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# ANALYSIS OF PROFITABILITY ACROSS DIVERSE MAIZE VALUE-ADDED PRODUCTS IN MEZAM DIVISION, CAMEROON

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***Abstract:*** Maize value-added products are essential for reducing post-harvest losses, enhancing food security, and generating income. While extensive research has focused on maize production in Cameroon, the identification of its value-added products, their profitability and impact on food security in the North-West Region has been underexploited. This study analyzed the profitability of maize value-added products in Mezam Division, North-West Region of Cameroon. The specific objectives of the study were to: identify various maize products, assess the diversity of these products, conduct a cost-benefit analysis of selected products, and identify the key constraints to profitability. Data were collected from 500 small-scale maize entrepreneurs, with 446 involved in maize value addition, using purposive, stratified, and snowball sampling techniques. Descriptive statistics identified maize products and constraints, while the Shannon Diversity Index assessed product diversity. A cost-benefit analysis was performed on four selected products: pap, parched corn, corn chaff corn, and corn beer. The findings revealed a total of 13 maize value-added products with a diversity index of 4.4. The cost-benefit analysis showed that the total cost of processing a bucket of maize (18 kg) into pap, parched corn, corn chaff corn, or corn beer was FCFA 16,875.39, FCFA 17,699.7, FCFA 9,939.02, and FCFA 9,435.62, respectively. The corresponding economic profits were FCFA 10,944.61, FCFA 5,700.30, FCFA 2,524.27, and FCFA 2,133.46 respectively. The primary

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constraints to profitability included fluctuating market prices, high production costs, limited access to finance, and inadequate storage facilities. Entrepreneurs can leverage this data to make informed decisions about future investments, focusing on products like pap and parched corn that offer the highest return on investment. They can also experiment with optimizing the production of less profitable products like corn beer or corn chaff to improve their overall profitability

***Keywords:*** Maize, Value-added products, Cost-benefit analysis, Profitability.

## 1. INTRODUCTION

Maize value-added products play a crucial role in reducing post-harvest losses, enhancing food security, generating income, and promoting sustainable agricultural development (Alabi *et al.*, 2018, Abdulrahaman & Kolawole, 2008; Yadav & Supriya, 2014). Maize is known as the "Queen of Cereals" because of its versatility and high production potential (Saritha *et al.*, 2020). While its cultivation is widespread, the leading producers include the United States, China, and Brazil. The processing and consumption of maize vary significantly across countries, with maize flour and meal being among the most popular products. Its versatility of maize allows for the preparation of over 3,500 value-added products that are used daily (Yadav & Supriya, 2014). According to the World Bank (2006), from one ton of maize, it is possible to produce 29 kg of maize oil, 241 kg of 21% protein feed, 46 kg of 60% gluten meal, and substantial quantities of starch, sweeteners, or ethanol.

Globally, maize is primarily used in feed (64%), human food (16%), industrial starch, and beverages (19%), with a remarkable 83% of its output dedicated to the starch and feed industries. As demand for value-added foods and industrial applications increases, maize continues to be a pivotal cereal crop (Malhotra, 2017). In developed nations, maize serves diverse purposes, including livestock feed and biofuel production, while in many other countries, it is primarily used for human consumption (Ranum *et al.*, 2014). The utilization and processing of maize vary worldwide. For instance, in the U.S., maize is a key ingredient in glucose-fructose syrup production, whereas Brazil focuses on animal feed. The European Union heavily relies on maize for animal feed and biofuels, with expectations of increasing bioethanol usage. In China, maize is primarily used for animal feed and industrial purposes, while Mexico has experienced significant growth in industrial maize processing.

Japan predominantly imports maize for feed production, starch, ethyl alcohol, and distilled beverages (ALIC, 2015a; BFAP, 2015, FAS, 2015a; EC, 2014; Starch Europe, 2015a;). During processing, maize undergoes either wet or dry milling, depending on the desired end products. Wet milling produces glucose-fructose syrups, starch, oils, alcohols, and ethanol, while dry milling yields cereal flakes, maize flour, grits, meal, and brewer's grits for beer. Both milling methods generate valuable by-products, with distiller's dried grains with soluble (DDGs) being widely used as livestock feed (World Bank, 2006).

Maize is a vital dietary staple in regions of Africa, Asia, and Latin America, commonly consumed in various forms such as porridges, breads, and tortillas. In Africa, maize serves as a key starchy staple, featured in an array of products including porridges, pastes, grits, and beer. It constitutes 22 to 25 percent of starchy staple consumption across the continent, making it the largest single source of calories, followed closely by cassava. However, the importance of maize as a staple food varies significantly between regions. Southern Africa exhibits the highest maize consumption, at 85 kg per capita per year, compared to 27 kg in East Africa and 25 kg in West and Central Africa. Green maize, consumed fresh on the cob, is enjoyed in various forms; parched, baked, roasted, or boiled and plays a crucial role in alleviating hunger during the dry season (Oladejo *et al*., 2012). In Nigeria, maize is transformed into corn flour, pap, massa, boiled corn, and dry grains, sweet corn, flint corn, pod corn, popcorn, dent corn, field corn, corn meal, corn flakes, corn oil (Ater *et al*.,2018; Igbokwuwe *et al*., 2022). In South Africa, starch manufacturers convert over 600,000 tons of maize each year into starch and related products, alongside the production of animal feed (BFAP, 2015). While in Tanzania, maize is predominantly processed into corn flour (Wilson & Lewis, 2015).

Despite being recognized as a strategic commodity for enhancing food security and reducing poverty in Africa, many countries have not fully capitalized on the opportunities for adding value to maize products. This underutilization limits efforts to leverage maize as a significant driver of economic growth and improved livelihoods across the continent (Ba, 2017). The analysis of critical factors such as costs, pricing, market research, profit margins, return on investment, and operational efficiency is therefore essential for evaluating the profitability of maize value-added products which can spur many to take advantage of this gold mine. For instance, Ater *et al*. (2020) employed the

Value Addition model to study profitable maize processing value chains in Nigeria, while Afolami and Ogunwand, (2021) used descriptive statistics and regression analysis to affirm the profitability of maize farming in Ondo State. These studies consistently concluded that maize value addition is a viable and profitable enterprise, encouraging more entrepreneurs to engage in this sector.

In Cameroon, maize holds particular significance, especially as it is predominantly cultivated by small-scale subsistence farmers, who represent over 35% of the rural population (Shellie *et al.*, 2019,Tagne *et al.*, 2008; Epule & Bryant, 2015;). The cultivation of maize spans various regions, with the West and North-West regions serving as primary production hubs, closely followed by the Adamawa and North regions (Agristat, 2009). Among these, the North-West Region (NWR) is a major contributor, producing approximately 69% of the country's maize yield (McHugh & Kikafunda-Twine, 1995). Furthermore, maize plays a vital role in the local beverage industry in Cameroon, with traditional maize-based drinks such as 'sha,' 'kwasha,' and 'nkang' being widely consumed (Ndemah & Schulthess, 2002). It is equally enjoyed in several forms, including boiled whole grains, porridge, couscous, and a traditional cake known as komba (Wilfred *et al.*, 2018). In Bafia, maize is transformed into various products, including maize beer, flat maize cakes with vegetables or groundnuts, maize porridge, maize fufu, maize milk, roasted maize, and boiled maize, among others (Nguegwouo *et al.*, 2017).

Despite extensive research on maize production in Cameroon (Wenda *et al.*, 2020; Ngome & Balgah, 2013; Manu *et al.*, 2014; Kane *et al.*, 2018; Leslie *et al.*, 2023), there has been little or no assessment of the profitability of value-added maize products, nor significant emphasis on their importance to food security. This gap hinders understanding of how small maize Agripreneurs in the Mezam Division of the North West Region are capitalizing on value-added opportunities for income generation. Additionally, many individuals do not recognize the economic potential of diversifying maize products, primarily due to a lack of awareness about profitability, which has deterred potential investments. To address this gap, this paper aims to analyze the profitability of value-added maize products processed in Mezam. The specific objectives include identifying various value-added maize products and assessing their diversity, conducting a cost-benefit analysis of selected products, and identifying constraints affecting the profitability of maize value addition. The findings of

this research will provide valuable insights for small-scale entrepreneurs, assisting them in enhancing profit margins and creating employment opportunities, thereby contributing to poverty alleviation and the achievement of Sustainable Development Goals (SDGs) 1 and 2 related to ending poverty and hunger respectively. Furthermore, this study will serve as a guide for potential investors, especially small and medium-scale investors, enabling them to make informed decisions within the maize processing sector.

## 2. LITERATURE REVIEW

According to the 2002 United States Farm Bill, value addition to agricultural commodities involves transforming the physical state of the commodity through production techniques or handling methods. The main objective of value addition is to broaden the product's consumer base, enhance revenue from the sales of the derived products, and include processing or physically separating the commodity or product by the producer (USDA, 2013; US Congress, 2002). In the context of this study, with maize, value addition can take various forms, including the production of infant foods, health foods, snacks, savory products, baked goods, and more (Yadav & Supriya, 2013). In identifying various value-added products from maize, Ater *et al.* (2018) conducted a study in Taraba State, Nigeria, revealing that the primary maize processing activities included corn flour production (32.8%), massa (19.1%), akamu (18.1%), roasted corn (18.7%), maize grains (11.3%), and boiled maize (5.9%). Moreover, Saritha *et al.* (2020) highlighted the diverse value-added products derived from maize. These products include corn oil, favored for cooking due to its high smoke point, and its industrial applications in soap, paint, and insecticides. Additionally, corn syrup, primarily composed of glucose, emerges as another important maize-based food product. Other popular maize products include corn flakes and corn pops, which serve as nutritious snack options. Roasted corn also remains a common value-added product. Expanding on these uses, Sempebwa (2017) emphasized maize's versatility, noting its applications in food, drugs, cosmetics, and animal feed. In alignment with these findings, Alabi *et al.* (2018) identified 17 common maize value addition techniques utilized in Nigeria, with pap making, solid gel (eko) production, and local roasting being the most prevalent methods. Furthermore, Omoare *et al.* (2019) explored the entrepreneurial skills of rural

women engaged in maize value addition in Abeokuta, Ogun State, Nigeria. Using a snowball sampling method with 210 respondents, the study found that the primary value-added products included popcorn (85.7%), corn cake (80.0%), and 'kokoro' (52.9%).

In the context of profitability, Afolami and Ogunwand (2021) investigated the profitability of maize farmers in Ondo State, Nigeria, using a multi-stage sampling technique to collect primary data from 150 farmers. Their analysis incorporated descriptive statistics, regression analysis, and the gross margin method, revealing that maize farming is a lucrative business, with total revenue amounting to ₹1,087,786.00 and total profit of ₹403,406. Additionally, Igbokwuwe *et al*. (2023) investigated the profitability and value addition of maize (Zea mays L.) processing into various by-products in Imo State, demonstrating that mechanized processing yields higher profitability compared to manual methods. This emphasizes the importance of transitioning to mechanization for enhancing food security and improving living standards. Despite these promising insights, challenges such as inadequate credit and high transportation costs continue to hinder progress within the maize sector. In a related study, Utonga (2022) conducted a cross-sectional analysis of maize production profitability among smallholder farmers in Mbinga District, Tanzania. Using a multistage sampling method to select 120 farmers, the findings revealed a gross margin of 1,182,650.79 TZS per hectare, suggesting that maize farming is indeed a profitable venture in the region. Conversely, Basera (2015) studied the profitability of smallholder maize producers in Zimbabwe, focusing on factors affecting productivity. Data from 120 producers in the Mazowe district were collected through structured questionnaires and supplemented by secondary data from the Ministry of Agriculture. The analysis showed generally low maize profitability, with only the 2014/15 season achieving a Benefit-Cost Ratio (BCR) greater than 1, yielding US$2.14 for every dollar spent. High costs for fertilizers, chemicals, and transport hindered profitability, while the age of farmers and selling to private buyers had positive effects. Moreover, Eze *et al*. (2023) assessed the economic viability of value-added cashew products in Southeast Nigeria, focusing on cost-benefit analysis and return on investment. Their findings indicated that variable costs constituted over 96% of total costs, with benefit-cost ratios of 1:1.4 for cashew kernel and nut, suggesting positive returns. Still building on the concept of adding value to agricultural produce.

In Nigeria, Ogah *et al.* (2020) performed a gross margin analysis of cashew processing in Benue State, further affirming its profitability.

In Cameroon, Shillie *et al.* (2019) analyzed the profitability of maize production across different farming systems in Tubah subdivision. Using a purposive sampling technique, the study selected 80 farmers from four villages (Bambili, Bambui, Big Babanki, and Small Babanki) and collected primary data through questionnaires and interviews. The analysis identified two main farming systems: mono-cropping and multi-cropping. Results showed that the Net Farm Income (NFI) and profits per bucket for mono-cropping were FCFA 2,103,266 and 3,322, while for multi-cropping they were FCFA 6,707,250 and 5,174.4, respectively. Overall, maize production under both systems was deemed unprofitable, primarily due to challenges such as inadequate credit, limited access to improved seeds, insufficient fertilizer application, and high labor costs.

## 3. METHODOLOGY

### Description of Study Area

The Mezam Division, located in the North West Region of Cameroon, is one of seven administrative divisions with Bamenda as its center. Covering an area of 1,745 km², it lies between latitudes 5°20' and 6°15' N and longitudes 9°7' and 10°21' E (MINEPAT, 2009). According to the 2005 census, Mezam had a population of approximately 524,127, resulting in a density of 300.6 inhabitants per km² (Ngoe *et al.*, 2015). The division consists of seven subdivisions: Bafut, Bali, Bamenda 1, Bamenda 2, Bamenda 3, Santa, and Tubah. The region has a cool, temperate climate influenced by mountainous terrain, with average annual rainfall of about 2,400 mm and temperatures averaging 23°C (Olayiwola *et al.*, 2015). It experiences a wet season from March to October and a dry season from November to February. The area's climatic conditions and three main soil types volcanic, hydromorphic, and ferralitic are conducive to agriculture. Over 80% of the rural population relies on agriculture, which includes a significant livestock sector (INS, 2010). Key crops grown in Mezam include maize, rice, potatoes, beans, plantains, cocoyams, cassava, and yams. Maize is a key food crop, is grown by nearly every household in the region (Manu *et al.*, 2014).

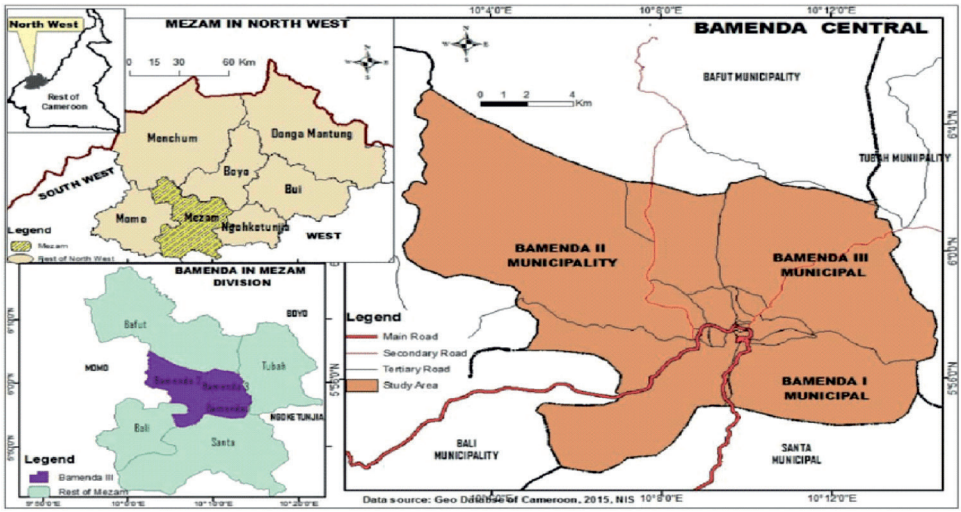


**Fig. 1: Map of Mezam in the North - West Region of Cameroon, showing the study area (Bamenda 1 , 2 and 3, Tubah and Santa Municipality)**

## Sampling and Sample Size Selection

We used three sampling techniques in this study. Firstly, purposive sampling was used to select Mezam Division from 58 divisions in Cameroon due to its high level of maize production (MINADER, 2016). Secondly, stratified random sampling was used to select 5 subdivisions (Bamenda 1, Bamenda 2, Bamenda 3, Tubah, and Santa) from seven subdivisions of Mezam division and two villages from the five selected subdivisions. Thirdly we used a snowball sampling to select 500 small maize entrepreneurs for the administration of a structured questionnaire since no specific register existed for maize entrepreneurs that were involved in the processing and commercialization of maize value-added products (Figure 1)

## Data Collection

Between November 2023 and February 2024, we distributed 500 questionnaires to gather data on maize value addition. Out of the respondents, 446 agreed that they were involved in maize processing (adding value to maize). We also asked about the different maize products they make along with the associated costs and revenues. Out of the 13 products, we focused on the four most common ones (pap, parched corn, corn beer and corn chaff) and studied the costs and benefits of producing these products. We concentrated on these four

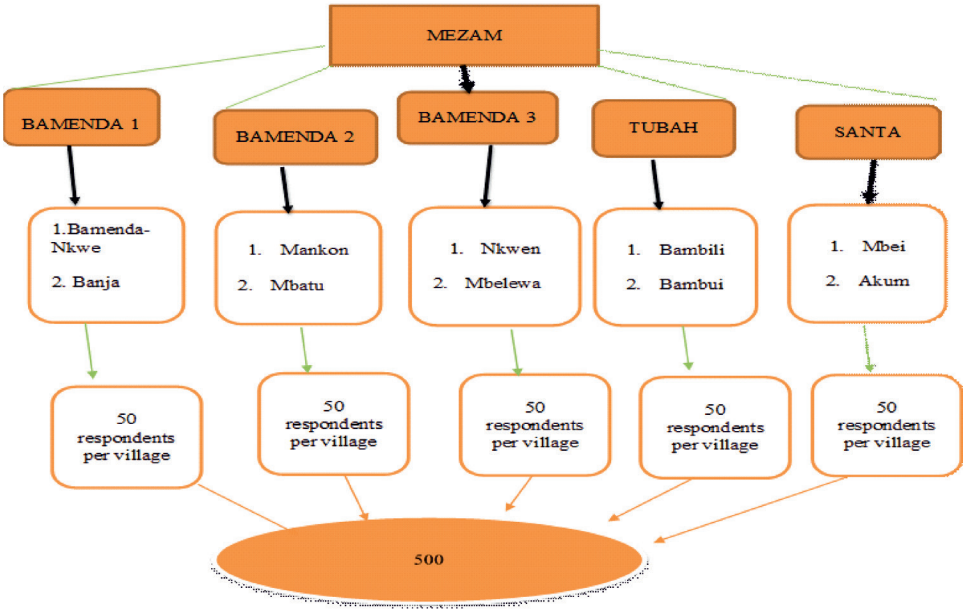


**Figure 2: Schematic Representation of the Sampling Procedure used in the Selection of Farmers for Questionnaire Administration**

because they represented 62.3% of the total value-added products selected, and respondents were more familiar with them, enabling more accurate estimations of costs and profits compared to the other products.

Furthermore, given the unknown population of small-scale maize processors, we calculated the necessary sample size for accurate proportion estimation using a 95% confidence level (Z = 1.96), a response rate of 50% (p = 0.5), and a confidence interval of ±5% (0.05), following Mensah (2014). The formula is:

$$n = (z^2\ (p)(1\text{-}p)) \div c^2$$

Where:

n = required sample size

z = standard normal deviation set at 95% confidence level

p = percentage picking a choice or response

c= margin of error

Thus, the Population involved in maize processing = $(1.96)^2 * 0.5(1\text{-}0.5)) \div (0.05^2) = 385$

We added 115 to the sample size to raised it to n=500. This was to ensure reliability, minimize potential biases, and give a better representative sample.

## Data Analysis

We coded the questionnaire, and the data were entered into Microsoft Excel 2019 for descriptive statistics. The data was then transferred to R studio version 3.5.1 for inferential statistics. We used descriptive statistics to identify different maize value-added products and the constraints affecting their profitability. We equally used Shannon-Weaver Diversity Index (*H*) to determine product diversity using the formula (*H*): $H=-\sum[(pi)\times\log(pi)]$ (Shannon and Weaver, 1949) where H = Shannon-Weaver Diversity Index, $Pi = ni/N$, *ni* = number of maize value-added products per respondents *i*, and *N* = total number of individuals. Thus, index is said to be good if it is ≥3.5 (Kent & Coker, 1992).

For cost-benefit analysis, we used the costs for processing 18kg of corn (as baseline) and the quantity of each of the four local products (pap, corn, corn beer, corn-chaff) resulting from the process.

Gross Margin was calculated using the formula: GM = TR–TVC (Olukosi and Erhabor, 2005) 1

where GM represents Gross Margin, TR is Total Revenue (Value Added Output multiplied by Price), and TVC is Total Variable Cost (including labor, processing/marketing, raw materials, and transportation)

Net Profit was determined using the formula: NP =TR–TVC–TFC ((Hoq *et al.*, 2012) 2

where NP is Net Profit and TFC refers to Total Fixed Cost, which includes rent and equipment

Economic Profit was calculated with the formula: EP = TR–TC 3

where TC is Total Cost (the sum of TVC, TFC, and Opportunity Cost), with Opportunity Cost (OP) encompassing the costs of forgone alternatives related to labor and equipment.

Gross Profit Margin (GPM) using: GPM = (Gross Profit ÷ Sales) ×100 (Munawir, 2001) 4

The Net Profit Margin was calculated as: Net Profit Margin = (Net Profit÷Net Sales) ×100 (Riyanto (1999) 5

The Economic Profit Margin (EPM) was calculated using: EPM = (Economic Profit÷Net Sales) × 100 6

We also determined the Rate of Return on Investment (ROR) with the formula: ROR =(TR–TC) ÷ (TC) × 100 7

Lastly, the Benefit-Cost Ratio (BCR) was calculated as: BCR =TR÷TC (Dreze and Stern, 1987; Gittinger, 1982) 8

## 4. RESULTS AND DISCUSSION

### Varieties of Maize Value-added Products in Mezam, NWR of Cameroon

We identified a total of 13 distinct maize value-added products from 446 small maize entrepreneurs (Table 1). Pap was the most abundant (18%) followed by corn beer (17%), parched corn (16%) and corn chaff (10.5%). These four products represented 62.3% of the total value-added products recorded while the remaining nine products represented 37.7% (Table 1).

**Table 1: Varieties of maize value-added products in Mezam, NWR Cameroon**

| *Product* | *Number* | *Percentage (%)* |
|---|---|---|
| Pap | 84 | 18.8 |
| Corn beer | 76 | 17 |
| Parched corn | 71 | 16.6 |
| Corn chaff | 47 | 10.5 |
| Boiled corn | 39 | 8.8 |
| Accra | 35 | 7.9 |
| Roast corn | 34 | 7.6 |
| Corn flour | 22 | 4.9 |
| Corn fufu | 19 | 4.3 |
| Pop corn | 10 | 2.2 |
| Feed | 6 | 1.4 |
| Starch | 2 | 0.4 |
| Corn pudding | 1 | 0.2 |
| Total | 446 | 100 |

### Diversity Index of Different Value-added Products in the Different Subdivisions

We calculated a Shannon-Weaver Diversity Index (H) of 4.4 for the Mezam division, with the diversity index for the various subdivisions ranging from 4.1 to 4.5 (see Table 2).

**Table 2: Diversity Index of Different Value-added Products in the Different Subdivisions**

| *Subdivision* | *Diversity index of value-added products* |
|---|---|
| Bamenda 1 | 4.5 |
| Bamenda 2 | 4.5 |
| Bamenda 3 | 4.5 |
| Tubah | 4.4 |
| Santa | 4.1 |
| Average | 4.4 |

## Profitability of Value-added Products

The total cost of processing 4 different maize products, each made from 18kg of maize was FCFA 83,631.5. Amongst the cost incurred, variable cost accounted for over 90% (78,137.82) of total cost while fixed cost represented less than 4% (3117.58) and opportunity cost less than 3% (2,376.21) of total cost. The total revenue generated from the sales of the four different maize products was FCFA 121,864.5, giving an economic profit of FCFA 38.233. Pap emerged as the most profitable product amongst these 4 maize products processed with a benefit cost ratio of 1.6 while corn beer was the least profitable with benefit cost ratio of 1.2 (Table 3b). The variable cost of pap (cooked, dried and wet) production was FCFA 43,172.68. The total revenue generated from the sales of pap was FCFA 74,432.2 resulting in a gross margin of FCFA 31,259.5. After deducting the fixed cost (FCFA 1,705.2), the net profit was estimated at FCFA 29,518.5, and the economic profit was estimated at FCFA 28,039.1 after deducting opportunity cost (FCFA 1479.41).

Furthermore, amongst these different varieties of pap, dry pap emerged as the most profitable with an economic profit of FCFA 10,944.61. Thus, from 18kg of maize grains, entrepreneurs incurred a total cost of FCFA16,875.39 to produce 13.91kg of pap valued at 2000frs per kg. The cost incurred included variable costs, which constituted 94.6% of the total cost, and fixed costs, which constituted 3.4% as well as opportunity cost which constituted 2% of the total cost. The variable costs included the cost of raw materials, water, grinding, drying, and marketing expenses, such as packaging materials,

labor costs, transportation costs, and other miscellaneous costs. The fixed costs included the cost of equipment maintenance and space, as well as the opportunity cost of labor and equipment. Additionally in terms of the rate of return (ROR), dry pap lead the pack with 64.9% showing that it is the most profitable.

Following pap, parched corn emerged as the second most profitable product processed from 18 kg of maize. From this amount, an average of 23.4 kg of parched corn is produced and sold at FCFA 1,000 per kg. The total production cost being FCFA 17,699.7, with variable costs accounting for 93.7% of this total. These variable costs included expenses for raw materials, groundnuts, firewood, labor, transportation, paper, marketing, and salt. Fixed costs, which made up 3.7%, involved equipment maintenance (such as frying pans, spoons, and basins) and rent. Opportunity costs included family labor and equipment use. Considering all these factors, the economic profit reached FCFA 5,700.3. The benefit-cost ratio was calculated at 1.3, and in terms of the rate of return (ROR), parched corn ranked just below pap with a ROR of 32.2%.

To process corn chaff from 18 kg of maize, a total cost of FCFA 9,939.02 was incurred, resulting in the production of 16.53 kg of corn chaff valued at FCFA 753.98 per kg, which generated a total revenue of FCFA 12,463.29. Entrepreneurs involved in this process achieved a gross profit of FCFA 3,147.37. However, after accounting for fixed and opportunity costs, the economic profit was reduced to FCFA 2,524.27, resulting in an economic margin of 0.24. The benefit-cost ratio was calculated at 1.3, indicating profitability, although not as high as that of pap and parched corn. Lastly, corn beer was identified as the least profitable value-added product. Approximately 45.8 kg of corn beer was produced from 18 kg of maize and sold at FCFA 252.6 per kg, yielding a total revenue of FCFA 11,569.08. The total costs, which included expenses for water, grinding, labor, equipment maintenance, and transportation, amounted to FCFA 9,435.62, giving an economic profit of FCFA 2,133.46. The economic margin for corn beer was 0.18, further confirming its status as the least profitable among the four products.

**Table 3a: Cost items for the maize value addition (corn chaff, parched corn, corn beer and pap)**

| *Cost Item* | *Corn Chaff* | *Parched Corn* | *Corn Beer* | *Pap* | | |
|---|---|---|---|---|---|---|
| | | | | *Cooked Pap* | *Dry Pap* | *Wet Pap* |
| Fixed Cost | | | | | | |
| Rent | 157.7 | 200 | 100 | 300 | 200 | 200 |
| Maintenance Equipment | 200 | 459.3 | 95.4 | 478.77 | 372.6 | 353.81 |
| Total Fixed Cost | 357.7 | 659.3 | 195.4 | 778.77 | 572.6 | 553.81 |
| Variable Cost | | | | | | |
| Raw Materials | 4,953.50 | 5,108.50 | 4,822.40 | 4,666.70 | 4,941.20 | 4,836.10 |
| Processing | 1,936.70 | 7,894.40 | 1,809.50 | 8,485.00 | 7,628.34 | 2,461.10 |
| Labor | 2,003.42 | 2,810.40 | 2,002.02 | 3,507.74 | 2,895.70 | 2,029 |
| Transportation | 422.3 | 775.5 | 426.5 | 641.9 | 498.6 | 581.3 |
| Total Variable Cost | 9,315.92 | 16,588.80 | 9,060.42 | 17,301.34 | 15,963.84 | 9,907.50 |
| Opportunity Cost | 265.4 | 451.6 | 179.8 | 792.66 | 338.95 | 347.8 |
| Total Cost | 9,939.02 | 17,699.70 | 9,435.62 | 18,872.77 | 16,875.39 | 10,809 |
| %TVC | 93.7% | 93.7% | 96% | 91.7% | 94.6% | 91.7% |
| %TFC | 3.6% | 3.7% | 2.1% | 4.1% | 3.4% | 5.1% |
| %OPC | 2.7% | 2.6% | 1,9% | 4.2% | 2% | 3.2% |

*Source:* Field survey

**Table 3b: Cost-benefit Analysis of Value-added Maize Products**

| *Cost Item* | *Corn Chaff* | *Parched Corn* | *Corn Beer* | *Pap* | | |
|---|---|---|---|---|---|---|
| | | | | *Cooked Pap* | *Dry Pap* | *Wet Pap* |
| Unit Price | 753.98 | 1000 | 252.6 | 583.33 | 2000 | 819.7 |
| Quantity sold | 16.53 | 23.4 | 45.8 | 51.03 | 13.91 | 20.55 |
| Total Revenue | 12,463.29 | 23400 | 11569.08 | 29767.33 | 27820 | 16844.84 |
| Gross Profit | 3,147.37 | 6,811.20 | 2,508.66 | 12465.99 | 11,856.16 | 6,937.34 |
| Net Profit | 2,789.67 | 6,151.90 | 2,313.26 | 11687.22 | 11,283.56 | 6547.7 |
| Economic Profit | 2,524.27 | 5,700.30 | 2,133.46 | 10894.56 | 10,944.61 | 6,036 |
| GPM | 0.25 | 0.29 | 0.22 | 0.42 | 0.43 | 0.41 |
| NPM | 0.22 | 0.26 | 0.20 | 0.39 | 0.41 | 0.39 |
| EPM | 0.20 | 0.24 | 0.18 | 0.37 | 0.39 | 0.36 |
| B/C Ratio | 1.3 | 1.3 | 1.2 | 1.6 | 1.6 | 1.6 |
| ROR | 25.4 | 32.2 | 22.6 | 57.7 | 64.9 | 55.8 |

*Source:* Field survey

## Constraints in the Profitability of Maize Value-Added Products

The profitability of maize value-added products in the North West region of Cameroon was affected by some challenges. Fluctuating market prices (n=126, 28.3%), high production costs (n=104, 23.3%), limited access to finance and credit (n=85, 19.1%) and poor storage facilities (n=78, 17.5%) were identified as the primary constraints impeding the profitability of maize value-added products. Other challenges included, insufficient machinery, frequent power failures, seasonal variations in production, and Lack of technical know-how, collectively accounting for 11.8% of the issues encountered.

**Table 4: Constraints in the Profitability of Maize Value-added Products**

| *Constraints in profitability* | *Frequency* | *percentage* | *Rank* |
|---|---|---|---|
| Fluctuating market prices | 126 | 28.3 | 1 |
| High production cost | 104 | 23.3 | 2 |
| Limited access to finance and credit | 85 | 19.1 | 3 |
| Poor storage facility | 78 | 17.5 | 4 |
| Frequent power failures | 16 | 3.6 | 6 |
| Insufficient machinery | 18 | 4.04 | 5 |
| seasonal variations in production | 10 | 2.24 | 7 |
| Lack of technical know how | 9 | 2.02 | 8 |
| | 446 | 100.0 | |

*Source:* Field survey

## DISCUSSION

The analysis of maize value-added products in the Mezam Division of Cameroon highlights four key products; pap, corn beer, parched corn, and corn chaff comprising 62.3% of the 13 identified products. This dominance reflects their role as traditional staples in local cooking practices, with consistent availability and cultural significance driving consumer demand. The simplicity in their production also fosters local engagement. In contrast to just 13 local products identified, Abdulrahaman and Kolawole (2008) noted the versatility of maize in Nigeria, with around 28 food items and medicinal uses, while Saritha *et al.* (2020) identified additional products like corn oil and corn syrup, further emphasizing maize's diverse applications. The Shannon diversity index results indicate a high level of diversity in the Mezam Division, allowing consumers access to a wide range of maize value-added products. In every market across the subdivisions, three or more of such products are commonly found. This

finding aligns with Nguegwouo *et al*. (2017), who documented various value-added maize products in Cameroon, particularly in Bafia, including maize beer, vegetable-infused flat cakes, maize porridge, maize fufu, maize milk, and roasted and boiled maize. This highlights the extensive diversity in maize value addition throughout the country.

The findings reveal that variable costs account for over 90% of the total costs associated with maize processing in Mezam, while fixed and opportunity costs represent less than 7%. This indicates that processors, particularly those transforming maize into cooked pap, primarily rely on traditional methods and lack modern processing equipment. As a result, they face challenges in accessing credit since they do not possess valuable assets for collateral. This finding aligns with Eze *et al*. (2022), who reported that variable costs also account for over 90% of the resources used for adding value to cashew products in the South-East zone of Nigeria. In contrast, Shillie *et al*. (2020) reported high production costs and low revenue in maize produced in Tubah Sub-division, leading to losses in both multi-cropping and mono-cropping systems. Also, the figures for gross profit, net profit, and economic profit indicate that value addition to maize provides substantial financial rewards, demonstrating the economic viability of the maize value addition enterprise. This finding aligns with Utonga (2022), who analyzed the profitability of maize production among smallholder farmers in various localities within the Mbinga District of Tanzania, concluding that maize production is indeed profitable for these farmers. Similarly, Igbokwuwe *et al*. (2022) found that processing maize is not only profitable but also integral to the value-added concept. Furthermore, Ater *et al*. (2020) conducted an analysis of maize value addition among entrepreneurs in Taraba State, concluding that this enterprise is profitable and encourages entrepreneurial involvement.

The study found that all value-added products have benefit-cost ratios (BCR) exceeding 1, indicating positive net income for processors. This contrasts with Basera (2015), who noted that maize enterprises in Zimbabwe are not particularly profitable with overall BCR <1. The rate of return (ROR) for maize products was significant, with returns for pap above 50%, supporting the FAO's observation that small-scale entrepreneurs prefer ventures with returns above 30% (FAO, 2008). Furthermore, Corn pap emerged as the most profitable product due to its high profit margins, making it a compelling

investment choice followed by parched corn and corn beer being the least, suggesting it is less economically attractive. This observation is consistent with Omoare *et al.* (2019), who noted that different value-added products yield varying profitability levels, necessitating careful consideration by entrepreneurs regarding resource allocation.

Fluctuating market prices emerged as a significant challenge for maize entrepreneurs, creating uncertainty in revenue streams and complicating long-term planning. A substantial portion of respondents in the Mezam region report being affected by this volatility, indicating a systemic issue within the maize market. This finding agrees with research by Ozor *et al.* (2018), which identified similar problems in Southeast Nigeria. Additionally, many respondents cited high production costs as a critical barrier to profitability, placing economic pressure on small-scale farmers who struggle to cover these expenses. This also aligns with Ater *et al.* (2020), who highlighted high input costs and significant loading and unloading expenses as constraints on maize value addition in Taraba State, Nigeria.

## 5. CONCLUSION

This study highlights that maize value addition is profitable and represents a significant source of income for small-scale entrepreneurs in the Mezam Division of the North-West Region of Cameroon. The identification of 13 products with high diversity suggests that there are various avenues for income generation, particularly through pap, parched corn, and corn chaff, which are among the most profitable with pap leading as the most economically viable product. However, the profitability of these products is constrained by challenges such as fluctuating market prices, high production costs, limited access to finance and poor storage facilities.

The dominance of variable costs in the total cost structure highlights the importance of managing inputs like raw materials, labor, and transportation to maximize profits. With minimal fixed and opportunity costs, entrepreneurs have room to scale operations without significantly increasing overheads. Furthermore, having low fixed costs and being mindful of opportunity costs can be beneficial for the maize value addition business by providing financial stability, flexibility, and a more informed approach to decision-making and resource allocation. Thus, strategic focus should be placed on high-return

products such as pap and parched corn, while exploring ways to improve the profitability of less profitable products like corn chaff and corn beer.

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