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VALUE CHAIN ANALYSIS OF CASSAVA AND CASSAVA BYE PRODUCTS IN OGUN STATE NIGERIA: A TRANSLOG COST FUNCTION APPROACH

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ABSTRACT

In this article, value chain analysis of cassava and cassava bye product in Ogun state Nigeria: a translog cost function approach is examined. A Multistage sampling technique was used to select 180 cassava processors and marketers. Socio-economic and household data were obtained from respondents with the use of pre-tested questionnaires. Data were analysed using descriptive statistics, budgetary technique, Translog Cost Function and Student t-test. The study found that majority (84.3% and 52.8%) of processors of cassava peels and marketers were female. In addition, 60.2% of the processors and 51.4% of the marketers had secondary education respectively. The value chain activities carried out by processors were transportation, drying and packaging while marketers transported, packaged and store peels for future sales. The Translog Cost Function Approach revealed that for cassava peel quantity processing, coefficient of labour equation is positive and significant at 5%. The positive sign of the coefficient implies that the share of wage rate of labour increases with increase in the cassava peel processing in the study area. This has put cassava peel at vintage position in terms of labour use and other expenses along the cassava value chain when compared to the other cassava products. The study recommends considering the share of revenue generated from the cassava products and by-products, in terms of wage rate and prices of other inputs, larger share of the revenue should be direct to cassava peel in order to maximize profit generated from this product. Also, based on economies of scale, cassava processors and marketers should spread their total cost over a large amount of output so that they can realize the value addition from most the cassava by-product (cassava peel)

Keywords: cassava product, bye product, value chain, marketers, processors

INTRODUCTION

Nigeria is the largest producer of cassava in the world with over 34 million tons produced in 2007 (FAO 2010). However, most of what is produced is consumed locally, with over 50 percent of the harvested produce wasted due to production and post harvest inefficiencies Odoemenem *et al*. (2011). To them, if these inefficiencies are addressed alongside the current development of improved varieties of cassava coupled with an associated yield increase, Nigeria could take advantage of the increased national and international market opportunities around the globe. To Odedina et al (2009), the need to increase food production is always a priority in Africa. To feed the ever increasing urban population, food supply from every farm household has to increase by at least 63% in 10 years. Cassava is a food security crop (Elegbede *et. al* 2017) because of its ability to grow under a wide range of conditions, some of which are quite unsuitable for other crops. Cassava roots also constitute an important source of employment and income in rural (often in marginal) areas, and for women as these people process cassava roots into products like gari, lafun, fufu, etc, to sell in their local markets and communities. Cassava also serves as raw material for industrial use (FAO, 1999).Cassava peels are wastes generated as a result of removal of the two outer coverings of cassava roots prior to its subsequent processing to other cassava products like flour, “gari,” “fufu” etc.

Aro *et al*. (2008) and Tewe (1996) gave the proportion of peel in a whole tuber in a factory processed and hand processed cassava peels as 5 and 8%, respectively. Most of these peels are left to rot away with unwholesome consequences on the environment in spite of their great nutritional potentials especially for livestock feeding. Despite this role of cassava in the economy of Nigeria, there is need to increase the value addition mechanism by improving the quality of cassava products being produced in Nigeria, as well as the processing equipment for the country to benefit from the high demand of cassava products presently both at domestic and international levels. This is because the production of cassava products is mainly at household level, employing little or no mechanization, resulting in an inability to meet the quality and quantity demand of the industry and other users of the product. Prominent among other factors are; high post harvest losses and low export of cassava products, (Onwulalu, 2007). Furthermore, the transformation of cassava waste into various forms for food, feed, and industrial raw material has the potential to help developing countries improve food security, create additional value in rural settings, generate income and employment and develop a more favourable balance of trade. In addition, Oluwalana (2011) reported that there are opportunities to utilize agro-processing wastes such as cassava peels to generate wealth. The wealth so generated from waste can lead to reduction of poverty among the rural entrepreneur especially the women processing the herbal soap in particular. This concept is called the “waste to wealth” initiative to improve the economic and health status of the beneficiaries.

A value chain can be defined as the full range of activities which are required to bring a product or service from conception, through the different phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final customers, and final disposal after use. Value chain of cassava peels describes the full range of activities which are required to bring the peels from conception, through the different phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final consumers, and final disposal after use. Value chain activities of cassava peels begins with the processing activities which includes; collecting of peels, drying, blowing, sieving and packaging. The marketing activities includes; transportation, bagging, and putting the peels in storage for future sales. The objectives of this article are to

1. Describe the socio-economic characteristics of stakeholders involved in the value chains of cassava products and bye products.
2. Estimate the influence of variation in prices on input mix and costs of making various cassava products and bye products available in the markets.
3. Estimate the elasticity of factor demand for cassava products and by-product in the study.

METHODOLOGY

The Study Area

Ogun stateis located in the south – western Nigeria and was created in 1976 by the then Federal Military Government from the old western region. It is located within latitudes $3^{0}30$'N - $4^{0}30$'N and longitudes $6^{0}30$'E-$7^{0}30$E (Ogun State Annual Report, 2000). The state has a total of 20 Local Government Areas. The state is bounded in the west by the Republic of Benin, in the south by LagosState and the AlanticOcean, in the east by OndoState and in the North by OyoState. OgunState covers a land area of 16,762 square kilometres with a population of 3,728,098 (2006 population census). Based on geographical spread and administrative convenience, the Ogun State Agricultural Development Programme (OGADEP) divided the State into four zones namely: Abeokuta, Ijebu-Ode, Ikenne and Ilaro

Sample Size and Sampling Techniques.

Primary data was used for this study. The data was collected through structured questionnaire from the main actors of cassava product and bye product along the value chain such as cassava processors and marketers. A Multistage random sampling technique was used to select 180 cassava based processors and marketers in the study area. This involved four stages, the first stage, involved the purposive selection of two zones from the four zones of the Ogun State Agricultural Development project (OGADEP) namely Abeokuta and Ijebu zones (Elegbede, *et al*., 2018). This was done because of the predominance of cassava based farming and processing in these zones. In the second stage, six blocks were proportionately selected from the two zones; three blocks each from the 2 zones. Next, simple random sampling of two cells from each block with a total of twelve cells. Finally, a random selection of nine processors and six marketers from each cell resulting in a total of 180 respondents.

Methods of Data Analysis

The study data were analysed using descriptive statistics, budgetary and translog cost function analysis. Frequencies, percentages and mean were used to describe socio – economic variables such as age, sex, educational level and years of experience, in processing and marketing of cassava product and bye product. The gross margin analysis was used to determine the profitability of processing and marketing cassava products. The translog cost function analysis based on (Bamiro and Shittu, 2009) was used to estimate the influence of variation of prices of input mix and costs of making various cassava products and bye products in Ogun State Nigeria.

MODEL SPECIFICATION

For the purpose of analysing the influence of variation in prices of various factors of input mix and costs of making various cassava products and by products in the study area will be determined using the Translog Stochastic Cost Function Analysis. According to (Bamiro and Shittu, 2009) the Translog Cost function is implicitly and explicitly presented as:

$$\ln C = \ln f(P_i, Q_i, Z_i; \alpha_i) + (V_i + U_i) \text{--} 1$$

where

C = Total Cost associated with cassava product
Q_i = Vector of product
P_i = Vector of input prices
Z_i= Vector of fixed input and socio-economic characteristics
α_i= Vector of parameters to estimated
V_i = Random errors
μ_i = Cost inefficiency

$$\ln C = \alpha_0 + \sum_{h=1}^{3} \alpha_h \ln Q_h + \sum_{i=1}^{3} \alpha_i \ln P_i + \frac{1}{2}\sum_{i=1}^{3}\sum_{j=1}^{3} \alpha_{ij} \ln P_i \ln P_j + \frac{1}{2}\sum_{h=1}^{3}\sum_{m=1}^{3} \alpha_{hm} \ln Q_h \ln Q_m + \sum_{h=1}^{3}\sum_{i=1}^{3} \alpha_{hi} \ln Q_h \ln P_i$$
$$+ \sum_{k=1}^{3}\sum_{i=1}^{3} \alpha_{ki} Z_k \ln P_i + \sum_{k=1}^{3}\sum_{h=1}^{3} \alpha_{kh} Z_k \ln Q_h + (V_i + U_i) \qquad \dots\dots\dots\dots\dots..\dots (2)$$

where

C = Total cost of cassava product (/Processor)

Pi or Pj = Unit cost (price) of the ith or jth (i, j=1, 2,3) input, including P_1 cost of cassava tubers (₦), P_2 Cost of labour (man day), and P_3 unit cost of other intermediate inputs, including water, energy, maintenances expenses, transportation, etc.

Q_h or Q_m is the quantity of the hth or mth (h, m= 1, 2, 3) output, including Q_1 for quantity of gari/kg, Q_2 for quantity of Lafun /kg and Q_3 for quantity of fufu/kg produced.

Z_k = the kth fixed input and socio-economic characteristic associated with the cassava products, defined as follows:

Z_1 = Age of processors in years

Z_2 = Sex of the cassava processors, dummy 1 for male and 0 otherwise

Z_3 = Highest educational level attained (number)

Z_4 = Experience in years

Z_5 = Cost of fixed assets (₦)

α's= Parameters associated with various explanatory variables in the model, which are distinguished by use of subscripts associated with related variables. These include h and m relating to the hth or mth output(s), i and j relating to the ith or jth input price(s), and k relating to the kth socio-economic characteristic and fixed inputs.

V_i = the random error

μ_i = the cost inefficiency.

Neoclassical theory suggests the matrix of second-order terms implicit in Equation (4) are symmetric ($\alpha_{ij} = \alpha_{ji}$ and $\alpha_{hi} = \alpha_{ih}$; note that i and j as well as h and m are similar). In addition, the cost function is homogenous of degree one in input prices such that $\sum \alpha_i = 1$ and$\sum \alpha_{ji} = \alpha_{hi} = \alpha_{ih} = 0$. Note that homogeneity of degree one in input prices does not impose homogeneity of degree one on the underlying production function, and almost no other constraints will be imposed on elasticity of substitution or the factor demand derivable from the translog cost function in Equation (2) (Biswanger, 1974).

Logarithmic differentiation of the cost function and the use of Sherpard's lemma will yield the following cost share and revenue share equation.

$$S_i = \frac{\partial \ln C}{\partial \ln P_i} = \alpha_i + \sum_{j=1}^{3} \alpha_{ji} \ln P_j + \sum_{h=1}^{3} \alpha_{hi} \ln Q_h + \sum_{k=1}^{3} \alpha_{ki} Z_k;\ i = 1,2,3 \ldots\ldots (3)$$

$$R_h = \frac{\partial \ln C}{\partial \ln Q_h} = \alpha_h + \sum_{j=1}^{3} \alpha_{jh} \ln P_j + \sum_{h=1}^{3} \alpha_{mh} \ln Q_h + \sum_{k=1}^{3} \alpha_{kh} Z_k;\ i = 1,2,3 \ldots\ldots (4)$$

Where S_i (i= cost of cassava tuber, cost of labour and cost of intermediate inputs) and R_h (h= Gari, lafun and fufu) respectively, will be the share of production cost and income associated with the ith and hth output.

By imposing revenue share equations on the system, we will assume that in addition to cost minimization behaviour, the processors will be maximizing profits. Imposing homogeneity forces one of the input prices to be a numeraire price (Akridge & Hertel, 1986). Hence, unit costs (prices) of labour and other intermediate inputs (P_2–P_3) will be expressed in terms of the price of the cassava tuber (P_1), and the share equation for cassava tuber (S_1) will be dropped, this will yield the following system of estimating equations.

$$S_i = \frac{\partial \ln C}{\partial \ln P_i} = \alpha_i + \sum_{j=2}^{3} \alpha_{ji} \ln {}^{P_j}\!/_{P_1} + \sum_{h=1}^{3} \alpha_{hi} \ln Q_h + \sum_{k=1}^{3} \alpha_{ki} Z_k;\ i = 1,2,3 \ldots\ldots (5)$$

$$R_h = \frac{\partial \ln C}{\partial \ln Q_h} = \alpha_h + \sum_{j=2}^{3} \alpha_{jh} \ln {}^{P_j}\!/_{P_1} + \sum_{m=1}^{3} \alpha_{mh} \ln Q_h + \sum_{k=1}^{3} \alpha_{kh} Z_k; h = 1,2,3 \ldots\ldots (6)$$

Translog cost functions, such as in Equation (2), will be estimated directly or in its first derivatives (Biswanger, 1974). Joint estimation of the translog cost function with the cost/revenue share equations is also common, given that the indirect cost/revenue share approach does not provide estimate of the intercept term (α_0). An example of the latter approach is in Dalton *et al*. (1997). Despite this limitation, however, this study will chose the indirect approach because the intercept term (α_0) will not be required in this analysis of the value chain of cassava on cost behaviour as well as in estimating elasticities of factor demand and input substitutions. Parameters of the system of Equations (5) and (6) will be estimated jointly by the iterative seemingly unrelated regression (SUR) procedure in SHAZAM (Windows Professional edition), with the symmetry conditions implicit in the *α's* imposed during estimation. The constant output own-price and cross-price elasticities of factor demand will then be estimated, following Biswanger (1974) and Johnston (1985) as follows:

$$\eta_{ij} = \frac{\alpha_{ij} + S_i S_j}{S_i} \text{ for all i, j; i } \neq \text{ j} \ldots \ldots \ldots \ldots (7)$$

$$\eta_{ii} = \frac{\alpha_{ii} + S_i^{\,2} - S_i}{S_i} \text{ for all i} \ldots \ldots \ldots \ldots (8)$$

where

ηii = constant output own-price elasticity of demand for the ith factor.

ηij = constant output cross-price elasticity of demand for the ith factor due to changes in price of the jth factor.

αij = Parameter of the jth input price in the ith cost share equation.

αii = Parameter of the ith input price in its own cost share equation.

S_i and S_j are respectively the shares of the ith and jth input in the production cost.

Thus, elasticities of factor substitution that will be reported finally in the study will be the Morishima elasticities computed as follows:

$$\boldsymbol{\delta_{ij}}^{\boldsymbol{M}} = \frac{\alpha_{ij}+S_iS_j}{S_i} - \frac{\alpha_{jj}+S_j^{\,2}-S_j}{S_j} \; \boldsymbol{for\ all\ i\ and\ j} \ldots \ldots \ldots \ldots \ldots (\mathbf{9})$$

Where

$\boldsymbol{\delta}_{ij}^{M}$is the Morishima elasticity of substitution of factor i for j.

α_{ij}, α_{ii}, S_i and S_j are as earlier defined.

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RESULTS AND DISCUSSION

Socioeconomic Characteristics of the Sampled Respondents

The result of the socioeconomic characteristics of actors of cassava value chain actors considered in this study is presented on Table 1 below and it revealed that the mean age of the cassava value chain actors was 44 years and 38 years for processors and marketers respectively. Also 77.9 percent and 81.2 percent of processors and marketers are aged below 50 years. This implies that majority of the value chain actors are in their economically active age. In addition, 60.2% of the processors and 51.4% of the marketers respectively had secondary education. In terms of sex, the study revealed that 15.7 percent are male while 84.3 percent are female for processors of cassava while for marketers of cassava28.3 percent are male and 52.8 percent are female respectively. The result revealed that majority of the actors in cassava value chain in the study area are female and this may be due to the fact that women are predominant in processing and marketing of agricultural produce while the males are basically into food crop production. In terms of years of experience in the trade, majority of them were very knowledgeable. About 61.9 % of the respondents had at least 6 years of experience in the trade.

Table 1: Socio – Economic Characteristics of actors of cassava along the value chain

	Processors		Marketers		Pooled	
Variable	**Frequency**	**Percentage**	**Frequency**	**Percentage**	**Frequency**	**Percentage**
Age Group (Years)						
21-30	21	19.4	22	30.6	23	12.8
31-40	30	27.8	23	31.9	53	29.4
41-50	29	30.7	14	18.7	43	23.9
51-60	17	15.7	5	6.9	22	12.2
>60	11	10.2	0	0.0	11	6.1
Total	108	100.0	72	100.0	180	100.0
Mean		44		38		
Sex						
Male	17	15.7	34	28.3	51	28.3
Female	91	84.3	34	52.8	129	71.7
Total	108	100.0	72	100.0	180	100.0
Educational Level						
No Formal Education	6	5.6	4	5.6	10	5.6
Primary	37	34.3	31	43.1	68	37.8
Secondary	65	60.2	37	51.4	102	56.7
Experience(years)						
≤ 5	11	10.2	7	9.7	18	10.0
6-10	30	27.8	24	33.3	54	30.0
11-15	16	14.8	19	26.4	35	19.4
16-20	19	17.6	10	13.9	29	16.1
21-25	7	6.5	5	6.9	12	6.7
26-30	14	13.0	7	9.7	21	11.7
≥ 31	11	10.0	0	0.0	11	6.1

Source: Computed from field Survey, 2019

The cassava value chain characteristics show that the cassava products such as gari, fufu and lafu has total variable cost of ₦22437.29, ₦20195.04 and ₦20203.18 respectively per annum and accounted for percent 98.26, 79.51 and 94.89 respectively of the total cost of the cassava product while the total variable cost for the by-product i.e peel was estimated as ₦2548.30 which accounted for 94.11 percent of total cost of the cassava by-product. It was discovered that the harvesting cost accounted for the highest of the total variable cost for the various cassava products. For the cassava products viz gari, fufu and lafu the harvest cost was estimated as ₦4158.82, ₦4600.00 and ₦4450.33 per annum which accounted for 18.21, 18.11 and 20.90 percent respectively while for the by-product (cassava peel) the drying cost accounted for the highest of the total variable cost and was estimated as ₦1037.14 which accounted for 38.30 percent of the total variable cost. Roasting cost, sieving cost and washing cost is next to harvesting cost for garri, fufu and lafu respectively and were estimated as ₦3663.82, ₦3877.78 and ₦4450.00 which accounted for 16.04, 15.27 and 20.82 respectively of the total cost. For cassava by-product i.e. peel the next to packaging cost is bagging cost which was estimated as 261.15 and accounted as 15.29 of the total variable cost. Also the total fixed cost for gari, fufu and lafu was estimated as ₦398.28, ₦5204.17, ₦1088.10 respectively while for cassava peels it was estimated as ₦159.57 and accounted for 1.74, 20.49, 5.11 percent for the cassava products and 9.34 for the cassava by-product. This shows that variable cost constituted larger proportion of the total cost for both the cassava products and the by-product.

The result further revealed that the revenue from fufu accounted for the highest of the cassava products which gave total revenue of ₦140658.65 as compared to the other products. The result also showed that gross margin is positive for both the cassava products and by-products. The value of the gross margin for gari, fufu and lafu was estimated as ₦35876.13, ₦120463.61 and ₦49186.82 respectively per annum. From the result of the gross margin it was discovered that fufu is more profitable along the cassava product value chain when compared to the other products. On the other hand the gross margin for the cassava peel was estimated as ₦36731.13 with total revenue of ₦39279.42. The profitability indicator for the cassava product and by-products revealed that the return per naira which is the ratio of the total revenue to the total cost was estimated as 2.55, 5.54, 3.26 and 14.51 respectively for gari, fufu, lafun and cassava peel. This means that for every one naira spent the processor these ratios.

The gross margin analysis of the various products and the by-product selected along the cassava value chain in the study area indicated that fufu was more profitable in relation to other cassava products

Table 2: Cassava Value Chain Characteristics

Description	Gari Value	% of Total Cost	Fufu Value	% of Total Cost	Lafu Value	% of Total Cost	Peel Value	% of Total Cost
Revenue (₦)								
Total revenue (₦)	58313.41		140658.65		69390.00		39279.42	
Variable Cost Items								
Harvesting cost	4158.82	18.21	4600.00	18.11	4450.33	20.90		
Transportation cost	3278.05	14.36	3810.71	15.00	3337.50	15.68	1000.00	36.93
Washing cost					4433.00	20.82		
Peeling cost	3187.65	13.96	2166.73	8.53				
Fetching cost	611.76	2.68	1600.00	6.30	500.00	2.35		
Soaking cost			2436.36	9.59	362.50	1.70		
Slicing cost					1390.00	6.53		
Grating mill cost	2218.83	9.72			775.00	3.64		
Sieving cost	2786.44	12.20	3877.78	15.27	1716.67	8.06		
Roasting/Drying cost (lafu)	3663.82	16.04			2920.00	13.71	1037.14	38.30
Packaging cost	1380.00	6.04					261.15	9.64
Bagging cost							250.00	9.23
Water cost	147.53	0.65	1703.45	6.71	318.18	1.49		
Firewood cost	859.51	3.76						
Fuel lubricant cost	144.87	0.63						
Total Variable cost(₦)	**22437.29**	**98.26**	**20195.04**	**79.51**	**20203.18**	**94.89**	**2548.30**	**94.11**
Fixed Cost Items								

Sundry material (Fixed cost)	398.28		5204.17		1088.10		159.57	
Total Fixed Cost(₦)	**398.28**	**1.74**	**5204.17**	**20.49**	**1088.10**	**5.11**	**159.57**	**5.89**
Total Cost (TC) (₦)	**22835.57**	**100.00**	**25399.20**	**100.00**	**21291.28**	**100.00**	**2707.86**	**100.00**
Gross Margin (₦)	**35876.13**		**120463.61**		**49186.82**		**36731.13**	
Profitability Ratio								
Returns per Naira	**2.55**		**5.54**		**3.26**		**14.51**	
Operating Ratio	**0.39**		**0.18**		**0.31**		**0.069**	

Source: Field Survey, 2019

Cost and Revenue Shares of the Cassava Products and By-Product along the Cassava value Chain

Table 3 present the parameter estimates for the share equations of the Translog cost function. Considering the number of estimated parameters, the statistical results as revealed in Table 3 are quite reasonable. The system R^2 was estimated as 0.88. The R^2s for labour share equation was estimated as 0.41, 0.70 for other inputs share equation, 0.91 for gari revenue share equation, 0.68 for lafun revenue share equation, 0.86 for fufu revenue share equation and 0.37 for peel revenue share equation. The F-test for the regression equation rejected the hypothesis that all estimated parameter are zero at 5% level of significance for the six equations.

Scale Effect for the Cassava Products and By-Product along the Cassava Value chain

The coefficient for gari quantity variable labour share equation is positive (0.0004) though not significant. Hence, the scale effect for garri quantity indicate that it is labour using, which implies that labour vis-à-vis the share of the wage rate increases with the output of gari as one would expect i.e as with increase in wage rate gari quantity increases. On the hand, the coefficient of gari quantity in other input prices (which include water, energy, maintenance expenses, transportation etc) equation is negative. This means that as more gari quantity is produced, the share of the input prices of the various selected inputs expenses decreases. This implies a decrease in other inputs cost with an increase in scale of production, which might be due to affordability of the various inputs needed for the gari processing by gari processors.

The coefficient of lafun quantity in labour and other inputs expenses equation are -0.0005 and 0.0022, respectively. Thus, the negative coefficient of labour indicate a labour-saving scale effect for lafun quantity while the positive coefficient for other inputs expenses equation imply other input expenses-using scale effect.

Both labour and other input expenses in fufu quantity processing are negative and not significant. This implies that, considering their scale effect both labour and other input expenses are labour-saving and input expenses-saving.

For peel quantity processing, coefficient of labour equation is positive and significant at 5%. The positive sign of the coefficient implies that the share of wage rate of labour increases with increase in the cassava peel processing in the study area. On the hand, for other input expenses, the coefficient which is -0.0007 is negative and not significant. This indicated other input expenses-saving scale effect for this by-product.

Effects of Socio-economic Characteristics on share of factor cost and output for Cassava Products and By-Products along the Cassava value Chain

The effects of socio-economic characteristics i.e age, sex, educational level and years of experience share equations on the cassava products and by-product was determined using the translog cost function presented in Table 3. The sex share equation was evaluated using dummy i.e 1 for male and 0 otherwise.

The coefficient of age is discovered to be negative and not significant for the labour and other inputs share equations. The negative sign of the coefficient of age in labour and other inputs share equation implies that the respondents at that age are both labour-saving and other input-saving. This means that there is reduction in the share of labour cost and other input cost as the age of the cassava processors and marketers increases along the cassava value chain. In the gari and lafun share equations age with a coefficient of -0.00099 and 0.0009 was significant at 0.1 level and 0.05 level respectively.

Moreso, in the fufu and peel revenue share equation, coefficient of the age was estimated as 0.0001 and -0.0001. Only fufu revenue share equation was significant at 0.1 level. The result revealed that the scale effect for fufu revenue share equation is age saving while for peel revenue share equation is age using. This means for peel age is significantly contributing to its processing and marketing in the study area.

The sex share equation made use of dummy in determining its contribution. The coefficient of sex was estimated is positive though not significant for labour share equation. This means that the scale effect is labour using, this indicate that male are more efficient and contributes more in cassava processing and marketing along the cassava value chain.

Economies of Scale of Cassava Products and By-Product along the Cassava value Chain

Economies of scale or increasing returns to scale exist when long-run average cost is decreasing. These economies can come from a number of sources, including spreading of total cost over a large amount of output. Another factor is utilization of labour, machinery and building. Diseconomies of scale, on the other hand, exist when the long-run average cost curve is increasing, and this combination discourages further increase in processing. The result in Table 8 show that coefficients associated with gari, lafun, fufu and peel revenue are significant at 5% level.

Elasticities of Factor Demand and SubstitutionThe own-Price Elasticity of Demand for Factors

The results of the elasticities of factor demand are reported in Table 3. All the price elasticities of factor demand have the correct sign. They are all negatives, implying that the demand for these resources decrease with increase their respective prices. This result is consistent with the law of demand, which states that ceteris paribus, the quantity demanded of a commodity is inversely proportional to the price of the commodity.

The low elasticities of demand for other expenses (0.0072), such as water, could be due to the fact that the processor who stocked his factory has no choice, he is under obligation to produce the cassava products (lafun) and simultaneously supply adequate quantity of water for soaking the product. These factors could therefore be regarded as necessities; changes (increase or decrease) in the price of these inputs have negligible effect on the quantity demanded. The elasticities of labour (-0.212) is relatively high, which suggest that their demands are less inelastic than that of other expenses. This implies that the degree of response of quantity demanded of the latter to price will be higher than that of the former.

The Cross-Price Elasticity of Demand for factors

Cross price elasticity of demand refers to the degree of responsiveness of quantity demanded of an input to the change in price of another factor. Positive cross price elasticity of demand means that the factors are substitutes while negative cross price elasticity of demand implies that the inputs are compliments. The results of cross-price elasticity of demand for factors are presented in Table 8. The results reveal that gari-labour, lafun-other input, peel-labour, gari-cassava tuber, fufu-cassava tuber pair are substitutes. The gari-other inputs, lafun-labour, fufu-labour, fufu-other input, peel-other input and peel-cassava tuber are compliment. These results are theoretically correct and practically plausible. The result implies that as the price of the cassava product (gari, fufu, lafun) or by-product (peel) increases, less cassava product or by-product is purchased and more labour and other inputs are demanded and utilized. With respect to gari-other input pair, a reduction in quantity of gari processed due to increase in price will compel the cassava processors to substitute the gari with other input such as water.

Table 3: Parameter Estimates for the Share Equations of a Translog Cost Function

	Explanatory variable											
		Price/unit Cost		**Output**					**Socio-economic characteristics**			
Share equation	**Constant**	**Wage price**	**Input price**	**Cassava tuber**	**Garri Qty**	**Lafun Qty**	**Fufu Qty**	**Peel Qty**	**Age**	**Sex**	**Edu. Level**	**Years of exp.**
Labour R^2 = 0.41	0.0981 (2.69)	-0.0212 (-5.514)	-0.0073 (-2.263)	-0.0285	0.0004 (0.1158)	-0.0005 (-0.1959)	-0.00065 (-0.1780)	0.0030 (2.451)	-0.0009 (-1.331)	0.0020 (0.1066)	-0.0033 (-1.644)	0.0013 (1.703)
Fixed inputs R^2 = 0.70	0.3500 (9.517)	-0.0072 (-2.263)	-0.0171 (-13.52)	-0.0243	-0.0031 (-0.7643)	0.0022 (0.5780)	-0.0008 (-0.1860)	-0.0007 (-0.3924)	-0.0006 (-0.9775)	-0.0093 (-0.5475)	0.0015 (0.8300)	-0.0001 (-0.1159)
Cassava tuber	0.5519	-0.0284	-0.0244	0.0528	0.00027	-0.00017	0.00014	-0.00023	0.00015	0.00073	0.00018	-0.00012
Garri revenue R^2 = 0.91	0.2557 (6.796)	0.0004 (0.1158)	-0.0031 (-0.7643)	0.00027	0.1919 (30.46)	-0.0589 (-12.64)	-0.1188 (-21.32)	-0.0101 (-5.021)	-0.00099 (-1.765)	-0.0085 (-0.5099)	0.0019 (1.062)	0.0004 (0.5275)
Lafun revenue R^2 = 0.68	0.38304 (9.293)	-0.0005 (-0.1959)	-0.0022 (0.5780)	-0.00017	-0.0589 (-12.64)	0.0729 (8.877)	-0.0252 (-3.251)	0.0060 (2.292)	0.0009 (2.074)	-0.0004 (-0.0302)	-0.0021 (-1.490)	-0.0006 (-1.097)
Fufu revenue R^2 = 0.86	0.1729 (3.301)	-0.006 (-0.1959)	-0.0008 (-0.1860)	0.00014	-0.1188 (-21.32)	-0.0252 (-3.251)	0.1637 (15.35)	-0.0025 (2.292)	0.0001 (0.1650)	0.0057 (0.3794)	0.009 (0.5643)	0.0001 (0.1553)
Peel revenue R^2 = 0.37	-0.0839 (4.808)	0.0030 (2.451)	-0.0007 (-0.3924)	0.00023	-0.0101 (-5.021)	0.0060 (2.292)	-0.0025 (-0.8239)	-0.0011 (0.6302)	0.0001 (-0.4195)	0.0035 (0.6271)	0.0035 (0.6271)	0.00002 (0.1088)

Note: t statistics in parenthesis below each parameter estimate.

Source: Field Survey, 2019

CONCLUSION AND RECOMMENDATION

The result of the study revealed that majority of Cassava processors and marketers are female. Also, the mean age of the cassava value chain actors was discovered to be 44 years and 38 years for processors and marketers respectively. It was also discovered that for cassava peel quantity processing, coefficient of labour equation is positive and significant at 5%. The positive sign of the coefficient implies that the share of wage rate of labour increases with increase in the cassava peel processing in the study area. This has put cassava peel at vintage position interms of labour use and other expenses along the cassava value chain when compared to the other cassava products.Based on findings of this study, the following policy recommendations were advanced to positively bring about improvement in the cassava value chain.

1. collaboration with the cassava association should be encouraged to participate in educative programmes such as seminars and workshop to educate them on the importance and value addition of cassava products and by-product.
2. Considering the share of revenue generated from the cassava products and by-products, in terms of

wage rate and prices of other inputs, larger share of the revenue should be direct to cassava peel in order to maximize profit generated from this product.

3. Based on economies of scale, cassava processors and marketers should spread their total cost over a large amount of output so that they can realize the value addition from most the cassava by-product (cassava peel)

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