_{11}$  = Extension contact (yes-1, No-0)

$X_{12}$  = Experience in Livestock husbandry (years)

$X_{13}$  = Cooperative Membership

$X_{14}$  = Access to credit (Yes=1, No=0)

## RESULTS AND DISCUSSIONS

### Types of small ruminants kept and the management system practiced by the small holder farmers in the area

The study shows that half (50.0%) of the respondents specialize only in goat production, followed by 46.0% who raise both goats and sheep, while only 4.0% engage in sheep farming alone (Table 1). This indicates that goat production dominates small ruminant activities in the study area. This dominance may be attributed to the socio-cultural and economic significance of goats, as they are commonly used in marriages, land transactions, religious ceremonies, and community events (Akinyemi et al., 2022). Furthermore, goats serve as a critical source of animal protein and contribute significantly to household nutrition, especially in rural communities (Ibrahim et al., 2023).

Small ruminants such as goats and sheep play a vital role in rural livelihoods. They are often sold during financial distress, such as crop failure or family health emergencies, providing an economic buffer for vulnerable households (Olawale & Musa, 2024). This supports the view that small ruminants, particularly dairy goats, are instrumental in poverty alleviation and sustainable rural development in low-income regions (Chukwu et al., 2021).

Figure 1 shows that most farmers (84.0%) practice a semi-intensive management system. Few respondents reported using intensive (14.0%) and extensive (2.00%) systems. This indicates that semi-intensive management dominates among small ruminant farmers in the study area, reflecting the low economic status of farmers.

### Cost and returns of small ruminant production

Table 2 presents the cost and returns of small ruminant production in Abia State. The total production cost averaged ₦598,224.20. Labour (₦102,888.90) and feeding (₦130,666.60) were the highest individual costs. Further analysis showed that Total Variable Cost and Total Fixed Cost accounted for ₦541,674.00 and ₦56,549.84 of the total cost, respectively. Average total returns were ₦1,257,778 per annum.

**Table 1.** Distribution of Types of Small Ruminant Livestock Raised in the Study Area

Variable	Frequency	Percentage
Sheep	3	4.0
Goat	40	50.0
Both Goat and sheep	37	46.0

### Marketing margin of small ruminant farmers in Abia State

Table 3 presents the marketing margin results for small ruminant farmers in the study area. The marketing margin is 44.66%, meaning that for every animal sold (goat or sheep), the farmer receives about 44.66% of the consumer price, while the remaining 55.34% goes to middlemen or retailers. This aligns with findings by Okonkwo (2013), who reported similar marketing margin patterns.

**Marketing efficiency of small ruminant husbandry marketing among small-holder farmers in Abia State**

Table 4 shows the marketing efficiency of small ruminant livestock marketing among smallholder farmers in Abia State. Marketing Efficiency of Small Ruminant Husbandry Marketing among Small-Holder Farmers in Abia State.

The results in Table 4 show that the average total selling price of small ruminants among smallholder farmers in Abia State is ₦58,780, ranging from ₦45,000 to ₦95,000, with a standard deviation of ₦13,991.67. This variability reflects differences in size, breed, and market conditions (Yusuf et al., 2022). Total marketing cost is ₦39,350, comprising an average purchase price of ₦32,530, transport costs of ₦6,170, and labor cost of ₦650. The purchase price accounts for about 82.7% of marketing costs, consistent with findings by Adepoju and Salau (2007) and Ifeanyi et al. (2023), who noted input prices as the largest cost in livestock marketing. Value added, the difference between selling price and total cost, is ₦19,430, indicating the gross profit before taxes and deductions.

Marketing efficiency (ME), calculated as value added divided by total cost, is 0.4938 (49.38%). According to Olukosi and Isitor (2005) and Okonkwo et al. (2021), an ME above 33% indicates moderate efficiency in traditional agricultural markets. This suggests small ruminant marketing in Abia State is reasonably efficient, though reducing transportation costs—currently over 15% of total costs—could improve efficiency further. These findings align with Ekunwe et al. (2008), who noted that despite infrastructural and logistical challenges, livestock markets in Nigeria provide moderate returns to smallholder farmers.

Reducing transaction costs like transportation and improving marketing infrastructure could further enhance efficiency (Adewale & Ogundipe, 2024). The relatively low labor cost suggests limited formal employment in the value chain, likely reflecting reliance on family labor or informal arrangements. As Adebayo and Adeola (2013) and Nwachukwu and Bassey (2022) indicate, informal labor systems are common in rural Nigerian agriculture, helping minimize costs but also signaling underemployment.

**Constraints associated with small ruminant production and marketing**

The constraints in Table 5 highlight the wide range of challenges smallholder farmers face in small ruminant production and marketing in Abia State. These issues hinder productivity, reduce profitability, and limit market participation.

The most critical constraint, reported by all respondents (100%), is a lack of technology/innovation, ranked 1st. This highlights a significant technological gap in the sector. As noted by Ayele et al. (2003) and Ogunbiyi et al. (2022), the lack of modern husbandry practices, disease control techniques, and breeding innovations significantly hampers small ruminant productivity in Sub-Saharan Africa.

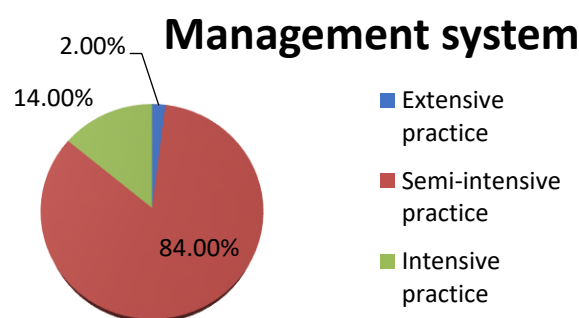


Figure 1. Percentage Distribution of Respondents According to Management System Practices

Table 2. Cost and Returns Estimate of Small Ruminant Animals Production for 8months in Abia State.

Item	Naira
Variable cost	
Stock	260,240.00
Cost of feed	130,666.60
Cost of the drug	47,878.80
Cost of labour	102,888.90
Total VC	541,674.30
Fixed cost	
Housing(Pen)	17,406.96
Drinking/feeding bowl/broom	39,142.88
Total FC	56,549.84
Total Cost = A+B	598224.2
Revenue	
Revenue from the sale of the livestock	1,257,778.00
Gross Margin(D-A)	716,103.40
Net Income (D-C)	659,553.60
Benefit cost Ratio(D/C)	2.10
Operating cost expenditure Ratio (A/D)	0.43
ROI(F/C)	1.10

**Table 3.** Marketing Margin of Small Ruminant Farmers in Abia State.

Item	Mean Price (N)	Min.	Max.	Sd.
CP Consumer price	58,780.00	45,000.00	95,000.00	13,991.67
MP Marketing price	32,530.00	12,500.00	55,000.00	10,099.71
CP-MP	26,250.00			
MM = (CP-MP)/CP	0.4466			
MM Percentage (%)	44.66			

**Table 4.** Marketing Efficiency of Small Ruminant Husbandry Marketing among Small-Holder Farmers in Abia State

	Item	Mean	Min.	Max.	Sd.
A	Total selling price	58,780.00	45000	95000	13991.67
	Marketing Cost				
	Purchase price	32,530.00	12500	55000	10099.71
	Cost of transport	6,170.00	1000	15000	4239.48
	Cost of labour (off- loading)	650.00	500	1500	17.22
B	Total Cost	39,350.00			
C	Valued added (A-B)	19,430.00			
D	ME = C/B	0.4938			
	Marketing Efficiency ME (%)	49.38%			

**Table 5.** Constraints Militating against Small Ruminant Production and Marketing

Item	Yes*(%)	Rank
Limited access to capital	46(92.00)	8 <sup>th</sup>
Inadequate infrastructure	49(98.00)	2 <sup>nd</sup>
Disease and pest management	47(94.00)	4 <sup>th</sup>
Feed scarcity	42(84.00)	12 <sup>th</sup>
Lack of technical know-how	44(88.00)	9 <sup>th</sup>
Inadequate market access and information	43(86.00)	10 <sup>th</sup>
Seasonal fluctuations	49(98.00)	2 <sup>nd</sup>
Lack of technology/innovation	50(100.00)	1 <sup>st</sup>
Losses due to predation by wild animals	32(64.00)	14 <sup>th</sup>
Theft	12(24.00)	16 <sup>th</sup>
Lack of access to improved breeding stock	47(94.00)	4 <sup>th</sup>
Climate change effects	47(94.00)	4 <sup>th</sup>
Inadequate policy support and institutional framework for small ruminant farming	48(96.00)	3 <sup>rd</sup>
Inadequate extension support	47(94.00)	4 <sup>th</sup>
High cost of transportation	27(54.00)	15 <sup>th</sup>
Land tenure Issues	43(86.00)	10 <sup>th</sup>
Poor market access	41(82.00)	13 <sup>th</sup>

Tied at 2nd place (98%) are inadequate infrastructure and seasonal fluctuations, both of which severely affect the production and marketability of small ruminants. Inadequate infrastructure—such as poor road networks, limited access to veterinary services, and the absence of modern slaughter and storage facilities—limits both input supply and market access (FAO, 2011; Ekong et al., 2023). Seasonal fluctuations, often driven by rainfall variability and feed availability, lead to unstable production cycles and price volatility, consistent with findings by Adediran et al. (2020); Ifeoma and Lawal,

(2021). Inadequate policy support and institutional frameworks were reported by 96% of respondents and ranked 3rd. This indicates systemic neglect and poor prioritization of small ruminant farming in agricultural policies. According to Nwosu et al. (2013); Balogun et al. (2022), the absence of enabling policies and targeted government support remains a major barrier to scaling up livestock enterprises among smallholder farmers in Nigeria.

Several constraints shared the 4th rank (94%), including disease and pest management, lack of access

to improved breeding stock, climate change effects, and inadequate extension support. These are interlinked issues that point to weak support services and vulnerability to environmental shocks. As [Devendra and Thomas \(2002\)](#) and [Chikere et al. \(2023\)](#) explain, without effective veterinary and extension systems, disease outbreaks and poor reproductive performance continue to suppress productivity.

Other notable constraints include limited access to capital (92%), ranked 8th, and lack of technical know-how (88%), ranked 9th. Access to credit is a well-documented bottleneck in small-scale agriculture, as formal financial institutions often perceive livestock farming as the high-risk ([World Bank, 2014](#); [Okeke & Bello, 2024](#)). The technical skills gap suggests a lack of training programs or uptake of best practices in livestock management. Lower-ranked constraints, such as high cost of transportation (54%), losses due to predation (64%), and theft (24%)—though reported by fewer farmers—still indicate specific areas needing attention, particularly for improving security and logistical efficiency in the rural livestock value chain. Overall, the data suggest that for small ruminant farming and marketing to be truly viable and sustainable in Abia

State, there needs to be a multifaceted intervention strategy—involving technology adoption, infrastructural development, policy reforms, and enhanced extension services. These findings echo those of [Abdullahi and Maigida \(2018\)](#) and [Umeh and Ayoola \(2024\)](#), who argue that improving productivity and efficiency in the livestock sector requires addressing both structural and institutional constraints simultaneously.

### Socio-economic factors influencing production of small ruminant husbandry and marketing in the study area

The results in [Table 6](#) show the regression estimates of socio-economic factors influencing small ruminant husbandry production in the study area. Among the four functional forms estimated, the exponential function was chosen as the lead equation based on the optimum R<sup>2</sup> value, number of significant variables, and conformity with a priori expectations. The F-value was highly significant at the 1% level, indicating a regression of best fit. The R<sup>2</sup> value of 0.5642 indicates that 56.42% of the variation in net income from small ruminant husbandry production was explained by the independent variables.

**Table 6.** Regression Estimates of Socio-economic Factors Influencing of Small Ruminant Husbandry Production in the Study Area

Variable	Linear	Exponential +	Double Log	Semi-Log
Age (X1)	1611.0670 (1.13)	0.0047 (1.22)	0.3370 (3.46)**	117599.6000 (2.22)*
Household size (X2)	8729.89 (3.09)**	0.0234 (2.73)*	0.0616 (0.80)	22127.3300 (0.78)
Marital status X3	11814.8200 (0.21)	0.0678 (0.44)	0.0879 (0.48)	19963.0500 (0.30)
Sex (X4)	72678.3500 (1.98)*	0.2320 (3.17)**	0.2449 (1.96)*	77119.9400 (2.96)**
Initial capital invested (X5)	-0.0108 (-0.11)	-2.55e-08 (-0.10)	-0.1163 (-0.15)	- 122058.3000 (-0.08)
Flock size (X6)	529.9256 (0.88)	0.0011 (0.65)	0.0389 (0.81)	18174.5000 (1.02)
Farm income (X7)	-2.4299 (-2.12)*	-5.16e-06 (-1.5)	0.2704 (-0.92)	- 122058.3000 (-2.42)*
Cost of medication (X8)	-0.9105 (-0.42)	-2.70e-06 (-0.46)	-0.0007 (-0.01)	-208.8066 (-0.01)
Cost of feed (X9)	0.4970 (4.60)***	1.35e-06 (3.46)**	0.0354 (0.84)	12625.2300 (0.82)
Cost of equipment (X9)	1.1984 (1.15)	3.00e-06 (1.05)	0.0297 (0.42)	9724.4810 (0.41)
Level of education (X10)	-12070.6600 (-1.22)	-0.0371 (-3.73)***	-0.1309 (-1.78)*	-43491.35 (-2.54)*
Extension contact (X11)	66774.0100 (1.15)	0.1541 (0.97)	0.1255 (0.79)	51703.72 (2.74)**
Farming experience (X12)	-839.9735 (-0.56)	-0.0024 (-0.67)	-0.0618 (-2.03)*	-19222.2100 (0.74)

**Table 6.** Regression Estimates of Socio-economic Factors Influencing of Small Ruminant Husbandry Production in the Study Area (continued)

Variable	Linear	Exponential +	Double Log	Semi-Log
Cooperative membership (X13)	41238.3900 (1.11)	0.1300 (3.13)**	0.1396 (0.88)	42273.5500 (0.72)
Access to credit (X14)	2397.3080 (0.19)	0.0016 (0.05)	-0.007	-1551.3870 (-0.10)
Constant (B <sub>0</sub> )	300308 (2.71)*	12.5150 (41.42)***	13.8279 (3.89)***	989167.8 (0.76)
F-cal	26.10	28.22	20.98	20.84
R-squared	0.5397	0.5642	0.5147	0.5018
Adj R-squared	0.4302	0.4662	0.4065	0.4049

Figures in parenthesis represents t – values, \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$  and \*  $p < 0.1$

Age (X<sub>1</sub>) is statistically significant in both the double-log and semi-log models, suggesting that older farmers possess more experience and decision-making maturity, which positively impacts production. This supports the findings of [Tangka et al. \(2002\)](#) and [Olayemi et al. \(2022\)](#), who argue that age enhances resource allocation efficiency in livestock production.

Household size (X<sub>2</sub>) is positively significant in the linear and exponential models. Larger households may provide more family labour for livestock management, thereby enhancing productivity ([Adediran et al., 2020](#); [Uche & Basse, 2023](#)).

Sex (X<sub>3</sub>) is a significant predictor across all models, particularly in the exponential and semi-log functions, indicating that male farmers—typically the dominant participants in livestock farming—tend to produce more, likely due to greater access to land and credit. This aligns with the findings of [FAO \(2011\)](#) and [Obafemi & Lawan \(2021\)](#), which highlight gender disparities in agricultural productivity in Nigeria.

Farm income (X<sub>6</sub>) shows a significant negative influence in both the linear and semi-log models, suggesting that higher income from other farming sources may reduce the priority given to small ruminant production due to substitution effects or opportunity costs ([Oladeebo & Fajuyigbe, 2007](#); [Ogunlana & Yusuf, 2023](#)).

Cost of feed (X<sub>8</sub>) is strongly significant in the linear and exponential models, with positive coefficients. This indicates that increased spending on feed positively contributes to output, likely by improving animal nutrition and growth. [Adepoju & Salau \(2007\)](#) and [Bello et al. \(2024\)](#) also identify feed as a critical input in small ruminant performance.

Level of education (X<sub>10</sub>) is significantly negative in the exponential, double-log, and semi-log models. This counterintuitive result may indicate that more educated individuals tend to pursue off-farm employment or diversify income sources away from livestock production ([Adebayo, 2013](#); [Eze & Iroanya, 2022](#)).

Extension contact (X<sub>11</sub>) is positively significant in the semi-log model, reinforcing the role of advisory services in improving farmer knowledge and the adoption of best

practices, thereby enhancing productivity, as observed by [Nwachukwu & Onyenweaku \(2007\)](#) and [Nwankwo & Okoli \(2023\)](#).

Membership of cooperatives is statistically significant in the exponential model, highlighting the importance of farmer groups in providing access to credit, inputs, and market information—key enablers of livestock productivity ([IFAD, 2012](#); [Ibrahim & Aliyu, 2024](#)). Farming experience and access to credit, though theoretically important, are not statistically significant in most models. This may suggest limited access to formal credit or a lack of innovation and responsiveness linked to experience in the study context.

## CONCLUSION AND RECOMMENDATIONS

Small ruminants are important domestic animals and constitute valuable resources in the tropical livestock production system in Nigeria. This study analyzed the economics of small ruminant husbandry production and marketing among smallholder farmers in Isiala-Ngwa North LGA of Abia State. The findings revealed high profitability and positive net income among small ruminant farmers, primarily due to the low cost of production. This presents a viable opportunity for poor rural farmers to engage in both production—mainly through the semi-intensive system—and marketing. While marketing margins are considerably higher than direct production costs, this difference is largely attributable to the additional costs incurred during marketing. The evidence suggests that the market for small ruminants operates efficiently, even with minimal government intervention in the study area.

Despite the economic potential of small ruminant production and marketing, farmers face significant constraints that hinder sectoral growth. These include lack of technology and innovation, inadequate infrastructure and seasonal fluctuations, weak policy support and institutional frameworks, ineffective disease and pest management, limited access to improved breeding stock, climate change impacts, and inadequate extension services. The study calls on small ruminant farmers to form and join cooperative societies to

improve access to information and increase economies of scale. This would lower production costs and boost income. It further recommends infrastructure development, the establishment of market information systems, and the promotion of farmer cooperatives as key strategies to strengthen the small ruminant value chain.

#### Authors Contribution

All authors have contributed equally to prepare the paper.

#### Availability of data and materials

The data that support the findings of this study are available from the corresponding author, upon reasonable request.

#### Conflict of interests

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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