FACTORS INFLUENCING THE USE OF HIGH QUALITY CASSAVA FLOUR AMONG MASTER BAKERS IN MAKURDI LOCAL GOVERNMENT AREA, BENUE STATE, NIGERIA

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Abstract: The rising cost of wheat importation for bread production has led to growing interest in the partial use/inclusion of high quality cassava flour (HQCF) alongside wheat flour in bread production in Nigeria, not much is known empirically about the factors affecting use (inclusion) of HQCF in bread production, and whether use of HQCF could mean higher profit (or not) for users compared to non-users. Consequently, this study examines the costs and returns on bread production, and factors influencing use of HQCF among some master bakers in Makurdi Local Government Area, Benue State. Data were collected from Forty (40) master bakers with the aid of questionnaire. Descriptive statistics, budgetary techniques, and logit regression model were the tools for data analyses. Results show that 37.5% of respondents used high quality cassava flour and that higher educational attainment would substantially enhance the likelihood of including HQCF in bread making. The gross margin (measure of profit) for both users (₦42.168) and non-users (₦36.622) of HQCF are not statistically different. Relatively shorter shelf-life of bread produced with HQCF, greater consumer preference for bread made with 100% wheat flour, and inadequate supply/availability of HQCF. Organizing more training workshops for bakers is likely to promote the use of high quality cassava flour.

Keywords: Bread production, cost and return, master bakers, profitability

Introduction

The development of agricultural commodity value chains that guarantee competitiveness and efficiency in the use of agricultural products like cassava, sorghum, cocoa, and rice for the production of different food products (Global, 2012) has continued to surface as a cardinal agricultural policy focus by the Nigerian government in recent times. For this study, the food product of interest is bread. Bread is relished by the general public, and one that can be produced using cassava flour. The importance of cassava for food is stressed by Hahn and Keyser (1985) when they stated that the crop is grown for use as food for more than thirty-nine African countries. The relevance of cassava is however not limited to consumption, but also include its numerous advantages as raw materials for industrial use-which includes, among others, production of paperboard, adhesives, plywood glue, extenders, bakery products and high quality cassava flour for bread making.

Development of market opportunities for cassava becomes imperative in ensuring increased income for resource-constrained households, increased employment opportunities and the potential of having lower food prices for consumers (Plucknett, 1998). The major ingredients in bread making are flour, water and yeast (Akobudu, 2006; Osuji, 2006). Before now, imported wheat flour has been the only kind of flour used in bread production in Nigeria. However, over the years, in response to the increase in the price of wheat, researchers have come out with the conclusion that wheat flour can be successfully substituted with cassava flour in bread (IITA, 2002; Giami *et al*., 2004; Nangano *et al*., 2005; Pasqualone *et al*., 2010). High Quality Cassava Flour (HQCF) is one of the numerous product of cassava obtained through a cassava value-added chains that is produced through grafting peeled fresh cassava roots, dewatering to a final moisture content of 35-45% followed by drying in a flash dryer and milling with a hammer mill.

High Quality Cassava Flour Initiative is a part of the Agricultural Transformation Agenda of the Government which seeks to promote major agricultural crops (cassava inclusive) through value addition programs and create market for farmers, among others. The country in 2011 imports wheat worth ₦635 billion ($4.2 billion) annually (Ohimain, 2014). Hence, in 2012, Nigeria released cassava-wheat bread policy mandating flour mills to partially substitute imported wheat with cassava up to 40% in spite of limited success of earlier released wheat policies involving the partial substitution of wheat with 5-10% cassava flour (Ohimain, 2014).

Evidence from the literature and past studies have revealed that, after the depreciation of the value of naira, the high cost of wheat almost sent bakers out of operation, thus compelling them to look for an alternative (PIND, 2011). To combat this challenge, International Institute of Tropical Agriculture IITA developed a simple and appropriate process for producing High Quality Cassava Flour that is suitable for baking. In addition, past studies have identified that training of master bakers is meant to further push the actualization of the cassava flour inclusion in bread baking (FIIRO, 2006). Against this background, it becomes imperative to gain understanding of factors influencing the use of high quality cassava flour (HQCF) and its consequences on the profitability of master bakers in the local government. Specifically the study seeks to: examine the factors affecting the use/inclusion of high quality cassava flour (HQCF) among master bakers. Compare the quantity of cassava flour supplied with the quantity demanded of high quality cassava flour among master bakers. Assess the constraints affecting the demand for high quality cassava flour. Examine the profit earning potential of users of high quality cassava flour among master bakers.

Materials and Methods

The study area

Makurdi is the State Capital and the largest urban centre in Benue State. It is located between latitudes 7º 35' - 7º 53' N and longitude 8º 24' - 8º 42' E and covers a land area of about 800 km². As of 2006, Makurdi had an estimated population of 297398 (NPC 2006). The urban area is transverse by the River Benue, which divides it into Makurdi North and South. The river has great influence on the climate which gives a mean annual temperature of about 32.5ºC. It is made up of eleven council wards, namely: Agan, Mbalagh, North bank I and II, Tse Bur, Fiidi, Central south, Modern market, Wailomayo (High Level), Clark and Ankpa Ward and Wadata. Makurdi is located in the Guinea Savannah vegetation zone. This is a transitional zone separating the forested belt of the south and true savannah of the North. The vegetation consists mainly of grass and variety of scattered small trees and shrubs. The state was selected in the north central region by the Federal Government for the launching of the cassava bread and training of master bakers.

Sample procedure and sample size selection

Simple Random Sampling and snowballing sampling techniques were used to select 40 master bakers (respondents) from the Local Government Area. A Simple random technique was used in selecting twenty (20) master bakers out of the master bakers' that attended training workshops on the use of high quality cassava flour, and snowballing sampling technique was used to select twenty (20) master bakers who did not attend the training in Makurdi Local Government Area of Benue State. The list of trained master bakers' was obtained from the State's Institute of Food Security (IFS) office at Makurdi. Simple random sampling procedure was first used, to select ten Wards (Wadata, Ankpa, North Bank I, High level, Agan, Fiidi, Clark, Central South, Tse Bur and Modern Market) out of eleven in Madurdi Local Government Area to allow for considerable spread of respondents across Wards. Thereafter, simple random sampling was used to select two master bakers from each of selected Wards. For the untrained master bakers, snowballing was used to select two master bakers in each of the selected Wards.Snowballing sampling procedure becomes appropriate because there are few numbers of untrained bakers' in the study area. These 40 master bakers' constituted the sample size for this study. Data for the study was collected from the bakers using structured questionnaire.

Method of data analysis

Data collected for the study were analyzed using budgetary techniques (Gross margin analysis), descriptive statistics and inferential statistics analytical tools.

Analytical tools

Logit Regression

Logit regression was estimated to examine the influence of certain factors on master bakers' use of high quality cassava flour (HQCF). The logit function can be defined following Pindyck and Rubinfeld (1998, pp 309) in its inverse logistic form as:

$$Prob(Y_i=1)=Ln\left(\frac{P_i}{1-P_i}\right)= \beta_0+ \beta_1X_{1i}+ \beta_2X_{2i}+ \beta_3X_{3i}+ \beta_4X_{4i}+ \beta_5X_{5i}+ \beta_6X_{6i}+ \beta_7X_{7i}+ \beta_8X_{8i}+ \beta_9X_{9i} + \beta_{10}X_{10i}$$

Where, Y= use of high quality cassava flour in bread production (1 if used, 0 otherwise).

X_1=price per bag of flour (Naira) (expressed in natural logarithm)

X_2=level of education of master baker (years)

X_3=age of master baker (years)

X_4=experience of master baker in bread production (years)

X_5=high cost of HQCF (1 if master baker perceives high cost of HQCF as a strong barrier to its use, 0 otherwise)

X_6=inadequate supply/availability of HQCF (1 if master baker perceives inadequate supply/availability as a strong barrier to adoption HQCF, 0 otherwise)

X_7=policy inconsistency (1 if master baker does not perceive government policy as a major barrier to the use of HQCF, 0 otherwise)

X_8=technological challenge (1 if master baker perceives technological challenge as a strong limiting factor to use of HQCF, 0 otherwise)

X_9=Consumer preferences for 100% wheat bread (1 if baker perceives this as a strong barrier to use of HQCF, 0 otherwise)

X_{10}=Presence of impurities in HQCF (1 if master baker does not perceive this as a strong barrier to the use of HQCF, 0 otherwise)

β=estimated parameters, including the constant term (β_0).

$Prob(Y_i=1)$ is the probability that master baker *i* will use HQCF.

For the dummy variables in the model, the original questions pertaining to constraints affecting the use of HQCF. Each of the questions is Likert type perception/opinion question on which master bakers' response could either be that the constraint is *very high, high, agree, low or none*. The questions on constraints are converted to dummies as appropriate for econometric analysis, and ease of interpretation. For each dummy variable, respondents indicating very high or high to question were assigned 1, while those indicating low or none were assigned zero (0).

Gross margin analysis

Gross margin was used to assess the profit earning potential in terms of costs and returns on bread production. Gross Margin is the difference between the total revenue and total variable cost (TVC) incurred in bread production. Some of the respondents were producing other products (confectionaries) in combination with bread. Hence, the gross margin can be used as appropriate proxy for appraising the performance of the bread making business.

The mathematical formula for calculating the gross margin for each master maker is shown in the equation below.

$$GM = PQ- \sum_{j=1}^{n} P_jX_j$$

Where GM = Total Gross Margin

$\sum$ = Summation sign

j = 1 to n. Where j is an index for individual variable production input and n is the total number of variable inputs in production

P = average price of product bread (naira)

Q= quantity (output) of bread produced per week (kg)

P_j= unit price of variable input j (Naira)

X_j = quantity (amount) of the jth variable inputs used per week (kg)

PQ = total revenue from bread production per week (Naira)

GM per bag of flour used = GM/total number of bags of flour used

Evaluation of severity of constraint

A 4-pointlikert scale was used to assess the severity of the constraints encountered in the use of high quality cassava flour for bread production. The mean score value generated for each constraint (as generated from the responses of respondents on the 4-point Likert scale) is used as proxy measure of the severity of the constraint. The mean score for each constraint (k) is as stated:

$$MS_k = \frac{\Sigma X_{ik}}{4N}$$

Where X_{ik} = response score (minimum, 1 and maximum, 4) of respondent i to constraint k. MS=Mean Score point. i = 1, 2, 3… N. N = Total of respondents. The decision rule is such that: when the estimated Mean Score point is 3.5 and above, the constraint is adjudged as highly severe and if it is between 2.5-3.49, it is viewed as severe. Likewise, if the Mean Score point is between 1.5 – 2.49, the severity of the constraint is adjudged to be very low, and when it falls between 1-1.49, it is taken as not severe.

T-test for difference of means

Independent sample t-test was used to examine the mean difference between the Gross Margin of users and non-users of high quality cassava.

$$t = \frac{(\overline{X_1} - \overline{X_2})}{\left(\frac{S_1^2}{N_1} + \frac{S_2^2}{N_2}\right)}$$

Where

$\bar{X}_1$ = Mean value of Gross Margin per bag on bread production for users of HQCF (Naira)

$\bar{X}_2$ = Mean value of Gross Margin per bag on bread production for non-users of HQCF (Naira)
S_1^2 =variance of the Gross Margin for users of HQCF
S_2^2 = variance of the Gross Margin for non-users HQCF
N_1 = number of master makers that used high quality cassava (15 bakers)
N_2 = number of master makers that did not use high quality cassava (25 bakers)

Results and Discussion

Distribution of respondents based on use and reasons for non-usage of HQCF for bread production

Presented in Table 1 isdistribution of respondents based on usage and reasons for non-usage of HQCF for bread making. Approximately 37.5% of the respondents include high quality cassava flour in bread making, while 62.5% did not use high quality cassava flour. Besides, the distribution of bakers that did not use HQCF, results show that 10% of the respondents are unaware of the possibility of including high quality cassava flour in bread baking, 42.5% of them do not have the technical skill to include it, while about 47.5% of them were unable to find high quality cassava flour in the market to buy. Gloria (2013) reported that government of Nigeria (GON) had to revert to 5% inclusion instead of 10% when it was obvious that the flour millers are unable to get enough high quality cassava to meet the demand of bread processors. The foregoing indicates that much has to be done in terms of making high quality cassava flour available in the market, and in terms of training workshops to improve master bakers technical skill and awareness about the use of high quality cassava flour for bread baking.

Table 1: Distribution of respondents by usage and reason for non-usage of HQCF

Variable	Frequency	Percentage
Usage of HQCF		
Use	15	37.5
Did not used	25	62.5
Total	40	100
Reason for non-usage		
Not aware	4	10.0
No skills	17	42.5
Not in the market	19	47.5
Total	40	100.0

Source: Field survey, 2014

Factors influencing the Use High Quality Cassava Flour (HQCF)

Results of the factors influencing the use of high quality cassava flour are presented in Table 2. Logit regression was run using five explanatory variables to determine what factors influences master bakers' use of high quality cassava flour (HQCF).The log likelihood value is -3.70; and the associated Chis-square value (19.70) is statistically significant ($p<0.05$). This implies that the model can be relied upon to explain probability of use of HQCF in the study area. The coefficient of the educational level of master bakers' attended training workshop is positively and significant at 1%. This implies that additional years of formal education can increase the chance of using high quality cassava flour. Higher education can enhance acquisition of innovation/technology (HQCF), skills/competencies and adaptation of existing knowledge to new ones. Rubas (2004) however cautioned that acquisition of knowledge, and skills does not automatically translate to efficient (or substantial) use of resources; that but significant adoption (which for this study may indicate sustained use of HQCF in bread production) will only occur when such adds value to the individuals. This is important especially when the average gross margin of users and non-users of HQCF are not radically different. Older bakers are also more likely to use HQCF. Inadequate supply of HQCF to master baker's by suppliers had a negative and significant effect on the likelihood of use of High Quality Cassava flour ($p<0.01$). This implies that availability and adequate supply of HQCF will enhance its usage among master bakers. This is consistent with the findings of Bhatta *et al.* (2008) that irregular supply of high quality cassava flour discourages the use of the products. David (2011) also linked failure to comply with 10% cassava flour inclusion in bread making by many master bakers to inadequate capacity to supply high quality cassava flour. The coefficient of government policy inconsistency is positively and statistically significant at 1%, signifying that the perception of an average master baker about government policies (as at the time of data collection) was not a disincentive to the use of high quality cassava flour. Technology challenge had negative and significant effect ($p<0.05$) on the likelihood of use of HQCF by master bakers.Action plan for cassava transformation in Nigeria (2009) reported that the major challenge in the use of high quality cassava flour is the process technology for production of high quality cassava flour with requirement that cassava roots must be processed within 24 h of harvesting to prevent fermentation and deterioration. The report furthered reviewed that other technological challenges include; inefficient local dryer and high cost of energy to run the factories due to erratic power supply in Nigeria. However, with respect to presence of impurities, the result indicates a positive and significant effect on use of HQCF. It can be deduced from the findings that absence of impurities in high quality cassava flour can substantially increase the chance of its use in bread making. UNIDO/FGN (2006) reported that presence of impurities such as sand affects the use of high quality cassava flour. The results show that the remaining variables are not statistically significant, indicating that the variables are unlikely to substantially influence the likelihood of use of HQCF in the studied population.

Table 2: Factors influencing the use of high quality cassava flour

Variables	Co-efficient	Robust Standard error	Z-value	P>|Z|
Low price of wheat flour	-32.5557	101.4816	-0.32	0.748
Educational level	5.698948***	1.610973	3.54	0.000
Age	0.533559**	0.265787	2.01	0.045
Years of experience	0.375724	0.285314	1.32	0.188
High cost of HQCF	-0.26016	1.322291	-0.20	0.844
Inadequate supply of HQCF	-6.80683***	1.904927	-3.57	0.000
Policy inconsistence of Government	9.784742***	3.149259	3.11	0.002
Technology	-6.25446**	2.430959	-2.57	0.010
Consumers preference for 100% Wheat bread	-2.28649	1.481534	-1.54	0.123
Impurity	4.775547*	2.497712	1.91	0.056
Constant	181.5837	866.0635	0.21	0.834
Likelihood		-3.70336		
LR Chi-square (10)		19.7		
p>Chi-square		0.0322		
Pseudo R-Square		0.8601		

Source: field survey, 2014; ***, **, * significant at 1%, 5% and 10%, respectively.

Distribution of respondents based on training workshop attended and the quantity of high quality cassava flour used after the training

Distribution of respondents based on training workshop attended and the quantity of HQCF used after the training are presented in Table 3. The result shows that the majority (55%) of the master bakers that participated in the training workshop attended twice. Only 10% of them attended more than two times. Out of the 50% that attended the training workshop, 17.5% of master bakers attended the training workshop once, 27.5% attended twice and 5% attended 3 times and above.

Table3: Distribution of respondents based on the number of training workshop attended

Variables	Frequency	Percentage
Attended Training	20	50
Non-Attendant	20	50
Total	40	100
Attended training once	7	35.0
Attended training twice	11	55.0
Attended training thrice or more	2	10.0
Total	20	100.0

Source: Field Survey, 2014

Constraints on use of high quality cassava flour for bread baking

Table 4 shows the distribution of respondents based on the constraints of the use of HQCF. Based on the mean severity score point, factors such as shorter product (HQCF) shelf life, strong consumer preferences for 100% wheat bread, inadequate supply/availability of HQCF and high cost of cassava flour, are the four main identified constraints limiting the use of high quality cassava flour for bread production. For example, Ohimain (2014) found, among others, that higher prices affected master bakers' use of high quality cassava flour. Sanni *et al*. (2005) also reported that strong consumer preferences for 100% wheat bread significantly affected master bakers' demand for high quality cassava flour. Other identified constraints include presence of impurities in cassava flour, perceived inconsistency in government policies, and technological challenges. For example, UNIDO/FGN (2006) reported that presence of impurities and colour problem affected bakers' use of cassava flour while Ohimain (2014) noted inconsistency in government policies as factors limiting use of high quality cassava in bread production. More specifically, approximately 87.5% of the master bakers considered consumer preferences for 100% wheat bread to be very high or high (strong) constraint. Approximately 90% of the master bakers indicated that the relatively shorter product shelf life to be a very high or high constraint to the use of high quality cassava flour for bread baking. Efforts to improve the shelf life of cassava floor may serve as an incentive for its usage. Only 25% of the bakers indicated that presence of impurity is a strong (very high or high) constraint to use of HQCF. Since the majority of the backers have low perception of impurity as a constraining factor, this may incentivize its use. Approximately 35% of the bakers perceived inconsistent government policies as strong constraint to the use of HQCF while 65% do not consider this as a major limiting factor.

Profit earning potential of the use of high quality cassava flour

The results of costs and returns on bread production are presented in Table 5. The cost of wheat flour account for the higher percentage (approximately 74%) of the total variable cost of bread production for both users and non-users of high quality cassava flour.High quality cassava flour account for about 6% of the total variable cost. The foregoing indicates that bakers would have to pay careful attention to the efficient utilization of flour in other to enhance the potentially realizable profit margin in bread making business. Average revenue was higher for users of high quality cassava flour than non-users of high quality cassava flour for bread production. Generally, it would appear that bread baking using composite flour (wheat-cassava flour mix) had higher gross margin per bag (₦93.74) than bread baking using only wheat flour (₦97.59). This is contrary to (Adebayo *et al*.,2010) and Ohimain (2014) who linked inclusion of high quality cassava flour in bread making to increased margin of realized profit.

Table 4: Percentage response on severity constraints affecting the use of HQCF

Constraints	Very high	High	Low	None	Mean score
High cost of HQCF	30	40	27.5	2.5	2.9
Shorter product shelf life	80	10	10	0	3.7
Inadequate supply/Availability of HQCF	35	32.5	30	2.5	3.0
Policy inconsistency of government	5.0	30	60	5.0	2.4
Consumer preferences for 100% wheat bread	65	22.5	10	2.5	3.5
Technological challenges	42.5	45	10	2.5	3.3
Presence of impurities	7.5	17.5	72.5	2.5	2.3

Source: Field Survey, 2014

Table 5:Gross margin of users and non-users of HQCF in bread production

Variables	Users of HQCF		Non users of HQCF	
	Mean cost (Naira)	Percentage of total variablecost	Mean cost (Naira)	Percentage of total variable cost
Cost- wheat flour	352526.67	68.03	344116.00	68.03
Cost- high quality cassava flour	31133.33	6.01	0.00	0.00
cost of flour	383660.00	74.04	344116.00	73.94
Cost-vegetable oil	6573.33	1.27	7374.01	1.58
Cost- sugar	48588.80	9.38	40024.00	8.60
Cost- salt	9246.67	1.78	7528.12	1.62
Cost- enzyme	350.00	0.07	860.00	0.18
Cost- margarine	37166.67	7.17	33580.00	7.21
Cost- yeast	80.00	0.02	224.00	0.05
Cost-labour	32535.36	6.28	31722.12	6.82
Total variable cost	518200.83	100.00	465428.25	100.00
Total revenue per bag (50kg) from sales of bread	809415.25		737712.68	
Gross margin (Naira)	291214.42		272284.43	
Quantity of Wheat Flour (Kg)	2846.67		2790.00	
Quantity of HQCF (Kg)	260.00		0.00	
Total Quantity of Flour (Kg)	3106.67		2790.00	
Gross margin per bag (50Kg) of flour	93.74		97.59	

Source: Field Survey, 2014

Table 6: Comparison between gross margin of users and no- users of high quality cassava flour

Categories	N	Mean	Std. Dev.	MD	t-value	N	p-value
Non Users of HQCF	25	97.593	139.015				
Users of HQCF	15	93.738	140.147	3.855	0.084	38	0.736

Source: Field Survey, 2014

Comparison between the Gross margin of flour for HQCF users and non-users

Presented in Table 6 are the results (t-test) of comparison between the gross margin per bag of the users (93.74) and the non-users (97.59) of high quality cassava flour. The result shows that the gross margin accruing to users (93.74) of high quality cassava flour is not significantly different from the gross margin of non-users (97.59) of high quality cassava. This implies that the users of high quality cassava flour for bread production (composite bread) unlikely to make more profit than the non-users. This, coupled with the constraints of strong consumer preference for 100% wheat bread, and inadequate supply of HQCF, may dampen adoption of high quality cassava flour.

Conclusion

The study attempted to compare the profit earning potentials of master bakers who used wheat-cassava mix and those that used wheat flour purely in bread production in Makurdi Local Government Area of-, Benue State, Nigeria as well as factors determining the use of high quality cassava flour among the bakers. We found that the profit earning potentials (gross margin) between the two groups of master bakers do not differ substantially. Positive and significant relationship exists between the numbers of training workshop attended by master bakers' and the likelihood of using high quality cassava flour in bread production. Shorter product shelf life of products, high consumer preferences for 100% wheat bread, and non-availability/inadequate supply, and relatively high cost of quality cassava flour are the main constraints limiting the use of high quality cassava in bread production. We conclude that although the use of high quality cassava in bread making project some signals for profit, this is unlikely to stimulate the use of high quality cassava flour for bread production since the gross margin of users and non-users of high quality cassava flour are more or less equal . Although findings suggest that increases in the numbers of training attended can substantially induce decision to uses high quality cassava flour, this may remain a speculation if the identified constraints to usage are unattended or sparingly addressed.

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