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Economic impact of cassava processing on farmer's income in Montserrado county, Liberia

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Abstract
The study was carried out to assess the economic impact of cassava processing on farmers income, the aim of the study were to examined the socio-economic characteristics of processors in the study area, determine the profitability level of processors, and analyzed the constraints to cassava processing and marketing. Data were collected with the aid of a questionnaire, face to face Interview were used as a medium to supplement the questionnaire in the case of illiterate respondents, and the study employed purposive sampling technique in selecting ninety eight 98 cassava farmers and processors for the study. Descriptive Analysis and Gross Margin Analysis (GMA) were used for data analysis through Excel and Statistical Packages for Social Sciences (SPSS). Gross Margin Analysis of the profitability to cassava processors revealed that value addition through cassava processing had a total Gross Margin of $3,250 as compare to non value addition at production level with a Gross Margin of $936.5. This indicates that value addition through cassava processing is more profitable in the study area. However, the constraints encountered by cassava processors during processing and marketing of products were; high cost of inputs, high transportation cost, inadequate storage facilities, poor road network, high perishability, poor product quality, use of crude implements, insufficient extension agents and fluctuation in product price. Against this backdrop the study recommends that government and non-governmental organizations should assist cassava farmers and processors with standardized processing facilities that will help in value addition to farmer's products and improve their income levels.

Keywords: cassava processing, farmers, gross margin analysis (GMA), constraints, Liberia

1. Introduction
Cassava (*Manihot esculenta* C*rantz*) is a root and tuber crop grown mostly in sub-Sahara Africa as a major source of food security and income generation for rural dwellers. A study conducted by Nwakor, (2012) [1] shows that cassava has contributed approximately 25% to farmer's income. Cassava is recognized as a major staple food crop and it plays an important role in food security and poverty alleviation (Achem *et al.*, 2013) [2]. According to Echebir (2008) [3] cassava possesses special attribute that render it appealing around the world, most especially to rural farmers in Liberia. It has gained popularity because of it grows under extreme weather conditions; it has low production resource requirements, biological efficiency in the production of food energy, availability throughout the year, its stability in different farming systems, resistance to pests and easily stored in the ground un-harvested until needed. Adeniji *et al*. (2011) [4], studies shows that these qualities contribute enormously to alleviating food crises in sub-Sahara Africa, because it succeeds under different climatic conditions and produces stable yields. In spite the fact that it possesses these attribute, fresh cassava tuber is extremely perishable lasting for 48% hours after harvest, it has a moisture content of 60-65%, starch 25%, fibre 2% protein 1% and other essential minerals, Adeniyi and Akande, (2015) [5]. Besides the tubers, the leaves are consumed extensively as vegetable. In Kehinde and Subuola (2015) [6], a recent study conducted shows that cassava has a unique role in agricultural development, particularly in sub-Saharan Africa. In Liberia, about 38% of the Gross Domestic Product (GDP) comes from agriculture of which cassava, rice and maize contribute 50% (MOFA, 2010) [7]. Approximately, 80% of the farmers in Liberia produce cassava which is a primary source of income generation and food security (RTIMP, 2006; IFAD, 2010) [8, 9]. In Liberia, cassava is the second most important staple food crop eaten domestically after rice, and it is also the major source of income for farmers in the study area. It is the cheapest source of carbohydrate used for human consumption, and as animal feed and it is grown by almost all agricultural farmers in the country (Onyemauwa, 2012) [10]. Cassava is produced annually for its energy, and starchy tuberous root. As cited in Nyerhovwo (2004) [11], cassava contributes to 70% of the daily calories intake of many rural farmers in Liberia as part of their meal; it is consumed at least once a day. The carbohydrates content present in cassava is 40% more than rice and 25% more than maize (NetGenCassava, 2013) [12].Cassava is essential not only as a sustainable crop, but also as a foreign exchange crop in generating cash for rural producers as compare to other staple crop contributing to alleviating poverty. Approximately, 500 million people in sub- Saharan Africa consume cassava tuber in processed form, because it contain cyanogenic glycoside which is toxic to both human and animals (Okogbenin *et al*., 2008) [13]. Consequently, value addition to cassava is essential, to reduce the bulkiness of fresh tuber, minimize post-harvest loses, increase shelf life, stabilize product prices and facilitate easy transportation from farm to local or urban markets.

Cassava processing in the study involves many complex activities including peeling, grating, fermentation, roasting, drying and packaging (Mcnulty and Adewale, 2015) [14]. These activities are carry out traditionally which is time consuming and it results in increased losses, inadequate storage facilities and low income due to lack of improve technology for farmers, particularly in study area (Akosua

and Bani, 2007) [15]. Cassava has gain potential in both the national and international market; it is due to the utilization of cassava products as food for human consumption, animal's feed and as raw materials for agro-industrial purposes such as; flour for bakery, ingredient for breweries and for bio-fuel production (Adekanye *et al.* 2013) [16]. In Ezedinma *et al*., (2007) [17], studies cassava production and processing faced many constraints, the production are left on the shoulders of poor farmers who cultivates not more than 1 hectare of land using unstandardized farming materials which makes the average yield insufficient to meet national or international demands. Furthermore, 80% of the farmers output is mainly for traditional-oriented markets and about 20% is processed into more durable products, and it is mostly consumed in processed forms (gari, chips, fufu, starch, and flour) (Iheke, 2008) [18]. Cassava processing is mainly traditional based, and it has been the major source of income and employment generation for rural farmers in the study area. In spite of their involvement into cassava processing activities, value addition is fronted as a viable option to alleviating the challenges encountered by farmers, because fresh cassava tubers are highly perishable. Furthermore, processed cassava products are important food staple in the study area, therefore, value addition through processing would create a stronger demand at all levels, increase income and create employments opportunities for farmers. Therefore, the study aimed at assessing the economic impact of cassava processing on farmers income in Montserrado County, Liberia. In order to achieve the main objective, the study therefore; examined the socio - economic characteristics of cassava farming processors, determine the average profitability level of cassava processing farmers, and also analyze cassava processing constraints to farming processors in the study area.

2. Methodology

2.1 Study Area

The study was carried out in Montserrado County, St. Paul River District, Liberia. It is located in north-western part of Liberia. It is bordered to the south by the Atlantic Ocean, west by Bomi County, north by Bong County, and east by Margibi County. The county has a total area of roughly 1,912.7 square kilometres, with an estimated population of 1,144.806 million inhabitants (Population Census 2008) [19]. The people are mostly farmers, traders and fishermen. Mixed farming is a common practice among the farmers. Montserrado County climate supports the growing of the following crops; cassava, rice, oil palm, rubber, cocoa, vegetables, maize, etc. This is because; the inhabitants are small holder farmers who major in cassava production and processing than any other County.

2.2 Data Collection Method

For the purpose of this research, and to achieve the intended objectives, primary data were collected through a well structured questionnaire. Interviews were scheduled as a medium to supplement the questionnaire in the case of illiterate respondents. Variables tested include; age, educational level, farming experience, household size, and income generated from cassava production and processing.

2.3 Sampling Technique

A Purposive Sampling technique was used in selecting (Montserrado) based on the farmer's participation in cassava processing in the study area, giving the total sample size of ninety eight (98) farmers involved in cassava production and processing of cassava products such as; gari, and fufu.

2.4 Data Analysis Methods

To achieve the earlier stated intended specific objectives, the following methods were employed to analyze the data:
Descriptive statistical package namely; frequency, and percentage were used in analyzing the Socio-economic characteristics of the respondents and the constraints limiting cassava processing and marketing in the study area.
Gross Margin Analysis was used to determine the profitability levels of cassava processors and non-processors in the study area. Gross Margin Analysis as described by (Farris and Bendle, 2012) [20] was computed as follow:

$$GM = TR - TVC$$

Where:
GM= Gross Margin
TR= Total Revenue (US$)
TVC= Total Variable Cost (US$)

Gross Margin is the profit index of both processors and non processors in the study area. According to (Farris and Bendle, 2012) [20], the higher the GM the more profitable a business will be and the lower the GM, the lesser the profit of the business.

3. Results and Discussions

3.1 Socio-economic Characteristics of Cassava Farmers

The analysis of the socio-economic characteristics of the respondents in Table.1 below reveals that (65.3%) of the respondents were females. It indicates that females are considering agriculture and cassava processing as a business. This fact allied with the work conducted by Ezedinma *et al*., (2007) [17]. From the analysis it also reveals that majority of the respondents (57.1%) were among the age range of 31-50 years, thus indicating that cassava processors and non processor in the study area are still strong and vigilant to increase their economic outputs. It was also observed that, 63.3% of the respondents were married, 25.5% single, while 11.2% were widowed, indicating that many of the farmers are certain to make use of family labour for their processing operations. The finding from the study also reveals that half of the total respondents 59.2% were not educated, 25.5% had secondary school education, and meanwhile, 14.3% had primary school education, does indicating that illiteracy could easily influence their response to new processing methods and innovation. Table.1 also reveals that majority of the respondents had a household size between 4-8 person, which indicates that the size of the family will definitely influence the amount of hired labour employed to increase processing output, 87.8% of the respondents are both cassava producers and processors, meanwhile, 64.3% of the respondent had 4-7 years of processing experience.

Table 1: Socio-economic Characteristics of Cassava processing Farmers

Variable	Frequency	Percentage (%)
Age (year)		
18-30	29	29.6
31-50	56	57.1
50 above	13	13.3
Total	98	100.0
Sex		
female	64	65.3
male	34	34.7
Total	98	100.0
Marital Status		
married	62	63.3
single	25	25.5
widow	11	11.2
divorced	0	0.0
Total	98	100.0
Level of Education		
informal	58	59.2
primary	14	14.3
secondary	25	25.5
university/college	1	1.0
Total	98	100.0
Household Size		
s/1-3	31	31.6
s/4-7	50	51.0
s/8 &above	17	17.3
Total	98	100.0
Profession		
C/production	12	12.2
C/production & processing	86	87.8
others	0	0.0
Total	98	100.0
Experience (year)		
p/2-3	21	21.4
p/4-6	14	14.3
p/7 & above	63	64.3
Total	98	100.0

***Source*:** Field Survey Data, 2019

3.2 Gross Margin Analysis of Cassava Production and Processing

3.2.1 Gross Margin Analysis for Cassava Production

The variables cost incurred for none value addition through cassava production includes; amortization of equipment, cultivation and farm layout, cassava cuttings, and labor. However, land was not valued because the farmers were the sole owners of the land. Table 2, below shows the cost incurred by farmers and the profit from producing cassava on one hectare of land in the study area. The Total Variable Cost (TVC) for cassava production per hectare was $704.71, the cost of cassava cutting was half of the total production cost $333 (47.3%), follow by the cost of cultivation and farm layout $200 (28.4%), while the average cost of amortization of equipment was $96.5 (13.7%), in addition the cost of labor was low $62.2 (8.8%) because most of the farmers were making maximum use of family labor rather than hired labor. From table 2, it also shows that the Total Revenue (TR) earned per hectare was $1,641.3; the Gross Margin (GM) was $936.5, while the gross margin percentage revenue was $ 57.1%, and this indicates that cassava production is profitable in the study area, because the Gross Margin were above 50% which implies that non processing farmers are gaining profit.

Table 2: Gross Margin Analysis for Cassava Production per Hectare (USD) (Exchange rate 1$USD=150 LRD)

Variables	Cost /ha in USD	Percentage
Amortization of equipment	96.5	13.7
Cultivation and Farm Layout	200	28.4
Cutting	333	47.3
Fertilizers	6.73	1.0
Herbicides	0.8	0.1
Pesticides	5.49	0.8
Labor	62.2	8.8
Total	704.71	100
Revenue per ha		
Average yield (12.5t/ ha)	12.5	
Average selling price/t	131.3	
Total Revenue	1641.3	
Gross Margin (TR-TC)	936.5	
Gross Margin % of Revenue	57.1	

***Source*:** Field Survey Data, 2019

3.2.2 Gross Margin Analysis of Cassava Processing

Table 3, reveals the cost incurred by farmers during cassava processing per hectare. The variable cost items comprised of; the purchase of fresh cassava tuber, peeling/washing, grating/milling, pressing/frying, labor and packaging for processing with (20%), (16%), (24%) and (12%)respectively constituting bulk of the processing cost. However, the Total Variable Cost (TVC) incurred during processing was $1,250. Also the Total Revenue (TR) incurred from cassava processing per hectare in the study area was $4,500 respectively. Furthermore, the table also reveals the Gross Margin Analysis (GMA) for the cost incurred from cassava processing by farmers in the study area was $3,250 from the sale of the two popular products (regular gari and odorless fufu); and the Gross Margin Percentage for value addition through cassava processing was 72%, which indicates that the project was profitable above 50%, this means that farmers invested less and yielded more profit, which shows that cassava processing is also a profitable adventure in the study area.

Table 3: Gross Margin Analysis for Cassava Processing per Hectare (USD)

(Exchange rate 1$ USD = 150) LRD		
Variables	**Frequency**	**Percentages**
Fresh tubers purchase	250	20
Peeling/washing	200	16
Grating/milling	300	24
Pressing /frying	150	12
Labour	150	12
Packaging	100	8
Other Miscellaneous	100	8
Total Variable Cost	1250	100
Revenue per ha		
Processed Products		
7.5t Regular gari@ sales 300 USD	2,250	
4.5t Odorless fufu@sales 500 USD	2,250	
Total Revenue	4,500	
Gross Margin (TR-TC)	3,250	
Gross Margin % of Revenue	72	
Source: Field Survey Data, 2019		

3.3 Distribution of Constraints Limiting Cassava Processing and Marketing

This section discusses the constraints limiting cassava

processing and marketing in the study area. The result from the findings reveals the constraints encountered by processors in Table 4, with their percentages and ranks; it shows that all the constraints were a severe problem to farmers. Some of the severe problems encountered by farmers include; high cost of processing inputs, high transportation cost, poor road network, fluctuation in price of processed product, inadequate storage facilities and poor access to information on new technique and innovation for cassava processing due to insufficient extension agents.

High cost of processing inputs and transportation cost rank 1st which were a major problem to farmers. Insufficient access to extension agent rank 2nd, Poor road network rank 3rd also a severe problem to farmers, use of crude implements rank 4th, also severe problem to cassava processing farmer, high perishability of cassava fresh tuber rank 5th and it is also a major problem, therefore, there is a need for cassava to be processed into more durable products for easy transportation, quality of the product rank 6th which could affect the price of the products, in addition, inadequate storage facility rank 7th while fluctuation in price of products rank 8th due to the instability of processed cassava products.

Table 4: Distribution of Constraints Militating Cassava Processing in the Study Area

Variables	Frequency	Percentage	Rank
High cost of inputs	98	100%	1st
High cost of Transportation	98	100%	1st
Insufficient extension agent	96	98%	2nd
Poor road network	95	97%	3rd
Use of crude implements	94	96%	4th
High perishability	92	94%	5th
Poor product quality	89	91%	6th
Inadequate storage facilities	90	92%	7th
Fluctuation in price	75	77%	8th

***Source*:** Field Survey Data, 2019

4. Conclusion and Recommendation

The study was carryout primarily to assess the economic impact of cassava processing on farmers income in Montserrado County. The finding reveals that value addition to cassava processing is still traditionally food-oriented and yet to reach national or international demand. It also reveals the cost incurred by farmers and the return from cassava production and processing in the study area and the difference in their Gross Margin, from the results it shows that non value addition through cassava production is profitable but most importantly value addition through cassava processing is more profitable with the Gross Margin of $9,179, this indicates that farmers invested less on cost, but got a higher gross margin from two popular processed products in the study area (regular gari and fufu).Even though, they are using traditional processing technique, yet they still earned some profit, which shows that cassava production has more potential which has not being utilized effectively. Constraints encountered by the farmers were all severe that would significantly influence processors income levels.

Therefore, in order for cassava processing to be more profitable as a business and for farmers income to be increased, the study makes the following recommendation and way forward based on the data gathered from the findings; adequate processing inputs are to be made available and at an affordable price in order for farmers to improve and increase their outputs and income levels, provision of good roads should be address for easy transportation of product from farm to market, farmers should be provided with sufficient extension agents to teach them new methods and innovation on how to increase their income through cassava processing. Farmers are also encouraged to invest into cassava processing and value addition, because of its profitability and economic returns.

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