



**PROFITABILITY ANALYSIS OF SMALL-SCALE CATTLE FATTENING IN  
MAIDUGURI METROPOLIS, BORNO STATE, NIGERIA**

<sup>1</sup>Ameh, B. O. and <sup>2</sup>Effiong, M. O.

<sup>1</sup>Department of Agricultural Economics, Abubakar Tafawa Balewa University, Bauchi

<sup>2</sup>Department of Agricultural Economics, University of Calabar, Calabar

**Corresponding Author's Email:** benjiamah@gmail.com, **GSM:** 08069601244

**ABSTRACT**

The study analysed the profitability and efficiency of small-scale cattle fattening enterprises in Maiduguri Metropolis, Borno State, Nigeria. Primary data were collected from 108 cattle fatteners using a structured questionnaire through a multistage sampling technique. Data were analysed using descriptive statistics, gross margin analysis, and the stochastic profit frontier (SPF) model. Results from the profitability analysis, computed on a per-cattle basis, revealed a mean total variable cost of ₦346,293 and total revenue of ₦446,460, resulting in a gross margin of ₦100,167 and a net profit of ₦95,807 per cattle. The benefit–cost ratio of 1.27 and return on investment of 27.32% indicate that cattle fattening is economically viable in the study area. The SPF results showed that feeder cattle purchase price and feed cost significantly reduced profit, while education, experience, access to credit, and herd size positively influenced profitability. The estimated gamma value (0.72) indicated that 72% of the variation in gross margin was due to profit inefficiency. The mean profit efficiency score of 0.74 suggests that fatteners could increase profits by about 26% if operating at full efficiency with existing technology. The findings revealed that the major challenges confronting small-scale cattle fatteners were predominantly cost-related. High feed costs constituted the most critical constraint (20.6%), closely followed by the high cost of feeder cattle (19.0%), together accounting for nearly 40% of total responses and highlighting the capital-intensive nature of the enterprise. Limited access to credit ranked third (15.2%), reflecting persistent financial barriers that hinder enterprise expansion and the adoption of improved production practices. The study concludes that small-scale cattle fattening in Maiduguri Metropolis is profitable but constrained by high input costs and institutional limitations. Policy measures aimed at reducing feed costs, improving access to credit, and strengthening extension and veterinary services are essential to enhance profitability and sustainability.

**Keywords:** Cattle, Fattening, Profitability, Gross-margin, Efficiency.

**INTRODUCTION**

Agriculture remains a central pillar of Nigeria's economy, underpinning rural livelihoods, food security, and income generation while employing a substantial proportion of the labour force (Chiaka *et al.*, 2022; Ohiomah *et al.*, 2025). Within this sector, livestock production and particularly cattle fattening, occupies a strategic position due to its contribution to meat supply, household income diversification, and value chain development, especially in northern Nigeria where agro-pastoral systems dominate (Shettima *et al.*, 2019; Jimoh *et al.*, 2023). Small-scale cattle fattening involves the purchase of young or underweight cattle, intensive feeding over a defined period, and resale at higher weights and prices, thereby adding value and enhancing producer returns while improving beef quality and market availability.

In Northern Nigeria, cattle fattening is often undertaken seasonally, closely aligned with festive periods such as Eid-ul-Kabir when demand for premium animals and beef peaks, creating opportunities for enhanced profitability (Gona *et al.*, 2017; Tafida *et al.*, 2023). Beyond its commercial relevance, cattle fattening also serves as a livelihood strategy for urban and peri-urban households, contributing to employment creation and resilience against economic shocks (Jibrin *et al.*, 2023). These attributes position cattle fattening as a viable pathway for strengthening urban livestock economies and supporting food systems in conflict-affected and fragile regions such as Borno State. Despite its potential, empirical evidence on the profitability and operational constraints of small-scale cattle fattening in Maiduguri Metropolis remains limited. Existing studies in the area have focused on the effects of insurgency on



feedlot management (Bukar, 2016) and comparative value addition along the cattle value chain (Ghide *et al.*, 2025), with scant attention to enterprise-level profitability and its determinants. Moreover, localized analysis of factors influencing gross margin among urban fatteners is largely absent, constraining the ability of policymakers and practitioners to design targeted, evidence-based interventions. Addressing these gaps is critical for improving enterprise sustainability, guiding investment decisions, and enhancing the efficiency of urban livestock systems.

Against this backdrop, the main objective of this study is to analyse the profitability of small-scale cattle fattening enterprises in Maiduguri Metropolis, Borno State, Nigeria. Specifically, the study aims to:

- i. describe the socio-economic characteristics of cattle fattening operators in the study area;
- ii. analyse the profitability of small-scale cattle fattening enterprises;
- iii. determine factors influencing the gross margin of cattle fattening operations; and
- iv. identify challenges facing cattle fattening businesses in the study area.

## METHODOLOGY

### The Study Area

The study was carried out in Maiduguri Metropolis, which consist of the Maiduguri Metropolitan Council and parts of Jere Local Government Area. The area has 11°46'18" N to 11°53'21" N as its latitudinal spread and 13°03'23" E to 13°14'19" E as its longitudinal extension (Mukhtar *et al.*, 2021). Maiduguri is the largest and main commercial city in the North Eastern Nigeria (Ahmed & Abah, 2014). It occupies an area of 69,436 square kilometres (km<sup>2</sup>). Based on a projection of the 2006 population census, the area had a population of 1.2 million people as at 2014 (National Population Commission (NPC). (2015). Maiduguri Metropolis is ecologically characterized as a Sahelian savannah with mainly grasses, shrubs, and few trees. The climate condition of the State is hot and dry for most part of the year. It has low rainfall which ranges from 500 mm to 1000 mm annually and a low relative humidity ranging from 42% to 49%. The average temperature is about 200C (Mukhtar *et al.*, 2021). The majority of the populace of the Maiduguri Metropolis is civil servants, traders, military and paramilitary and artisans. Major crops cultivated in the study area are millet, sorghum, maize, groundnut, wheat, cowpea and the major livestock reared are cattle, sheep, goats and poultry production hence the determinants of food security and food security status of the low-income group could reflect to some extent the food security situation in the State (Mukhtar *et al.*, 2021).

### Method of Data Collection

A cross-sectional survey design was employed for this study. Primary data were obtained from small-scale cattle fatteners through the use of a structured questionnaire administered via face-to-face interviews. The questionnaire was organized into distinct sections covering respondents' socio-economic characteristics, production and cost information for profitability analysis, and perceived constraints and challenges affecting small-scale cattle fattening within the study area. The face-to-face approach facilitated clarity of questions, improved response accuracy, and ensured a high response rate.

### Sampling Procedure and Sample Size

A multistage sampling technique was adopted to ensure systematic selection of respondents and adequate representation of small-scale cattle fatteners within the study area. In the first stage, Maiduguri metropolis was purposively selected due to the notable increase in small-scale cattle fattening activities and its strategic role as a major livestock trading hub in the region.

In the second stage, the Cattle Market Association located at Kasuwan Shanu was purposively chosen to serve as the sampling frame, given its organized structure and comprehensive register of active cattle fatteners. In the third stage, registered members of the association were purposively selected based on predefined eligibility criteria, including primary engagement in cattle fattening, operation at a small-scale level, and willingness and availability to participate in the survey. To minimize selection bias and capture operators outside the formal association structure, a snowball sampling technique was further employed to identify and recruit unregistered cattle fatteners operating within the metropolis. Overall, a total of 108 cattle fatteners, comprising both registered and non-registered operators, were successfully interviewed and constituted the final sample size for the study.



### Analytical Techniques

Descriptive statistics, including frequencies, percentages and means, were used to summarize respondents' socioeconomic characteristics and identify perceived challenges associated with cattle fattening. Profitability was assessed using gross margin analysis, computed as the difference between total revenue and total variable costs. In addition, a stochastic profit function model was employed to estimate the effects of input–output variables on gross margin while accounting for random shocks and inefficiency effects.

### Gross margin model

The gross margin model was used to estimate the profitability of cattle fattening in the study expressed as follows:

$$GM_i = \sum_i^n P_i Q_i - \sum_i^n C_j X_j$$

Where:

- GM<sub>i</sub> = Gross Margin of Cattle (₦)
- P<sub>i</sub> = Unit price of fattened cattle (₦)
- Q<sub>i</sub> = Number of cattle fattened (Number)
- C<sub>j</sub> = Unit cost of variable input (₦)
- X<sub>j</sub> = Quantity of variable input j used (Kg)

GM analysis was used in this study based on the following assumptions: fixed cost of production is negligible, all cattle were fattened for the average period of 2 – 4 months, all fattened cattle used purchased inputs such as feeds, labour, drugs and vaccine, and no cattle lost either as a result of disease or theft.

### Stochastic Profit Model

The stochastic profit frontier is specified as:

$$\ln(\pi_i) = \beta_0 + \sum_{k=1}^n \beta_k \ln(X_{ki}) + V_i - U_i$$

Where:

- π<sub>i</sub> = Normalized gross margin (₦) of the *i*<sup>th</sup> cattle fattener
- β<sub>0</sub> = Intercept
- β<sub>k</sub> = parameters to be estimated
- X<sub>ki</sub> = vector of explanatory variables
- V<sub>i</sub> ~ N(0, σ<sub>v</sub><sup>2</sup>) = symmetric random error (statistical noise)
- U<sub>i</sub> ≥ 0 = one-sided inefficiency term (half-normal or truncated-normal)

### Explicit Empirical Model

$$\ln(\pi_i) = \beta_0 + \beta_1 \ln(PB_i) + \beta_2 \ln(FC_i) + \beta_3 \ln(VC_i) + \beta_4 \ln(LB_i) + \beta_5 \ln(TR_i) + \beta_6 \ln(EDU_i) + \beta_7 \ln(EXP_i) + \beta_8 \ln(HHS_i) + \beta_9 \ln(CRD_i) + \beta_{10} \ln(VET_i) + \beta_{11} \ln(FSD_i) + V_i - U_i$$

Where:

- π<sub>i</sub> = Gross margin (₦) of fattening enterprise
- PB = Purchase price of cattle (₦/head)
- FC = Feed cost (₦)
- VC = Veterinary cost (₦)
- LB = Labour cost (₦)
- TR = Transportation cost (₦)
- EDU = Years of formal education
- EXP = Years of cattle fattening experience
- HHS = Household size (number)
- CRD = Amount of credit accessed (₦)
- VET = Frequency of veterinary visits



FSD = Fattening stock density (number of cattle fattened)

**Inefficiency Model**

$$U_i = \delta_0 + \delta_1 AGE_i + \delta_2 EDU_i + \delta_3 EXP_i + \delta_4 EXT_i + \delta_5 MS_i + W_i$$

Where:

AGE = Age of respondent (years)

EDU = Years of formal education

EXP = Years of experience

EXT = Access to extension services (1 = yes, 0 = no)

MS = Membership of cooperative (1 = yes, 0 = no)

$W_i$  = Random error term

## RESULTS AND DISCUSSION

### Socioeconomic Characteristics of the Respondents

The socio-economic characteristics of respondents (Table 1) revealed the important attributes that shape the performance of small-scale cattle fattening enterprises in Maiduguri Metropolis. The mean age of respondents was 42.7 years, with over 80% of the respondents fell within the age bracket of 20 – 50 years. This suggests adequate physical capacity, risk-bearing ability, and managerial competence necessary for intensive livestock operations. This finding corroborates the reports of Gona *et al.* (2017) and Milikias and Gebre (2024), who observed that middle-aged producers tend to be more productive and profit-oriented in cattle fattening enterprises. The enterprise was predominantly male-dominated (89.8%), reflecting prevailing cultural norms and the labour-intensive nature of cattle fattening. This result aligns with Ibrahim *et al.* (2024), who attributed low female participation in livestock production to constraints related to asset ownership, access to capital, and socio-cultural barriers. Majority (75.0%) of respondents were married indicating that cattle fattening constitutes a major livelihood activity within household economies, where family labour may contribute to reducing production costs (Karim *et al.*, 2020; Brito *et al.*, 2024). The mean household size was 9 persons, which potentially enhances labour availability for farm operations but may simultaneously increase household consumption pressure on household income. Although 24.1% of respondents had no formal education, over 44% attained at least secondary education, a level generally considered sufficient for record-keeping, informed decision-making, and the adoption of improved management practices (Jimoh *et al.*, 2023). Respondents also exhibited considerable experience in cattle fattening, with a mean of 8.9 years, a factor empirically linked to improved technical efficiency and profitability in livestock enterprises (Milikias & Gebre, 2024).

Despite these favourable human capital attributes, institutional support was notably weak. Only 42.6% of respondents had access to credit, while 36.1% reported contact with extension agents. This limited access constrains enterprise expansion and the adoption of improved production practices, a challenge widely documented in Nigerian livestock systems (Mapiye & Dzama, 2024; Aondoakaa *et al.*, 2025). Furthermore, less than half (44.4%) of the respondents belonged to cooperative societies, thereby restricting their collective access to finance, training opportunities, and market information (Avila *et al.*, 2025).

The average herd size of 8 cattle per production cycle reflects the small-scale nature of the enterprise, although it presents potential for expansion and the realization of economies of scale. Overall, the results suggest that while small-scale cattle fattening in Maiduguri Metropolis is operated by relatively active and experienced individuals, limited access to credit, extension services, and cooperative support remains a major constraint to improved profitability and operational efficiency.



**Table 1: Socioeconomic Characteristics of Respondents**

Variables	Frequency	Percentage	Mean
<b>Age</b>			
20 – 40	52	48.1	<b>42.7 years</b>
41 – 50	36	33.3	
51 – 60	18	16.7	
61 – 80	2	1.9	
<b>Sex</b>			
Male	97	89.8	
Female	11	10.2	
<b>Marital status</b>			
Married	81	75.0	
Single	17	15.7	
Separated	6	5.6	
Widowed	4	3.7	
<b>Household size</b>			
1 – 5	25	23.1	<b>9 persons</b>
6 – 10	56	51.9	
11 – 15	17	15.7	
16 – 20	9	8.3	
21 – 25	1	1.0	
<b>Educational Level</b>			
No formal education	26	24.1	
Primary	34	31.5	
Secondary	30	27.8	
Tertiary	18	16.6	
<b>Fattening Experience</b>			
1 – 5	28	25.9	<b>8.9 years</b>
7 – 12	44	40.7	
13 – 18	36	33.4	
<b>Access to credit</b>			
Yes	46	42.6	
No	62	57.4	
<b>Access to extension services</b>			
Yes	39	36.1	
No	69	63.9	
<b>Cooperative membership</b>			
Member	48	44.4	
Non-member	60	55.6	
<b>Average herd size fattened per cycle</b>			
1 – 5 cattle	41	38.0	<b>8 cattle</b>
6 – 10 cattle	53	49.0	
> 10 cattle	14	13.0	
<b>Total</b>	<b>108</b>	<b>100</b>	

**Source:** Field Survey, 2023

### **Profitability Analysis of Small-Scale Cattle Fattening Enterprise**

The profitability analysis computed on a per-cattle basis (Table 2) indicates that small-scale cattle fattening is economically viable in Maiduguri Metropolis. The mean total variable cost (TVC) per cattle was ₦346,293, confirming the capital-intensive nature of the enterprise. Feeder cattle purchase constituted the largest share of TVC (61.5%), followed by feed cost (24.9%), while labour, veterinary services, transportation, and water accounted for relatively minor proportions. This cost structure underscores feeder cattle and feed as the principal cost drivers, consistent with earlier studies in northern Nigeria (Tafida, 2023; Ibrahim *et al.*, 2024).



The mean total fixed cost (TFC) was low (₦4,360 per cattle), reflecting the small-scale and semi-intensive production system, with pen/land rent dominating fixed costs. The total cost of production per cattle was ₦350,653, while total revenue averaged ₦446,460, largely derived from the sale of fattened cattle. This yielded a gross margin of ₦100,167 and a net profit of ₦95,807 per cattle, confirming the profitability of the enterprise. The return on investment (27.32%) and benefit–cost ratio (1.27) further demonstrate that cattle fattening provides attractive financial returns, particularly during periods of high market demand (Gona *et al.*, 2017; Tafida *et al.*, 2023; Ohiomah *et al.*, 2025). However, the dominance of feeder cattle and feed costs highlights the vulnerability of profits to input price fluctuations, as similarly reported by Ibrahim *et al.* (2024). Overall, the results suggest that while cattle fattening is profitable, improved access to affordable feed and feeder stock would enhance enterprise sustainability.

**Table 2:** Estimate Cost and Returns Associated with Fattening a Beef Cattle

<b>Variables</b>	<b>Mean (₦/ Cattle)</b>	<b>Percentage (%)</b>
<b>Total variable cost</b>	346,293	
Feeder cattle	215,540	61.5
Cost of feeds	87,220	24.9
Transportation cost	9,550	2.7
Veterinary service	13,483	3.8
Water	5,500	1.6
Labour	15,000	4.3
<b>Total fixed cost (Rental values)</b>	4,360	
Housing/pen/land	3,500	1.0
Feeding & watering equipment	860	0.2
<b>Total Cost (TC)</b>	<b>350,653</b>	<b>100</b>
<b>Revenue</b>		
Manure	8,460	
Cattle	438,000	
<b>Total Revenue</b>	<b>446,460</b>	
<b>Profitability Indicators</b>		
Gross Margin (GM = TR – TVC)	<b>100,167</b>	
Net Profit ( $\pi$ = TR – TC)	<b>95,807</b>	
Return on Investment (%)	<b>27.32</b>	
Benefit Cost Ratio	<b>1.27</b>	

**Source:** Field Survey 2023

### Stochastic Profit Frontier (SPF) Analysis for Small-scale cattle Fattening

The stochastic profit frontier results indicate significant profit inefficiency among cattle fatteners. The gamma estimate ( $\gamma = 0.72$ ;  $p < 0.01$ ) shows that 72% of the variation in gross margin arises from inefficiency rather than random shocks, confirming that managerial and institutional factors dominate profit performance. Similar magnitudes of inefficiency have been reported in smallholder livestock systems across sub-Saharan Africa (Aminu *et al.*, 2022; Osadare *et al.*, 2024). Input costs exert significant negative effects on profitability. Feeder cattle purchase ( $\beta_1 = -0.482$ ) and feed cost ( $\beta_2 = -0.365$ ) show the largest elasticities, underscoring feed and stock acquisition as the primary cost drivers in fattening enterprises. Veterinary, labour, and transportation costs further compress margins, consistent with evidence that variable input and transaction costs substantially reduce livestock profits (Uchenna *et al.*, 2018; Jibrin *et al.*, 2023). Conversely, education, experience, credit access, and herd size positively influence profit, suggesting that human capital, financial liquidity, and scale economies improve input allocation and marketing efficiency. These findings support studies linking managerial capacity and credit inclusion to higher farm performance (Kibona *et al.*, 2023).

**Table 3:** Maximum Likelihood Estimates of Stochastic Profit Frontier for Small-Scale Cattle Fatteners in Maiduguri Metropolis (n = 108)

Variable	Parameter	Coefficient	Std. Error	t-value
Constant	$\beta_0$	2.314***	0.423	5.47
Purchase price of cattle (PB)	$\beta_1$	-0.482***	0.091	-5.30
Feed cost (FC)	$\beta_2$	-0.365***	0.074	-4.93
Veterinary cost (VC)	$\beta_3$	-0.128**	0.056	-2.29
Labour cost (LB)	$\beta_4$	-0.174**	0.081	-2.15
Transportation cost (TR)	$\beta_5$	-0.093*	0.052	-1.79
Education (years) (EDU)	$\beta_6$	0.214**	0.097	2.21
Experience (years) (EXP)	$\beta_7$	0.287***	0.083	3.46
Household size (HHS)	$\beta_8$	0.071	0.061	1.16
Credit accessed (CRD)	$\beta_9$	0.331***	0.094	3.52
Herd size/stock density (FSD)	$\beta_{10}$	0.402***	0.087	4.62
<b>Variance parameters</b>				
Sigma-squared ( $\sigma^2$ )		0.318***	0.067	4.74
Gamma ( $\gamma$ )		0.72***	0.06	12.00
Log-likelihood		-43.87		

**Source:** Field Survey, 2023

Significance levels: \*\*\*1%, \*\*5%, \*10%

The inefficiency model (table 4) shows that age increases inefficiency, whereas education, experience, extension contact, and cooperative membership significantly reduce inefficiency. This indicates that knowledge acquisition and institutional support enhance decision-making and adoption of improved practices. Extension and cooperative participation likely lower information and transaction costs, thereby improving efficiency. Comparable effects have been documented in recent frontier analyses of livestock producers (Abdulai & Eberlin, 2021; Beshir *et al.*, 2023).

**Table 4:** Inefficiency Effects Model

Variable	Parameter	Coefficient	Std. Error	t-value
Constant	$\delta_0$	0.921***	0.201	4.58
Age (years)	$\delta_1$	0.184**	0.079	2.33
Education (years)	$\delta_2$	-0.271***	0.083	-3.27
Experience (years)	$\delta_3$	-0.308***	0.092	-3.35
Access to extension (1 = Yes)	$\delta_4$	-0.216**	0.099	-2.18
Cooperative membership (1 = Yes)	$\delta_5$	-0.247**	0.102	-2.42

**Source:** Field Survey 2023

The result of the profit efficiency score (table 5) showed a mean profit efficiency score of 0.74 which implies that, on average, cattle fatteners in Maiduguri could increase their gross margin by 26% if they operated at full profit efficiency, using existing technology and resources. These findings strongly suggest that policies promoting access to affordable feed, formal credit, extension services, and cooperative participation would substantially enhance profitability of small-scale cattle fattening enterprises in Maiduguri Metropolis.

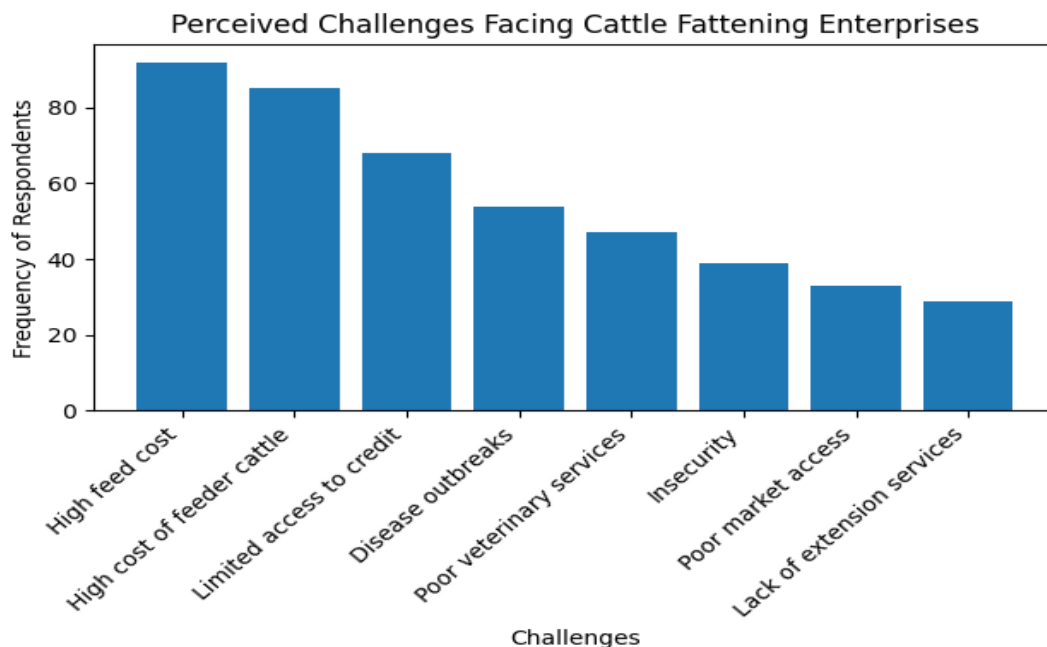
**Table 5:** Distribution of Profit Efficiency Scores

Efficiency Range	Frequency	Percentage
< 0.50	8	7.4
0.50 – 0.59	14	13.0
0.60 – 0.69	21	19.4
0.70 – 0.79	29	26.9
0.80 – 0.89	24	22.2
≥ 0.90	12	11.1
<b>Mean efficiency</b>		<b>0.74</b>
<b>Minimum</b>		<b>0.41</b>
<b>Maximum</b>		<b>0.93</b>

**Source:** Field Survey 2023

### Perceived Challenges Facing Small-Scale Cattle Fattening Enterprises

The result of the challenges facing small-scale cattle fatteners in the study area (Figure 1) revealed high cost of feed emerged as the most challenge encountered (20.6%), closely followed by the high cost of feeder cattle (19.0%), jointly accounting for nearly 40% of all responses and underscoring the cost-intensive nature of the enterprise. Limited access to credit ranked third (15.2%), indicating persistent financial barriers that restrict enterprise expansion and adoption of improved practices, consistent with findings by Ja’afar-Furo *et al.* (2023) and Jibrin *et al.* (2022). Health-related challenges were also prominent, with disease outbreaks (12.1%) and poor veterinary services (10.5%) significantly affecting productivity and profitability, in line with Jibrin *et al.* (2022). Security concerns (8.7%), poor market access (7.4%), and inadequate extension services (6.5%) further reflect weak institutional and infrastructural support. Overall, the results suggest that despite its profitability, cattle fattening in the study area is constrained by high input costs, financial limitations, and insufficient support services, which threaten its sustainability unless adequately addressed.



**Figure 1:** Perceived Challenges facing Cattle Fattening in the Study Area

**Source:** Field Survey 2023

### CONCLUSION AND RECOMMENDATIONS

This study evaluated the profitability and efficiency of small-scale cattle fattening enterprises in Maiduguri Metropolis, Borno State. Results from the gross margin and net profit analyses confirm



that cattle fattening is economically viable, with positive returns per animal, a benefit–cost ratio exceeding unity, and a relatively high return on investment. However, profitability is strongly conditioned by the cost structure, particularly the high costs of feeder cattle and feed, which constitute the largest share of production expenses. The stochastic profit frontier analysis further revealed that profit inefficiency significantly explains variations in gross margins, indicating considerable scope for improving resource use and managerial efficiency. Key factors enhancing profitability included education, experience, access to credit, herd size, extension contact, and cooperative membership, while older age was associated with higher inefficiency. Despite its profitability, the enterprise is constrained by high input costs, limited access to credit, animal health challenges, insecurity, and weak institutional support. The study therefore concludes that although cattle fattening remains a viable enterprise in Maiduguri Metropolis, strengthening support services and reducing production constraints are essential for improving efficiency, profitability, and long-term sustainability.

## REFERENCES

- Ahmed, F. F., & Abah, P. O. (2014). Determinants of food security among low-income households in Maiduguri Metropolis of Borno State, Nigeria. *Asian Journal of social sciences and humanities*, **3**(1): 4 – 86.
- Aminu, F., Mohammed, H., & Onwughara, S. (2022) Profit efficiency assessment of goat marketers in Lagos state, Nigeria. *DISCOVERY*, **58**(4): 1439-1446.
- Aondoakaa, E., Aiyedogbon, J. O. & Oniore, J. (2025). Impact of Financial Inclusion on Livestock Production in Nigeria: 1986 – 2024. *International Journal of Humanities Social Science and Management*. **5**(3): 628-640.
- Avila, E., Del Rosario, M. C. R., Maleniza, J., Mora, N., Ogarte, N., Rodriguez, J., & Velasco, C. R. (2025). Enhancing Farmer Engagement in Cooperatives: Implications of Awareness and Interest. *GPH-International Journal of Business Management*, **8**(1); 37 – 68. <https://doi.org/10.5281/zenodo.14617242>
- Brito, M., Correia, V., de Deus, C. & Gomes, M. (2024) Analysis on the Impact of Cattle Fattening Technology on Farmer Households in Atabae Timor-Leste. *Agricultural Sciences*, **15**; 399 – 407. doi: 10.4236/as.2024.154023.
- Bukar, M. M. (2016). Effects of insurgency on traditional cattle feedlot management in Maiduguri, Nigeria. *Journal of Management and Science*, **6**(1): 27 – 33. DOI:10.26524/jms.2016.4
- Chiaka, J. C., Zhen, L., Yunfeng, H., Xiao, Y., Muhirwa, F. & Lang, T. (2022). Smallholder Farmers Contribution to Food Production in Nigeria. *Frontiers in Nutrition*. **9**: 916678. <https://doi.org/10.3389/fnut.2022.916678>
- Ghide, A. A., Mohammed, S. T., Umar, A. S., & Ibrahim, A. (2025). Hedonic Price Analysis of Beef Cattle Attributes in Maiduguri, Borno State, Nigeria. *Asian Journal of Agricultural Extension, Economics & Sociology*, **43**(7): 127-136. DOI: <https://doi.org/10.9734/ajaees/2025/v43i72796>
- Gona, A., Mohammed, I. & Baba, K. M. (2017). Evaluation of profitability among cattle fattening enterprises in Kebbi State, Nigeria. Conference Proceedings of The 18th Annual National Conference of the Nigeria Association of the Nigerian Agricultural Economists Held at Federal University of Agriculture, Abeokuta, Nigeria 16<sup>th</sup> – 19<sup>th</sup> October, 2017. 304 – 296. [https://ageconsearch.umn.edu/record/288343/files/NAAE\\_2017\\_041.pdf](https://ageconsearch.umn.edu/record/288343/files/NAAE_2017_041.pdf)
- Ibrahim, U. S., Tahir, A. D., Yusif, M. & Ahmed, S. S. (2024). Costs and return analysis for short period small scale cattle fattening in Kano State Nigeria. *Nigerian Journal of Animal Production*, **6**: 1259 – 1262. <https://doi.org/10.51791/njap.vi.6355>
- Ja'afar-Furo, M. R., Hamid, M. Y., Gabdo, B. H., & Thlaffa, Y. A. (2023). Evaluation of Profitability and Resource-use Efficiency in Cattle Fattening Enterprise in Nigeria: Evidence from Adamawa State. *Adamawa State University Journal of Agricultural Sciences*, **11**(4): 234-245.
- Jibrin, S. A., Ali, I. M., Baba, B. A. & T. M. Oladele, T. M. (2022). Profitability of Cattle Fattening Enterprise in Maiduguri, Borno State, Nigeria. *American Journal of Agricultural Science, Engineering, and Technology (AJASET)*, **7**(2): 60 – 63, DOI: <https://doi.org/10.54536/ajaset.v7i2.1042>



- Jibrin, S. A., Ali, I. M., Baba, B. A., & Oladele, T. M. (2023). Profitability of Cattle Fattening Enterprise in Maiduguri, Borno State, Nigeria. *Am. J. Agric. Sci. Eng. Technol*, **7**: 60-63. DOI: <https://doi.org/10.54536/ajaset.v7i2.1042>
- Jimoh, S. O., Baruwa, O. I., & Kolapo, A. (2023). Analysis of profit efficiency of smallholder beef cattle farms in South-West Nigeria. *Cogent Economics & Finance*, **11**(1): 67-74. <https://doi.org/10.1080/23322039.2023.2181786>
- Karim, R., Islam, M. N., Uddin, M. M. & Hossain, M. M. (2020). Livelihood improvement of farmers through cattle fattening of Mymensingh District: A socio-economic study. *Journal of Agriculture, Food and Environment (JAFE)*. <http://doi.org/10.47440/JAFE.2020.1301>
- Kibona, C. A., Kironyi, L., & Zhang, Y. (2023). Profit Efficiency and its Determinants among Traditional Beef Cattle Farmers in the Meatu District of Simiyu Region, Tanzania. *Asian Journal of Agricultural Extension, Economics & Sociology*, **41**(10): 525-548. DOI: 10.9734/ajaees/2023/v41i102198
- Mapiye, O., & Dzama, K. (2024). Strengthening research-extension-farmer-input linkage system for sustainable smallholder livestock farming in Africa: progress and prospects. *Tropical animal health and production*, **56**(8): 363. <https://doi.org/10.1007/s11250-024-04210-9>
- Milikias, M., & Gebre, M. (2024). Beef cattle fattening practices, marketing systems and challenges: The case of Bench Sheko and Sheka Zones of southwest Ethiopia. *Heliyon*, **10**(9), e29790. <https://doi.org/10.1016/j.heliyon.2024.e29790>
- Mukhtar, A., Abdulkarim, B. Z., & Ladan, T. A. (2021). Socio-economic benefits of livestock rearing in Maiduguri metropolis, Borno state, Nigeria. *IOSR J. Humanit. Soc. Sci*, **26**(1): 16 – 23.
- National Population Commission., (2015). Population Projections of Local Government Areas: NPC: Abuja.
- Ohiomah, S. S., Bossey, A. O. & Umoru, A. I. (2025). Agricultural sector output contribution to Economic Growth in Nigeria: An Examination of the Critical Nexus. *Journal of Human Resources and Management Science*. **7**(7): 43 – 58, DOI: <https://doi.org/10.70382/hujhrms.v7i7.007>
- Osadare, E., Salman, K. K., Dada, G. E., Okewumi, F. T., & Sowunmi, F.A. (2024). Determinants of Profit Efficiency among Cattle Producers in Oyo State, Nigeria. AGRODEP Working Paper Series No. 5. African Growth and Development Policy (AGRODEP) Modeling Consortium.
- Shettima, B. G., Mohammed, D., Lawan, U. & Ghide A. A. (2019). Livestock Fattening: A Source of Livelihood Diversification among Households in Adamawa State, Nigeria. *Nigerian Journal of Animal Science and Technology (NJUST)*, **2**(1): 54 – 62. Retrieved from <https://njast.com.ng/index.php/home/article/view/8>
- Tafida, I., Nazifi, B., Lawal, A. T., & Ahmed, A. I. (2023). Ram fattening under feedlot system profitability among smallholder fatteners in Kano Metropolis, Kano State, Nigeria. *Nigerian Journal of Animal Production*, **3**: 523 – 527.
- Uchenna, O. C., Onyeibo, O. C., & Chioma, J. L. (2018). Economics of cattle fattening in Adamawa State, Nigeria: New frontiers and critical challenges. *International Journal of Social Sciences and Economic Research*, **3**(11): 567-578.