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Comparative economic analysis of groundnut oil and soya milk production in the Tamale Metropolis of the Northern Region of Ghana

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Abstract

This paper examined a comparative economic analysis of groundnut oil and soya milk production in the Tamale Metropolis of the Northern Region. Purposive sampling, Stratified random sampling and Snowball were the techniques used for data collection. The data collected was subjected to descriptive analysis with the use of pie charts, bar charts and frequency distribution tables with a sample size of 70 respondents for groundnut oil processors and soya milk producers. The study revealed that a groundnut processor requires an average investment cost of GH¢ 487.74 whiles a soya milk producer may incur an estimated cost of GH¢ 423.2, with a weekly cost of GH¢ 350.57 and GH¢ 88.8 for groundnut and soya milk processing respectively. Estimated average total revenue of GH¢ 401.1 per week was recorded for groundnut oil as against GH¢ 109 per week for Soya milk. The estimated weekly profits for groundnut oil production was GH¢ 50.5 per week and GH¢ 20.2 per week for soya milk production. The profitability analysis revealed a benefit cost ratio of 1.1 and 1.2 for groundnut oil and soya milk production respectively. This shows that even though both proved profitable, soya milk production was more profitable than groundnut oil production considering the cost drivers. The study recommends that processors/entrepreneurs should form groups or associations to access credit and inputs from financial institutions, government should assist financial institutions to lower interest rates for lending and repayments and preservatives and quality of the soy milk should be researched further.

Keywords: Comparative, Economic, Groundnut, Soya bean, Processors, Profitability, Cost, Tamale, Northern Region, Ghana

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1. Introduction

Processing of agricultural products is generally accepted as the efficient method of maintaining the shelf-life of produce and a significant means of reducing production cost resulting from post harvest losses. The importance of food processing industries (Micro and Macro) especially in Africa cannot therefore be over emphasized. That notwithstanding, the food processing industry of Ghana like other African countries is dominated by the informal sector comprising mainly of small and medium scale rural enterprises owned and operated by women who depend solely on indigenous technology (Aseidu, 1989). Groundnut and Soya beans are some of the agricultural produce that is processed into groundnut oil and soya milk respectively. Soya beans are grown primarily for meal, and oil is a secondary product. Soya milk can be made at home with traditional kitchen tools or with a soya milk machine. The coagulated protein from soya milk can be made into tofu just as dairy milk can be made into cheese. During processing, the soya beans are cracked to remove the hull and then rolled into full-fat flakes. The rolling process disrupts the oil cells, facilitating solvent extraction of the oil. After the oil has been extracted, the solvent is removed, and the flakes are dried, creating defatted soya flakes. While most of the defatted soya flakes are further processed into soya bean meal for animal feeding, the flakes can be ground to produce soya flour, sized to produce soya grits or TVP for food uses.

Groundnut (*Arachis hypogea*) is a major crop widely grown in all the tropical and sub-tropical regions of the world for direct use as food, for oil and for high protein meal produced after oil extraction (Omioulem and Sinha, 1991). At present about 40% of the crop is processed into oil, which has a multitude of domestic and industrial application. It may be use for cooking, for margarines and vegetable ghee, for sweeten in pastries and bread, for pharmaceutical and cosmetic product, as a lubricant and emulsion for insecticides, and as a fuel for diesel engine (Duke, 1981). Soya beans (*Glycine Max*) is belief to have originated from China. The crop is widely spread to East and South Asia, America, Africa and Middle East. It is believed that the soya bean was introduced into Ghana in 1910 (Piper and Morse, 1923). The world production of soya bean amounts to 100,839,000 tones with the United States producing about 60% of the total production.

Small scale agro-processing plays a vital role in ensuring food security by reducing food losses; improve access to food; increase food availability and the range of food produced and making food safe to eat. African women perform 90% of the processing and marketing of the continent's staple food (Galeen, 1994). As an aspect of agro-processing is a dynamic and fast growing sector and therefore has the potential to provide opportunities for income generation and employment. This is particularly important; as agriculture and the formal sector are unable to absorb growing labor force in LDCs. Research has shown that in Thailand SMEs generates 50% of the employment and are estimated to create 6% of the GDP and also accounted for 50% of the exports in manufacturing services in 1996. Food processing can play an important role in providing variety to the diet with spicy or strong flavored produce like pickles and sauces since most people around the world often live on very monotonous diets based on local starchy staples. Agro-processing can contribute to improved food indirectly through generating income to purchase a more varied and nutritious diet and directly through producing a range of food products that contribute to nutritious diet.

Northern Ghana is faced with poverty, high illiteracy rate and general under development (GSS, 2008). These problems have eaten into the core of the elderly and middle aged, particularly women. This state of affairs has drawn most NGO's into the region to help salvage the situation by formulating and introducing practical strategies that actively involve women and processors. These NGO's have been organizing these women in groups to support their income generating activities. These women are involved mainly in agro processing such as shea butter extraction, groundnut oil extraction, soya bean processing, rice processing, gari processing etc. There are other many untapped economic opportunities in the agro processing sector in the Northern Region.

The objectives of this paper was to analyze the relative contributions of the various cost components to total cost in groundnut oil extraction and soya milk production, determine the processing cost functions for groundnut oil and soya milk production, find out the average cost of investment in groundnut oil and soya milk production, determine the sources of funding for both enterprises, determine the relative profitability of groundnut oil and soya milk production and identify the problems associated with groundnut oil and soya milk production.

2. Materials and methods

The study was conducted in Tamale, the administrative capital of the Northern Region. Tamale is located east of longitude 1^{o} and between latitude 8^{o}N and 11^{o}. Tamale has uni-modal rainfall pattern with a mean annual rainfall of 1,100mm over 95 rainy days which begin later April to early May. The elevation is believed to be 180m above sea level with a wind speed less than 10km/h. (Ghana Districts.com). The indigenes are Dagombas and have Dagbanli as their language.

The Tamale Metropolis has a population of about 371,351 (GSS, 2010). Being the administrative capital of the region and an urban centre, there are several other ethnic groups and languages in the Metropolis. The occupations of the inhabitants include civil service, farming and petty trading. Agro-processing has also become a major occupation for the landless semi literate women within the Metropolis. The dominant vegetation is woody savannah. Some of the common tree species are Dawadawa, Neem, Ebony trees and Shea trees. The soil is generally silt-sand which lies on a more or less deep laterite layer.

Primary data was gathered by the use of questionnaires that was administered in the study area with a sample size of 70 with groundnut and soya bean processors being the sample units. Purposive sampling was used in deriving the study area and the sample size for the study due to the cluster nature of the processors within the Tamale Metropolis. Quantitative data such as quantities of oil and milk produced, cost of inputs, revenue from production were collected. Qualitative data including sex, educational background, marital status and years of experience were also collected. Regression analysis was done to determine the influence of certain variables such as the quantity of raw material used per week, labor input per week and years of experience on quantities produced per week for both groundnut oil and soya milk with the cost functions for the study being:

$C = f(Q)$

$C = b_0 + b_1Q + b_2Q^2 + b_3Q^3$ .... (1)

C = total cost of production

Q = total output

The production functions for study:

$\ln Q = b_0 + b_1\ln X_1 + b_2\ln X_2 + b_3\ln X_3 + b_4\ln X_4 + U$……………………………….. (2)

Q = Quantity produced per week (oil and milk)

bs = coefficients.

X_1 = Quantity of raw material processed per week

X_2 = Years of experience

X_3 = Labor input per week

X_4 = Fuel wood used per week

U_I = Stochastic term

Figure 1. The Study Area

The profitability of groundnut oil and soya milk production was estimated using Benefit- Cost ratio (B/C). The total cost of production was estimated as the sum of total fixed cost and total variable cost of production. I.e. TC = TFC + TVC. Profitability was measured using Benefit-Cost ratio was used to estimate the profitability of groundnut oil and soya milk production as follows:

$$\sum B / \sum C = \frac{\text{Sum of benefit}}{\text{Sum of cost}}$$

where:

ΣB = Summation of benefits (total revenue)

ΣC = Summation of cost of processing

3. Results and discussions

The contribution of various cost components thus firewood, raw materials, labour, sugar, transportation, milling, rubber and others in soya bean and groundnut oil production shows that raw material contributes the highest (82.4 %) to variable cost where as sugar is the highest contributor (36.6 %) to variable cost of production for soya milk. This shows that the price of raw material greatly affects the profits of groundnut oil producers and also the price of sugar greatly affects the profits of soya milk producers in the study area as seen in Table 1 below.

Table 1. Contributions of the Various Cost Components and the Average Variable Cost of Production per week

	Soya Milk	Relative contribution of cost component	Groundnut oil	Relative contribution of cost component
Variable elements	Cost(GH¢)	Percentage%	Cost(GH¢)	Percentage%
Raw material	17.1	19.4	288.8	82.4
Fuel wood	8.0	9.0	17.8	5.1
Labour	10.0	11.3	13.2	3.8
Sugar	32.3	36.6	0.0	0.0
Transport	5.2	6.0	15.0	4.3
Milling	4.4	5.0	12.3	3.5
Rubber	7.2	8.2	0.0	0.00
Others	4.0	4.5	3.2	0.9
Total	88.2	100.0	350.3	100.0

Source: (Field Survey, 2011)

These clearly indicate that the variable cost component of the production process for both ground nut and soya bean is the main cost driver of the processing.

Revenues from the study shows ground nut was far more better because respondents could sell both the oil and powder but soymilk processors could only sell the milk. Hence per week, the groundnut processor could make GH¢ 401.1 to three times higher than soya milk of the same cost investment with a weekly revenue of GH¢ 109.0.

Cost Benefit Analysis of the findings indicates the two livelihood options are profitable but that of soya milk processing is a little profitable than groundnut oil as seen below with 1.1 and 1.2 respectively. This confirms Gittinger, (1982) studies that a B/C ratio of more than 1 means a venture is profitable; B/C ratio of 1 means break even and less than 1 means not profitable.

$$\sum B / \sum C = \frac{\text{Sum of benefit}}{\text{Sum of cost}}$$

where:

ΣB = Summation of benefits (total revenue)

ΣC = Summation of cost of processing the average input.

1. Groundnut oil

$\Sigma B/\Sigma C = 401.1/350.3 = 1.1$

2. Soya milk

$\Sigma B/\Sigma C = 109/ 88.2 = 1.2$

Regression analysis of the cost and production function reveals that for the cost function of $C = b_0 + b_1Q_1 + b_2 Q^2 + b_3Q^3$, shows R^2 of 0.6448 means that the independent variables (Q, Q^2, Q^3) explains 64.5% of the dependent variable (total cost) and thus a good fit Gujarat.

$$\mathbf{C} = 1.567045 + 2.598469Q - 0.0083082Q^2 + 8.07e\text{-}06Q^3$$
$$(0.58492) \quad (0.00245) \quad (0.000003)$$

Table 2. Regression Results (Cost Function)

Cost (C)	Coefficient	Standard Error	t	P>|t|	R^2	Adjusted R^2	F
Q	2.598469	0.58492	4.44	0.000	0.6448	0.6105	18.76
Q^2	-0.0083082	0.00245	-3.41	0.002			
Q^3	8.07e-06	0.000003	3.30	0.002			
_ Cons	1.567045	31.97712	0.05	0.961			

Source: (Field Survey, 2011)

If one produces at Q^2 it means that 1% increase in cost will lead to 0.008308% fall in output (diminishing returns sets in at Q^2). The others (Q, Q^3) are positively related to cost, that is when cost increases they will also increase by their corresponding coefficients in percentage terms. The independent variables are all significant at 5% significant level. Hence the cost function is: $C = 1.567045 + 2.598469Q - 0.0083082Q^2 + 8.07e\text{-}06Q^3$ which is a cubic function.

Production Function for the study:

$Q=b_0X_1^{b1}X_2^{b2}X_3^{b3}X_4^{b4}X_5^{b5}X_6^{b6}$

$LnQ = b_0 + b_1 lnX_1 + b_2 lnX_2 + b_3 lnX_3 + b_4 ln X_4$

From the regression results presented in Table 3 below, the R^2 of 0.7519 means that the independent variables (inputs) explains 75.2% of the dependent variable (output) and thus a good fit Gujarati (2004). The inputs are quantity of groundnut processed (X_1), years of experience (X_2), labor (X_3) and fuel wood (X_4). The standard error of the beta's and the t- values show that X_1, X_2 and X_4 are significant contributors to output whiles X_3 is not significant at 5% significant level.

Table 3. Regression Result for Groundnut Oil (Production Function)

Output (Q)	Coefficient	Standard Error	t	P>|t|	R^2	Adjusted R^2	F
X_1	0.22278	0.09834	2.27	0.031	0.7519	0.7189	22.73
X_2	1.11464	0.16810	6.63	0.000			
X_3	0.06963	0.08157	0.85	0.400			
X_4	0.55014	0.13225	4.16	0.000			
_ Cons	0.02137	0.24133	0.09	0.930			

Source: (Field Survey, 2011)

$$lnQ = 0.02137 + 0.22278lnX_1 + 1.11464lnX_2 + 0.06963lnX_3 + 0.55014lnX_4$$
$$(0.09834) \quad (0.16810) \quad (0.08157) \quad (0.13225)$$

All the independent variables are directly related to dependent variable (output). This means that 1% increase in any one of them will lead to a corresponding increase in output by their respective coefficients in percentage terms. The P>|t| values indicates that years of experience (X_2) and fuel wood (X_4) contribute more to output followed quantity of groundnut used (X_1), and labour (X_3).

Table 4 below shows the results of the regression run to find out the cost function for soya milk production. The R^2 of 0.3118 means that the independent variable (Q) explains 31% of the dependent variable (total cost) and thus not a good fit. Very low R^2 is possible especially with cross sectional data Gujarat (2004).

Table 4. Regression Result for Soya Milk (Cost Function)

Cost	Coefficient	Standard Error	t	P>|t|	R^2	Adjusted R^2
Q	0.0075	0.0019	3.87	0.000	0.3118	0.2910
_cons	15.5800	1.3243	11.77	0.000		

Source: (Field Survey, 2011)

C=15.58002 + 0. 0075Q

All the permutations were made; C = f (Q, Q^2, Q^3), C = f (Q, Q^2,), C = f (Q, Q^3), C = f (Q) but none come out significant at 5% significant level except C = f (Q) which made the equation a linear one as seen in Table 4.

The production regression results presented in Table 5 below shows an R^2 of 0.8796 which means that the independent variables (inputs) explains 87.9% of the dependent variable (output) and thus a good fit as espoused by Gujarati, (2004). The inputs are quantity of soya beans processed (X_1), years of experience (X_2), labour (X_3) and fuel wood (X_4).

The standard error of the beta's and the t-values show that X_1 is significant at 5% significant level whiles X_2, X_3 and X_4 are not significant.

Table 5. Regression Result for Soya Milk (Production Function)

Output (Q)	Coefficient	Standard Error	t	P>|t|	R^2	Adjusted R^2	F
X_1	0.00062	0.0001	12.39	0.000	0.8796	0.8635	54.77
X_2	0.03902	0.0820	0.48	0.638			
X_3	-0.09855	0.1282	-0.77	0.448			
X_4	0.20113	0.1306	1.54	0.134			
_ Cons	2.25264	0.0658	34.22	0.000			

Source: (Field Survey, 2011)

$\ln Q = 2.25264 + 0.00062\ln X_1 + 0.03902\ln X_2 - 0.09855\ln X_3 + 0.20113\ln X_4$

X_1, X_2 and X_4 are directly related to the dependent variables (outputs). This means that 1% increase in any one of them will lead to a corresponding increase in output by their respective coefficients in percentage terms. The P>|t| values indicates that quantity of soya beans used (X_1) contribute more to output followed by fuel wood (X_4), labour (X_3) and years of experience (X_2).

Respondents enumerated several challenges they faced in their chosen livelihood of groundnut oil processing and soya milk extraction. Lack of capital was the most pressing constraint for both enterprises with power failure being the next constraint faced by soya milk producers since it leads to spoilage of the milk. Stress and tiredness as a result of large quantities processed was also huge pressing problem for groundnut oil producers in Table 6. They suggested that accessing credit will help them hire labour for the production thus reduces their stress level and health burdens. Risk of buying low quality raw material was also faced by soya milk producers which affects the quantity and quality of milk produced. This goes in line with Liu et al. 1995 who categorized soya beans into food bean and oil bean. If the wrong bean is used it can affect production. High interest on loans and short repayment period was mentioned by entrepreneurs who receive micro credit as a set back to their businesses and as such will require lower interest in credit request for their productions.

Table 6. Problems Associated with Production

	GROUNDNUT		SOYA MILK	
Constraints	Frequency	Percentage	Frequency	Percentage
Lack/adequate capital	30	31.9	30	24.6
Power failure (light off)	1	1.1	25	20.5
Risk of buying low quality raw material	6	6.4	22	18.
Tiredness and stressfulness due to activities carried out	29	30.9	19	15.6
Poor grinding and inadequate grinding mills	10	10.6	16	13.1
High interest on loans and short repayment period	13	13.8	2	1.6
Scarcity and high prices at lean season	5	5.3	8	6.6
Total	94	100.0	122	100.0

Source: (Field Survey, 2011)

4. Conclusion

Results of the analysis showed that women form the greater percent of the food processing industry in Tamale. These MEs serve as the main source of employment for the poor women who have very little or no formal education and this support Aseidu (1989).

The results further revealed that credit is needed by women groups as a major source of capital for them to expand their enterprises. However, high interest on loans or very short period for repayment may push the fewer women who receive credit further down the poverty line. The profitability analysis conducted revealed that both enterprises are profitable, but soya milk production is more profitable than groundnut oil production. This calls for MFIs (Micro Finance Institutions) to expand their facilities to women in these micro enterprises who receive little or no credit especially those into soya milk production with suitable conditions for repayment. Raw material takes a huge chunk of the capital of groundnut oil producers whiles sugar takes a greater portion of the amount invested into soya milk production.

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