



(RESEARCH ARTICLE)



## ECONOMIC ANALYSIS OF VALUE ADDITION AND MARKETING OF PROCESSED MEAT PRODUCTS IN TARABA STATE, NIGERIA

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### ABSTRACT

This study examined the economics of value addition and marketing of processed meat products in Taraba State, Nigeria. Specifically, the study identified the value-addition practices adopted by meat processors and marketers, assessed the profitability of different value-added meat products, and analysed the market concentration of processed meat products. A multi-stage sampling technique was employed to select 259 meat processors and marketers from 12 major markets in the study area. Primary data were collected and analysed using descriptive statistics, farm budgeting techniques, and the Herfindahl-Hirschman Index (HHI). The findings revealed that beef processors adopted more value-addition practices than chevon and mutton processors. Fresh meat cutting and dressing (93.44%) and suya production (82.63%) were the most common practices among beef processors, while suya was the dominant value-added product for chevon (52.51%) and mutton (39.38%). Frozen meat and *kilishi* production recorded relatively low adoption. Profitability analysis showed that all value-added meat products were economically viable, with positive net incomes, benefit-cost ratios greater than one, and positive returns per naira invested. *Kilishi* was the most profitable product across beef (NI = ₦3,812.74/kg; BCR = 1.56), chevon (NI = ₦4,334.36/kg; BCR = 1.58), and mutton (NI = ₦4,175.54/kg; BCR = 1.58), whereas fresh meat recorded the lowest returns. Market concentration analysis indicated that fresh meat operated in a competitive market (HHI < 0.15), while smoked meat, dried meat, suya, balangu, and tsire exhibited moderate concentration. *Kilishi* and frozen meat recorded the highest concentration levels (HHI = 0.220-0.244). The study concluded that value addition significantly enhances profitability and recommended investment in processing infrastructure, cold-chain facilities, technical capacity development, and affordable credit to promote the adoption of high-value meat products and improve the competitiveness of the meat value chain in Taraba State.

**Keywords:** Value Addition, Meat Processing, Profitability, Market Concentration, Herfindahl-Hirschman Index, Taraba State, Nigeria.

### 1 INTRODUCTION

Livestock production is a vital component of agricultural development and food systems worldwide, contributing substantially to food security, employment generation, household income, and national economic growth. Beyond supplying high-quality animal protein, the livestock sector provides raw materials for agro-industries and supports millions of livelihoods through production, processing, transportation, and marketing activities. Globally, increasing

population growth, urbanisation, rising household incomes, and changing consumer preferences have continued to drive the demand for livestock and livestock products, particularly processed meat products with improved quality, convenience, and longer shelf life (FAO, 2023).

In sub-Saharan Africa, livestock production plays a strategic role in poverty reduction and rural development by providing employment opportunities and serving as a source of income for farming households. Nigeria possesses the largest livestock market in sub-Saharan Africa, supported by its large human population and growing demand for animal protein (Rekwot et al., 2025). The livestock subsector has continued to make significant contributions to the nation's agricultural economy, with its share of Nigeria's Gross Domestic Product (GDP) increasing by 2.3 percent in the second quarter of 2023 compared with the corresponding period of the previous year (National Bureau of Statistics, 2023). This growth reflects the increasing importance of livestock production in meeting domestic food requirements and stimulating economic activities along the livestock value chain.

The growing demand for livestock products is influenced by several socio-economic factors, including rapid population growth, rising income levels, urbanisation, changing lifestyles, and evolving consumer preferences for processed and conveniently packaged animal products. The expansion of industrial-scale meat processing enterprises has further stimulated the development of downstream activities within the livestock sector. Consequently, meat processing has become an important component of livestock value chains because it enhances product quality, extends shelf life, improves food safety, and creates additional economic opportunities for producers, processors, marketers, and consumers (Kadju et al., 2020).

Value addition is widely recognised as one of the most effective strategies for improving agricultural profitability and enhancing competitiveness within agrifood systems. It refers to the transformation of a product from its original form into a product with greater economic value through processing, packaging, grading, branding, preservation, or other forms of product enhancement (Boland, 2009; Oni, 2013). Similarly, Popoola et al. (2015) described value addition as the transformation of raw agricultural commodities into products that possess higher utility and increased market value. Within the livestock sector, value addition enables producers and marketers to diversify products and increase returns by converting raw meat into products such as smoked meat, dried meat, *kilishi*, *suya*, *balangu*, *tsire*, and frozen meat, all of which command higher market prices because of their enhanced quality, convenience, and longer storage life.

Apart from increasing profitability, value addition contributes significantly to employment creation, enterprise development, income diversification, reduction of post-slaughter losses, and improved market access. The World Bank (2017) noted that investments in value addition encourage the establishment of processing enterprises, strengthen market linkages between producers and processors, and create opportunities for small-scale entrepreneurs to participate more effectively in agricultural value chains. Through efficient processing and marketing, livestock products can satisfy consumer preferences while generating higher returns for value chain actors.

Despite the enormous economic potential associated with meat value addition, many livestock producers and marketers in Nigeria continue to market animals or fresh meat with minimal processing, thereby limiting opportunities for increased income generation. This situation is largely attributed to inadequate processing facilities, limited technical knowledge, poor access to finance, weak market information systems, inadequate infrastructure, and insufficient investment in modern meat processing technologies. Consequently, producers and marketers are unable to fully exploit the economic benefits associated with value-added meat products, resulting in lower profitability and reduced competitiveness within the livestock sector (Odunuga et al., 2026).

Taraba State possesses one of the largest cattle populations in northeastern Nigeria and serves as an important source of livestock and meat products for neighbouring states and other parts of the country. Meat processing and marketing activities such as the production of fresh meat, smoked meat, dried meat, *kilishi*, *suya*, *balangu*, *tsire*, and frozen meat provide income and employment for numerous households across the state. However, despite the widespread practice of meat processing, empirical information on the profitability of different value-added meat products, the value addition practices employed by processors, and the level of market concentration among marketers remains limited. Furthermore, understanding the profitability and market structure of value-added meat enterprises is important for identifying products with greater investment potential and determining the competitiveness of meat markets. Economic indicators such as gross margin, net income, benefit-cost ratio, return per naira invested, and the Herfindahl-Hirschman Index provide valuable information for assessing enterprise performance and market concentration. It is against this background that this study examined the economics of value addition and marketing of processed meat products in Taraba State, Nigeria, with a view to identifying value addition practices, analysing the profitability of different processed meat products, and determining the level of market concentration among meat marketers.

## 2 METHODOLOGY

### 2.1 The Study Area

The study was conducted in Taraba State, North-Eastern Nigeria. According to the National Population Commission (NPC, 2006), the state had a population of 2,274,836, projected to have increased to approximately 3,425,402 in 2024 based on an annual growth rate of 2.3%. Taraba State lies between latitudes 6°30' and 8°30' North and longitudes 9° and 12° East, covering a land area of 54,426 km<sup>2</sup> (Daniel & Oruonye, 2011). It shares boundaries with Gombe and Bauchi States to the north, Adamawa State to the east, the Republic of Cameroon to the south, and Plateau, Nasarawa, and Benue States to the west (TADP, 2016). Administratively, the state comprises three political zones: the northern, central, and southern zones, encompassing sixteen Local Government Areas (Akeredolu & Ejembi, 2023). Taraba State is characterised by diverse climatic and ecological conditions that support crop and livestock production. Annual rainfall ranges from about 800 mm in the north to over 2,000 mm in the south, while the fertile soils support the cultivation of cereals, root crops, and other agricultural enterprises (Taraba State Government, 2018, cited in Kasari et al., 2024).

Taraba State is recognised as one of Nigeria's major livestock-producing states, with substantial populations of cattle, sheep, goats, pigs, and poultry distributed across the state, particularly in Jalingo, Ardo-Kola, Gassol, and parts of the Mambilla Plateau. Livestock production supported meat processing enterprises such as suya, kilishi, and balangu, which contributed to employment and household income. In addition, interventions such as the Livestock Productivity and Resilience Support (L-PRES) Project, rehabilitation of livestock markets and slaughter facilities, and the establishment of the Livestock Service Centre in Sunkani enhanced veterinary services, feed processing, and market infrastructure (Pulse Nigeria, 2024). These attributes justified the selection of Taraba State as the study area for analysing value addition and marketing of processed meat.

### 2.2 Sources of Data

The study relied on both primary and secondary sources of data. Primary data were collected directly from meat processors, marketers, and other actors along the meat value chain in Taraba State using a structured questionnaire.

### 2.3 Sampling Procedure and Sample Size

The study employed a multi-stage sampling technique to select respondents. In the first stage, three major markets with high meat processing and marketing activities were purposively selected from each of the four agricultural zones of Taraba State based on information obtained from market authorities and the Taraba State Ministry of Agriculture making total of 12 markets for the study. In the second stage, a sampling frame comprising meat processors and marketers in the selected markets was obtained from the recognisance survey using snowballing techniques in which a total of 736 meat processors and marketers was identified. The sample size of 259 respondents was determined using Yamane's (1967) formula at a 5% level of precision as shown below:

$$n = \frac{N}{1+N(e)^2} \text{-----} (1)$$

Where:

$n$ = Sample size

$N$ = Population size

$e$ = Level of precision (sampling error), usually 5% (0.05)

Substituting into the formula:

$$n = \frac{736}{1+736(0.05)^2}$$

$$n = \frac{736}{1+736(0.0025)}=259.15$$

$$n \approx 259$$

In the final stage, the sample size was proportionately allocated to the selected markets according to the number of meat processors and marketers in each market. Thereafter, simple random sampling was used to select the respondents for questionnaire administration. This sampling procedure ensured adequate representation of respondents and enhanced the reliability and generalisability of the study findings.

## 2.4 Methods of Data Analysis

Data collected were analyzed using descriptive statistics, Value addition model, Farm budgeting techniques and Herfindahl-Hirschman Index (HHI)

## 2.5 Value Addition Model

Value Added in marketing refers to the additional benefits or enhancements that a product provides to customers beyond its basic features. Following Bennett et al. (2019) cited in Rekwot et al. (2025) a value-added model was used to gain further insights on the value created by the actors in the beef cattle value chain and it is expressed as follows;

- $VA = TR - IC$  ----- (2)
- Where;
- VA = Value added (N)
- TR = Total revenue (unit price x quantity) (N)
- IC = Intermediate consumption (cost of raw materials used up in the value addition activity) (N)

## 2.6 Farm Budgeting Technique

The financial performance of meat processing and marketing enterprises was evaluated using Gross Margin (GM), Net Income (NI), and Profitability Index (PI). The formula is stated as:

- Gross Margin (GM):  $GM = TR - TVC$  ----- (3)
- Where;
- TR = Total Revenue,
- TVC = Total Variable Costs)
- Net Income (NI):  $NI = TR - TC$  ----- (4)
- Where;
- TC = Total Cost, i.e., Fixed Costs + Variable Costs)
- Profitability Index (PI):  $PI = TR \div TC$  ----- (5)
- Interpretation:
- $GM > 0$  indicates coverage of variable costs
- $NI > 0$  indicates profitability
- $PI > 1$  indicates a profitable enterprise;
- $PI < 1$  indicates losses

## 2.7 Herfindahl-Hirschman Index (HHI)

- The Herfindahl-Hirschman Index (HHI) will be used to measure market concentration:
- $HHI = \sum (S_i^2)$  ----- (6)
- Where  $S_i$  = market share of firm i as a proportion of total market, and n = number of firms)
- Interpretation:
- $HHI < 0.15$  =Low concentration (competitive market)
- $0.15 \leq HHI \leq 0.25$  =Moderate concentration
- $HHI > 0.25$  = High concentration (oligopolistic market)

# 3 RESULTS AND DISCUSSION

## 3.1 Value addition Practices in meat processing and Marketing in the Study area

Table 1 presents the various value addition practices undertaken by meat processors and marketers in the study area. The results revealed that respondents engaged in several forms of value addition, including fresh meat cutting and dressing, smoking, drying, *kilishi* production, *suya* production, *balangu* production, *tsire* production, and refrigeration/freezing. The findings showed that fresh meat cutting and dressing was the most common value addition practice for beef, with 242 respondents (93.44%) participating, followed by *suya* production (82.63%), smoking (75.29%), *balangu* production (72.97%), *tsire* production (67.95%), drying (66.80%), *kilishi* production (58.69%), and refrigeration/freezing (49.03%). The high participation in fresh meat cutting and dressing reflects the strong demand for freshly prepared beef and the relatively simple processing techniques involved, while the widespread production of *suya*, *balangu*, and smoked beef demonstrates consumers' preference for ready-to-eat and preserved meat products. This finding is consistent with FAO (2023), which reported that meat processors in developing countries predominantly engage in basic processing activities such as cutting, dressing, smoking, and drying because they require relatively low capital investment while meeting consumer demand.

For chevon (goat meat), suya production was the most common value addition practice (52.51%), followed by smoking (47.88%), fresh meat cutting and dressing (45.56%), *balangu* production (44.40%), *tsire* production (42.08%), drying (37.07%), refrigeration/freezing (23.55%), and *kilishi* production (15.83%). The higher participation in suya production suggests that goat meat is widely preferred for roasted products because of its unique flavour and consumer acceptability, whereas the low production of chevon *kilishi* may be attributed to the limited availability of suitable meat cuts and the specialised processing techniques required. Similarly, suya production ranked highest for mutton (39.38%), followed by smoking (35.14%), *balangu* production (33.98%), fresh meat cutting and dressing (33.59%), *tsire* production (30.50%), drying (28.57%), refrigeration/freezing (16.99%), and *kilishi* production (3.47%). The very low involvement in mutton *kilishi* production suggests limited consumer demand and lower suitability of sheep meat for this product.

Across the three meat types, beef recorded the highest level of value addition in almost all processing activities, which may be attributed to its greater market availability, stronger consumer demand, and wider suitability for products such as *kilishi*, suya, *balangu*, and *tsire*. Chevon recorded moderate participation across most activities, while mutton had the lowest participation. These variations may reflect differences in livestock availability, consumer preferences, processing characteristics, and market demand. A similar trend was reported by the International Livestock Research Institute (2022), which found that beef dominates value-added meat markets in sub-Saharan Africa because of its larger supply base and greater consumer acceptance.

The relatively low adoption of refrigeration/freezing, particularly for chevon (23.55%) and mutton (16.99%), suggests inadequate cold storage facilities, unreliable electricity supply, and the high cost of refrigeration equipment. Consequently, many processors rely on traditional preservation methods such as smoking and drying to extend shelf life and reduce spoilage. This finding agrees with FAO (2023), which identified inadequate cold chain infrastructure and erratic electricity supply as major constraints to meat preservation in many developing countries.

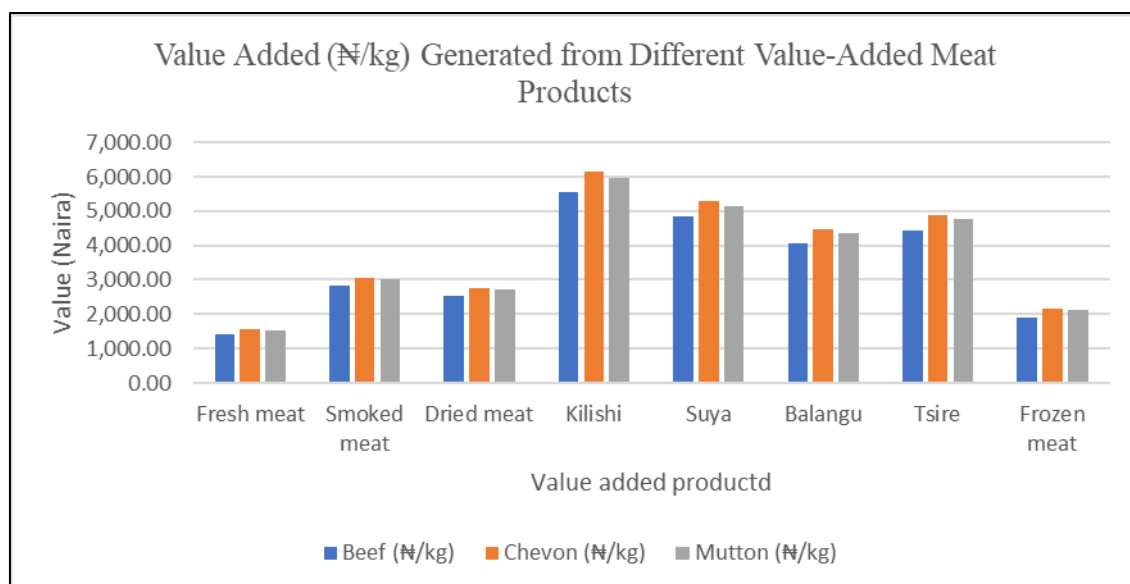
**Table 1: Value Addition Practices Involved in Meat Processing in The Study Area**

| Value Addition Practices        | Beef f (%)  | Chevon f (%) | Mutton f (%) |
|---------------------------------|-------------|--------------|--------------|
| Fresh meat cutting and dressing | 242 (93.44) | 118 (45.56)  | 87 (33.59)   |
| Smoking                         | 195 (75.29) | 124 (47.88)  | 91 (35.14)   |
| Drying                          | 173 (66.80) | 96 (37.07)   | 74 (28.57)   |
| Kilishi production              | 152 (58.69) | 41 (15.83)   | 9 (3.47)     |
| Suya production                 | 214 (82.63) | 136 (52.51)  | 102 (39.38)  |
| Balangu production              | 189 (72.97) | 115 (44.40)  | 88 (33.98)   |
| Tsire production                | 176 (67.95) | 109 (42.08)  | 79 (30.50)   |
| Refrigeration/Freezing          | 127 (49.03) | 61 (23.55)   | 44 (16.99)   |

Source: Field survey, 2026. NB: Multiple responses were allowed; therefore, frequencies and percentages exceed the sample size (n = 259), and column totals do not equal 100%.

### 3.2 Value additions in Processing and marketing of meat products

Figure 1 shows that the amount of value added generated from processed meat products varies considerably across product types and meat categories (beef, chevon, and mutton). *Kilishi* generated the highest value added, ranging from approximately ₦5,500/kg for beef, ₦6,100/kg for chevon, and ₦6,000/kg for mutton, making it the most profitable value-added product. This was followed by Suya, which generated about ₦4,800/kg for beef, ₦5,300/kg for chevon, and ₦5,100/kg for mutton, and *tsire*, with values ranging from approximately ₦4,400/kg to ₦4,900/kg. Balangu also recorded substantial value addition, ranging between ₦4,000/kg and ₦4,500/kg across the three meat types. In contrast, smoked meat and dried meat generated moderate value addition of about ₦2,800–₦3,000/kg and ₦2,500–₦2,700/kg, respectively, while frozen meat recorded relatively low values of about ₦1,900–₦2,100/kg. Fresh meat generated the least value added, ranging from approximately ₦1,400/kg for beef to ₦1,600/kg for chevon and mutton.



**Figure 1: Value added in N/kg of various meat products in the Study Area**

### 3.3 Profitability Analysis of Value Addition in Meat processing and Marketing

#### 3.3.1 Probability Analysis of value Addition in Beef processing and Marketing

Table 2 presents the profitability analysis of different value-added beef products marketed in the study area. The results revealed that all the value-added beef products were profitable, as indicated by positive gross margins, net incomes, benefit-cost ratios (BCRs), and returns per naira invested (RNI). This suggests that value addition in beef processing and marketing is a viable enterprise capable of generating income for processors and marketers. This finding is consistent with Odunuga et al. (2026), who reported that value addition in cattle and cattle products significantly improves profitability and income generation among processors and marketers in Ogun State, Nigeria. The purchase cost of raw beef was relatively similar across all products, ranging from ₦5,011.74/kg for dried meat to ₦5,026.31/kg for smoked meat, indicating that differences in profitability were largely driven by processing costs and selling prices rather than the cost of raw meat. Total variable costs accounted for the largest proportion of production costs, while fixed costs remained relatively low, implying that profitability was mainly influenced by operating expenses such as labour, fuel, spices, packaging, and transportation.

Among the products, *kilishi* was the most profitable, recording the highest gross margin (₦3,966.59/kg), net income (₦3,812.74/kg), benefit-cost ratio (1.56), and return per naira invested (0.56). This implies that every ₦1.00 invested in *kilishi* production generated ₦1.56 in revenue and ₦0.56 as net profit, reflecting its high market demand, premium selling price, longer shelf life, and greater value addition through processing. Similarly, Hemanth et al. (2024) noted that highly processed meat products generally command premium prices and higher profit margins because value addition enhances product quality, extends shelf life, and increases consumer acceptability. Similarly, *suya*, *tsire*, and *balangu* were highly profitable, with net incomes ranging from ₦2,778.87/kg to ₦3,381.02/kg and benefit-cost ratios of 1.44–1.52. Their strong performance suggests efficient resource utilization and high consumer demand for convenient, ready-to-eat meat products.

Smoked meat, dried meat, and frozen meat recorded moderate profitability, with net incomes ranging from ₦1,115.52/kg to ₦1,808.16/kg and benefit-cost ratios of 1.19–1.30. Although their returns were lower than those of highly processed products, they remained economically viable due to improved shelf life, reduced spoilage, and enhanced marketability. In contrast, fresh meat recorded the lowest profitability, with a gross margin of ₦925.81/kg, net income of ₦848.16/kg, benefit-cost ratio of 1.15, and return per naira invested of 0.15. Although profitable, its lower returns may be attributed to minimal processing, a shorter shelf life, and greater susceptibility to spoilage, which limit opportunities for higher value realization. The findings also support those of Atanda and Oparinde (2023), who observed that greater value addition increases the economic value of agricultural products by creating higher returns than the sale of minimally processed products, thereby improving enterprise profitability and livelihood outcomes.

**Table 2: Summary of Profitability Analysis of Value Addition in Processing and Marketing of Different Beef Products in the Study Area (₦/kg)**

| Value-added Product | Purchase Cost (PCM) | TVC      | TFC    | TC       | GM       | NI       | BCR  | RNI  |
|---------------------|---------------------|----------|--------|----------|----------|----------|------|------|
| Fresh meat          | 5,018.46            | 5,491.72 | 77.65  | 5,569.37 | 925.81   | 848.16   | 1.15 | 0.15 |
| Smoked meat         | 5,026.31            | 5,936.36 | 101.77 | 6,038.13 | 1,909.93 | 1,808.16 | 1.30 | 0.30 |
| Dried meat          | 5,011.74            | 5,815.56 | 96.00  | 5,911.56 | 1,719.25 | 1,623.25 | 1.27 | 0.27 |
| Kilishi             | 5,024.68            | 6,596.83 | 153.85 | 6,750.68 | 3,966.59 | 3,812.74 | 1.56 | 0.56 |
| Suya                | 5,017.82            | 6,338.16 | 128.47 | 6,466.63 | 3,509.49 | 3,381.02 | 1.52 | 0.52 |
| Balangu             | 5,015.94            | 6,165.69 | 120.18 | 6,285.87 | 2,899.05 | 2,778.87 | 1.44 | 0.44 |
| Tsire               | 5,022.13            | 6,255.28 | 125.91 | 6,381.19 | 3,207.58 | 3,081.67 | 1.48 | 0.48 |
| Frozen meat         | 5,019.57            | 5,707.71 | 111.25 | 5,818.96 | 1,226.77 | 1,115.52 | 1.19 | 0.19 |

**Key:** PCM = Purchase Cost of Raw Meat; TVC = Total Variable Cost; TFC = Total Fixed Cost; TC = Total Cost; GM = Gross Margin; NI = Net Income; BCR = Benefit–Cost Ratio; RNI = Return per Naira Invested.

### 3.3.2 Probability Analysis of value Addition in Chevon processing and Marketing

Table 3 presents the profitability analysis of value addition in the processing and marketing of different chevon (goat meat) products in the study area. The findings revealed that all the value-added chevon products were profitable, as indicated by positive gross margins, net incomes, benefit–cost ratios (BCRs), and returns per naira invested (RNI). This demonstrates that value addition in chevon processing and marketing is an economically viable enterprise capable of generating substantial returns for processors and marketers. This finding is consistent with Odunuga et al. (2026), who reported that value addition significantly enhances the profitability of cattle and livestock products in Nigeria by increasing product value and market returns.

**Table 3: Summary of Profitability Analysis of Value Addition in Processing and Marketing of Different Chevon (Goat Meat) Products in the Study Area (₦/kg)**

| Value-added Product | Purchase Cost (PCM) | TVC      | TFC    | TC       | GM       | NI       | BCR  | RNI  |
|---------------------|---------------------|----------|--------|----------|----------|----------|------|------|
| Fresh meat          | 5,683.24            | 6,184.92 | 81.99  | 6,266.91 | 1,060.76 | 978.77   | 1.16 | 0.16 |
| Smoked meat         | 5,691.58            | 6,654.73 | 106.83 | 6,761.56 | 2,079.79 | 1,972.96 | 1.29 | 0.29 |
| Dried meat          | 5,674.86            | 6,515.40 | 100.20 | 6,615.60 | 1,905.97 | 1,805.77 | 1.27 | 0.27 |
| Kilishi             | 5,688.42            | 7,329.31 | 160.86 | 7,490.17 | 4,495.22 | 4,334.36 | 1.58 | 0.58 |
| Suya                | 5,679.74            | 7,056.44 | 135.58 | 7,192.02 | 3,907.94 | 3,772.36 | 1.52 | 0.52 |
| Balangu             | 5,681.35            | 6,880.89 | 125.63 | 7,006.52 | 3,265.95 | 3,140.32 | 1.45 | 0.45 |
| Tsire               | 5,686.83            | 6,970.30 | 132.00 | 7,102.30 | 3,616.15 | 3,484.15 | 1.49 | 0.49 |
| Frozen meat         | 5,685.42            | 6,413.32 | 117.81 | 6,531.13 | 1,442.97 | 1,325.16 | 1.20 | 0.20 |

**Key:** PCM = Purchase Cost of Raw Meat; TVC = Total Variable Cost; TFC = Total Fixed Cost; TC = Total Cost; GM = Gross Margin; NI = Net Income; BCR = Benefit–Cost Ratio; RNI = Return per Naira Invested.

The purchase cost of raw goat meat was relatively similar across all products, ranging from ₦5,674.86/kg for dried meat to ₦5,691.58/kg for smoked meat, indicating that profitability was mainly influenced by processing costs and selling prices rather than the cost of raw meat. Total variable cost accounted for the largest proportion of production costs, while fixed costs remained relatively low, suggesting that labour, fuel, spices, packaging materials, and transportation were the major cost components. Among the value-added products, *kilishi* was the most profitable, recording the highest gross margin (₦4,495.22/kg), net income (₦4,334.36/kg), benefit–cost ratio (1.58), and return per naira invested (0.58). This indicates that every ₦1.00 invested in chevon *kilishi* production generated ₦1.58 in revenue and ₦0.58 as net profit, reflecting its premium market value, longer shelf life, and strong consumer demand.

Similarly, *suya*, *tsire*, and *balangu* generated substantial profits, with net incomes ranging from ₦3,140.32/kg to ₦3,772.36/kg and benefit-cost ratios of 1.45-1.52. Their high profitability suggests that value addition through roasting,

seasoning, and product differentiation enables marketers to obtain higher selling prices. Smoked meat, dried meat, and frozen meat recorded moderate profitability, with net incomes ranging from ₦1,325.16/kg to ₦1,972.96/kg and benefit-cost ratios between 1.20 and 1.29. Although their returns were lower than those of highly processed products, they remained economically viable because processing improves preservation, reduces spoilage, and enhances marketability. In contrast, fresh chevon recorded the lowest profitability, with a gross margin of ₦1,060.76/kg, net income of ₦978.77/kg, benefit-cost ratio of 1.16, and return per naira invested of 0.16. Although profitable, its lower returns may be attributed to minimal value addition, a shorter shelf life, and greater susceptibility to spoilage, which limit opportunities for increased income.

### 3.3.3 Probability Analysis of value Addition in Mutton processing and Marketing

Table 4 presents the profitability analysis of value addition in the processing and marketing of different mutton (sheep meat) products in the study area. The findings revealed that all the value-added mutton products were profitable, as evidenced by positive gross margins, net incomes, benefit-cost ratios (BCRs), and returns per naira invested (RNI). This indicates that value addition in mutton processing and marketing is a profitable enterprise capable of enhancing the income of processors and marketers. This finding agrees with Iliyasu et al. (2008), who reported that processed meat enterprises in Maiduguri, Borno State, were profitable, with *kilishi*, *tsire*, and *balangu* generating positive returns because value addition increased product value and consumer demand.

The purchase cost of raw mutton was relatively similar across all products, ranging from ₦5,407.35/kg for dried meat to ₦5,421.74/kg for smoked meat, indicating that profitability was mainly influenced by processing costs and the market value of finished products rather than the purchase price of raw meat. Total variable cost accounted for the largest proportion of production costs, while fixed costs remained relatively low, suggesting that labour, fuel, spices, packaging materials, and transportation were the major cost components.

Among the value-added products, *kilishi* was the most profitable, recording the highest gross margin (₦4,333.55/kg), net income (₦4,175.54/kg), benefit-cost ratio (1.58), and return per naira invested (0.58). This implies that every ₦1.00 invested in mutton *kilishi* production generated ₦1.58 in revenue and ₦0.58 as net profit, reflecting its premium selling price, longer shelf life, and strong consumer preference. Similarly, *suya*, *tsire*, and *balangu* generated high returns, with net incomes ranging from ₦3,050.78/kg to ₦3,646.15/kg and benefit-cost ratios of 1.45-1.53. Their profitability indicates efficient resource utilisation and consumers' willingness to pay for convenient, ready-to-eat meat products.

Smoked meat, dried meat, and frozen meat recorded moderate profitability, with net incomes ranging from ₦1,278.25/kg to ₦1,963.63/kg and benefit-cost ratios of 1.20-1.30. Although their returns were lower than those of highly processed products, they remained economically viable because processing improves preservation, reduces spoilage, and expands market opportunities. In contrast, fresh mutton recorded the lowest profitability, with a gross margin of ₦1,053.13/kg, net income of ₦973.73/kg, benefit-cost ratio of 1.16, and return per naira invested of 0.16. Although profitable, its lower returns may be attributed to minimal value addition, a shorter shelf life, and greater susceptibility to deterioration during storage and marketing.

**Table 4: Summary of Profitability Analysis of Value Addition in Processing and Marketing of Different Mutton (Sheep Meat) Products in the Study Area (₦/kg)**

| Value-added Product | Purchase Cost (PCM) | TVC      | TFC    | TC       | GM       | NI       | BCR  | RNI  |
|---------------------|---------------------|----------|--------|----------|----------|----------|------|------|
| Fresh meat          | 5,412.86            | 5,903.61 | 79.40  | 5,983.01 | 1,053.13 | 973.73   | 1.16 | 0.16 |
| Smoked meat         | 5,421.74            | 6,364.00 | 104.94 | 6,468.94 | 2,068.57 | 1,963.63 | 1.30 | 0.30 |
| Dried meat          | 5,407.35            | 6,234.31 | 98.03  | 6,332.34 | 1,904.61 | 1,806.58 | 1.29 | 0.29 |
| Kilishi             | 5,418.69            | 7,034.99 | 158.01 | 7,193.00 | 4,333.55 | 4,175.54 | 1.58 | 0.58 |
| Suya                | 5,410.82            | 6,764.13 | 132.40 | 6,896.53 | 3,778.55 | 3,646.15 | 1.53 | 0.53 |
| Balangu             | 5,414.57            | 6,594.88 | 122.65 | 6,717.53 | 3,173.43 | 3,050.78 | 1.45 | 0.45 |
| Tsire               | 5,419.28            | 6,684.64 | 129.36 | 6,814.00 | 3,499.83 | 3,370.47 | 1.49 | 0.49 |
| Frozen meat         | 5,416.35            | 6,128.24 | 115.37 | 6,243.61 | 1,393.62 | 1,278.25 | 1.20 | 0.20 |

**Key:** PCM = Purchase Cost of Raw Meat; TVC = Total Variable Cost; TFC = Total Fixed Cost; TC = Total Cost; GM = Gross Margin; NI = Net Income; BCR = Benefit-Cost Ratio; RNI = Return per Naira Invested.

### 3.3.4 Market Concentration in The Marketing of Value-Added Meat Products

Figure 1 presents the market concentration of value-added beef, chevon, and mutton products in Taraba State using the Herfindahl–Hirschman Index (HHI). The HHI values indicate varying degrees of market concentration across the processed meat products, reflecting differences in the level of competition among marketers. The figure shows that fresh meat recorded the lowest HHI values for beef (0.122), chevon (0.128), and mutton (0.124), indicating a low-concentration and highly competitive market where no individual marketer controls a substantial market share. This finding is consistent with Kassali et al. (2018), who reported that the retail beef market in Lafia Metropolis, Nasarawa State, exhibited low market concentration and a relatively competitive structure because many retailers participated in the market.

In contrast, smoked meat, dried meat, *suya*, *balangu*, and *tsire* recorded HHI values ranging from 0.146 to 0.226, indicating moderate market concentration. Although competition remains active, market shares are distributed among relatively fewer marketers. This may be attributed to the specialised skills, processing techniques, and equipment required for processing these products, which limit market entry and increase concentration. A similar observation was made by Eze et al. (2016), who found that although soybean marketing in Nigeria involved many market participants, concentration increased among wholesalers because processing, handling, and capital requirements limited the number of active traders.

Among the products, *kilishi* (0.220-0.235) and frozen meat (0.238-0.244) recorded the highest HHI values, although they remained below the threshold for highly concentrated markets. These relatively higher values suggest that fewer marketers control larger market shares, largely because of the substantial investment required for specialised processing facilities, cold storage, refrigeration equipment, reliable electricity supply, and transportation infrastructure. This finding also agrees with Adesipe (1987), who reported that cattle marketing in Zaria was characterised by imperfect competition because a relatively small proportion of traders controlled a large share of market sales, mainly due to high operating capital requirements that created barriers to market entry.

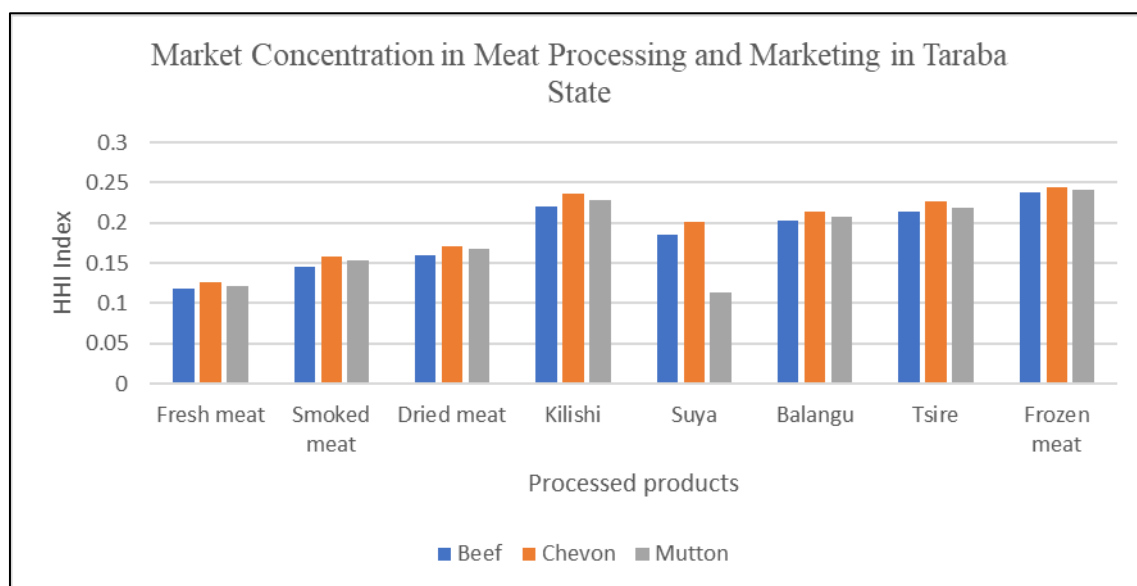


Figure 2: Market Concentration of Value-Added products in Processed Meat Marketing in Taraba State

## 4 CONCLUSION

The study concluded that value addition in meat processing and marketing is an economically viable enterprise in Taraba State, Nigeria. Beef processors adopted more value-addition practices than chevon and mutton processors, although the use of advanced processing techniques such as refrigeration, freezing, and *kilishi* production remained low. The profitability analysis revealed that all value-added meat products generated positive returns, with *kilishi* recording the highest net income and benefit-cost ratio across all meat types, while fresh meat yielded the lowest returns. The market concentration analysis further showed that fresh meat marketing was highly competitive, whereas processed products, particularly *kilishi* and frozen meat, exhibited moderate market concentration due to the greater investment and technical expertise required.

## Recommendations

Based on the findings of the study, the following recommendations are made:

- Government and development agencies should provide training and extension services to improve processors' skills in modern value-addition techniques, particularly the production of high-value products such as *kilishi*.
- Public and private sector investments should be directed towards improving electricity supply, cold-chain facilities, and modern meat processing infrastructure to reduce spoilage and enhance product quality.
- Financial institutions and government intervention programmes should provide affordable credit and equipment financing to enable processors and marketers to acquire modern processing and storage technologies.
- Meat processors and marketers should be encouraged to diversify into high-value meat products such as *kilishi*, *suya*, *tsire*, and *balangu* to improve profitability, expand market opportunities, and increase returns on investment.

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## STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

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### Disclosure of conflict of interest

The authors declare no conflict of interest

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