ECONOMIC ANALYSIS OF LOCUST BEANS PROCESSING AND MARKETING IN ILORIN, KWARA STATE, NIGERIA

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Abstract

This study was designed to estimate the economic analysis of locust bean processing and marketing in Ilorin, Kwara State, Nigeria. Primary data was used and purposive sampling technique was adopted to select the respondents used for the study. A total number of 60 respondents were interviewed. The data collected were analyzed using inferential statistical tool such as regression analysis. Budgetary analysis technique was also used to analyze the profitability of locust bean processing and marketing in the study area. Majority of the processors and marketers are making profits; 68.3% operate above breakeven point while 26.7% operate at breakeven point and the rest 5% was below the breakeven point, this indicates that they neither profit nor lost. The regression analysis result shows that quantity processed, family size and years of experience in processing are significant at 1%, 5% and 10% respectively while education level and stall rent is negative and significant at 1% and 5% respectively. F- Test also explained that independent variables are jointly significant at 1% probability level with an adjusted R^2 of 78.9%. The overall rate of return on investment indicates that average rate of return is 0.5 (50%), which is positive. It is therefore concluded that profit made by the processors and marketers can be improved on by increasing the quantity of locust bean being processed through adoption of newly discovered method of processing and improved method of preservation, packaging and marketing of the product to international standard by reducing the odour of the product without the loss of essential nutrients and palability in order to generate foreign exchange. Also, rules and regulations against cutting of economic trees for alternative uses should be enforced to maximize their values.

Keywords: Locust bean, Condiment, Income, Processing and Marketing

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Introduction

African locust bean tree "*Parkia bioglobosa*" belongs to the family of *Fabaceae* sub family "*Mimosoidea*" and genus "*Parkia*". The plant was named after Mungo Park by Robert Brown in 1826. The tree is widely recognized in West Africa as an important multipurpose tree of West Africa Savannah land. The most important part of the tree is found in its seeds and processed seed is used as condiment for soup. It is a source of natural nutritious condiment which features frequently in the traditional diet of the people (Fagbemi, 1989). Apart from the flavouring attribute of the processed locust bean "Iru", it also contributes significantly to the intake protein, carbohydrate, calcium, phosphate, iron content and essentials fatty acids, particularly vitamin B, riboflavin and vitamin A (Aju *et al.*, 2008; Oduro *et al.*, 2007; Popoola and Galaudu, 2000; Beaumont, 2002; Oladele *et al.*, 1995; Musa, 1991; Odunfa, 1985). Table 1 shows the nutrition composition of locust bean seed. It is also called by different local names in different localities; for instance, it is referred to as "kinda" in Serria Leone, "kpalugu" among the inhabitants of Nothern Ghana, "nere" in Burkina Faso. "Igba" in Yorubaland and "worku" in Ghana (Diawara *et al.,* 2000; Odunfa, 1985). The tree produces many benefits; it produces fruits which are enclosed in numerous large pods, and it tolerates a wide range of alluvial, sandy and lateritic soil, and also resists pest and diseases, survives fires and strives in full sun and tropical heat. Within Africa, clearly its prospects are greatest in West Africa, where the trees are planted and its

products are known and loved. The fruits are brown in colour when ripe; it contains numerous black seeds embedded in yellowish sweet tasting pulp. This yellowish pulp can be made into colourful and refreshing drinks. Also in the dry area, locust bean trees serve as potential sources of food, edible oil, fodder lumber, fire wood and green manure. It was estimated that about 200,000 tons of Africa locust beans seeds are gathered each year in Nigeria alone, as well as large quantities are produced in the savannah region of Oyo, Osun and Kwara States of Nigeria

(Onnyi *et al.*, 2004). The seeds are the most valued product of the tree. In Nigeria, it serves as food buffer during lean period while reliable income accurse to the farmers involved in harvesting and marketing of the product. This array of multipurpose uses have been reported to include food, medicine, manure, gum, shade, wind break, bee food, stabilization of degraded environmental, livestock seed, fuel, fibre fish poison among several others (Campbell-Platt, 1986; and Keay, 1989).

Table 1. Nutrition composition of locust bean seed

Component	Amount (%)
Crude protein	40.0 − 47.4
Fat	31.4 − 42.9
Carbohydrate	15.0
Crude fiber	3.1 − 5.6
Ash	3.3 − 5.6
Calcium (mg/100g)	309.0 − 880.0
Iron (mg/100g)	480.0 − 546.0
Phosphorous (mg/100g)	517.0 -584.0
Metabolic energy (Kcal/100g)	480.0 − 546.0
Gross energy (Kcal/100g)	517.0 − 618.0

Source: Odunfa, 1985

It generates reliable and dependable income for the farmers and women who involved in its processing and marketing. The processed bean known as "Iru" is a popular food condiment common in West African countries. It adds flavor and taste to most dishes, soup, sauces and stew made to accompany porridge, rice and cooked yam and cassava in the region. This means that the fermented food condiment is a crucial and widely consumed food of high nutritional value to millions of Nigeria both in rural and urban areas. It also serves as a source of protein supplements in the diet and the flavourant contribute some nutrients notable minerals and vitamins to nutritional requirements of a poor family especially in rural areas (Fagbemi, 2002; Oyerinde and Daramola, 2004; and Diawara *et al.*, 2000).

It is unfortunate that locust bean is fast losing its popularity to some other flavoring agent like maggi, royco, knorr, etc. which its nutritive value cannot be compared with that of dawadawa. The Federal Office of Statistics (now National Bureau of Statistics) in 2003 reported that about $200 million is spent annually on imported food flavor in Nigeria with a projection of 15% annual future increase despite the fact that, traditionally produced flavoring products have lower caloric value and higher dietary protein content than imported flavor. This situation may be a result of

the product's odour and product quality due to the poor manufacturing practice. Locust bean processing and marketing has been facing a lot of challenges despite the dawn of science and technology. Processing is still largely in home (family yard) in a crude way and handled by local women; the production has not increased substantially due to problems associated with production process; there is no standard measurement of grading of the condiment for sale so as to know whether the condiments are properly utilized for profit maximization. It was also hypothesized that no significant relationship exists within all the explanatory variables and the net revenue. It is therefore necessary to examine the factors affecting profitability level of locust bean in the study area.

Processing and preservation of fermented locust bean

All food processes are made up of a series of steps (sometimes called "unit operations") which have to be followed in a particular sequence in order to make the food. If the steps are changed, or even if their sequence is changed, the process will produce a different product. The production of locust bean condiment (*Iru*), is essentially a traditional family yard practice done in rural cottage industry mainly by woman. The harvested bean seeds mainly sold in markets to women who processed them. Many scientists

had researched into the traditional method of processing locust bean; among which are- Odunfa, 1981; Campbel-platt, 1986; Oni, 1997. Oni (1997) describes the seven stages of processing operation which are: Shelling, Pre-drying, Pounding, Winnowing or Sieving, Washing, Drying and Visual sorting. Odunfa (1985) presented a flow chart (Fig. 1), showing the stages in traditional method of processing locust bean.

In the studies conducted on modern method of processing locust bean, it was noted that the boring routine practice in cooking time was reduce by use of pressure cooker which reduced the rigor 12 hours of boiling to 2 hours. Dehuller and separator – dual purpose equipment has drastically reduced the traditional method of production of between 4 days – 6 days to 4 hours; having production capacity of 1500 kg (Audu *et al.*, 2004). Table 2 shows the comparative proximal chemical composition of iru produced locally and sample from Federal Institute of

Industrial Research Oshodi, (FIIRO) Lagos, Nigeria.

Africa locust bean seed
↓
Boil in water for 12 hrs
↓
Cooling and washing
↓
Boil cotyledons in water
↓
Drain through raffia sieve
↓
Spread while hot in wide calabash tray
↓
Stack strays together, wrap with jute bag
↓
Ferment for 36 hrs
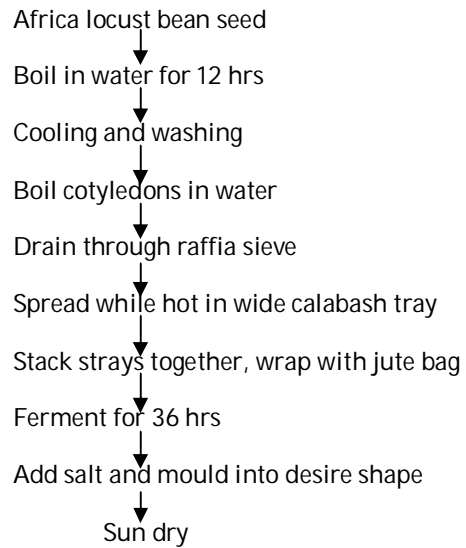↓
Add salt and mould into desire shape
↓
Sun dry

Fig. 1. Flow chart for traditional processing of locust bean fruits to food condiment (Odunfa *et al.*, 1985)

Table 2. Comparative proximal chemical composition of iru produced locally and sample from FIIRO

Components (%)	Unfermented locust bean	Fermented locust bean	FIIRO
Crude protein	30.0	44.2	45.3
Fat	15.0	28.4	31.2
Carbohydrate	4.9	16.4	15.9
Crude fiber	3.1	6.9	4.6
Ash	2.9	4.1	3.0

Source: Onnyi *et al.* (2004)

Fermentation is a process whereby beneficial bacteria are encouraged to grow. These bacteria increase the acidity or alcohol content of a food and therefore prevent the growth of spoilage and food poisoning bacteria (Traditional foods processing for profit). The use of an incubating material set up at optimum temperature of relatively 350°C has been discovered to reduce the time and also have better sensory properties than the one fermented locally (Adewumi and Igbeke, 1992). The physical properties of the incubating material used to determine the rate of fermentation. The higher the porosity, the higher the rate of fermented organ and faster the rate of fermentation (Onnyi *et al.*, 2004).

Preservation is an important purpose in processing. Spoilage is caused by three factors: micro-organisms, chemical reaction and enzymes. Appropriate preservative technique is necessary for different product. Iru may be preserved by grinding in a thick paste before mould into ball or circular platelet followed by sun dry. Spices, additives such as salt are incorporated before molding the final product while sun drying is

undertaken to facilitate its stabilization. Also, humectants, sugar, salt create unfavourable condition for micro organism and they retain nutrients to a desirable extent. Iru is very rich in protein and used as a meat substitute in many poor home of West Africa, since it proved meaty flavor in addition to stew and soup (Cambell-platt, 1986). The average daily intake in northern Nigeria is about 1.4% of the daily calories and 5% of the total protein and is the single largest source of protein in the average diet of inhabitant of Zaria in the Northern Nigeria (Odunfa, 1985); its decline in popularity especially among the growing urban population has led to rapid increase in the import of foreign cube flavor and its efficient preservation methods has led to the necessity to modernize production technique and optimize preservation method by addition of preservatives.

Materials and Methods

The study area

This study was carried out in Kwara state, which is one of the six states in north central Nigeria. The state lies in the north central zone and

covers an area of 74256 sq km or of the total area of Nigeria. Kwara state is bounded in the north by Niger state, in the south by Oyo, Osun and Ekiti states, in the east by Kogi state and in the west by Benin Republic. Because of its unique geographical position, the state is referred to as the "gateway" between the north and the south of the country. The state is divided into sixteen (16) local government areas. Kwara state was selected for the study because, in Nigeria the locust bean tree plants thrives well within the Guinea and Sudan Savannah areas as well as the lower Sahel regions of the country with a rainfall requirement of 600–1500 mm annually. Agriculture is the main stay of the economy with prevailing agricultural system combined with bush fallow and mixed cropping with emphasis on subsistent farming, while some engage in craft activities such as weaving, blacksmithing, bricklaying, carpentry, welding, etc. Fishing is also prominent along the lower River Niger Basin. Kwara state is a heterogeneous state attracting different ethnic groups including the Yorubas, Nupes, Barubas, Fulanis and Hausas. The major ethnic groups in the state are the Yorubas and their language is widely spoken across the state.

Sampling procedure and sample size

A purposive sampling technique was used to select 60 respondents for the study from Zone C of Kwara state agricultural zones (comprises of 5 Local Government areas: Ilorin west, east and south, as well as Moro, and Asa LGAs) were chosen out of the other zone in the state; because they are predominant area of production and marketing activities of locust bean.

Research instrument

Majority of the respondents (processors and marketers) are illiterates; hence structural interview schedule was used to collect the information on personal and socio-economic characteristics, processing and marketing as well as cost and returns.

Data analysis

Regression analysis was used to estimate the relationship between selected socio-economic variables and the net revenue. This is an economic tool for predicting the value of dependent variable given the values of the independents variables and measures the degree of association between two or more variables; hence, the coefficient of determination (R^2) shows the level of variation in dependent variable (Y), which is explained by variation in X(s). The model for this analysis is given below as follow:

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8)$$

where Y = Estimated profit, X_1 = Age (yrs), X_2 = Marital status, X_3 = Stall rent, X_4 = Quantity processed, X_5 = Years of experience, X_6 = Transportation cost, and X_7 = Educational level, and X_8 = Family size.

Also, enterprise budgetary analytical approach was used to estimate cost and return in locust bean processing and marketing so as to be able to know the net profit of the processors/ marketers. According to Adegeye and Dittoh (1985), profit is defined as the net flow of income. Thus, how profit is measured depends on what measure chosen to be used; in essence, profit indicates whether a business is worthwhile or not. Benefit Cost Ratio and Rate of Return on Investment were used to measure the profitability and determine the worth-whileness of locust bean enterprises.

Profit = Total Revenue – Total Variable Cost
Mathematically, $\pi = TR - TFC + TVC$

Where π denote Profit; TR is Total Revenue (amount realized from the enterprise); TFC is Total Fixed Cost (expenditure incurred on fixed assets used in processing and marketing e.g. calabash, pot-sieve e.t.c) and TVC is the Total Variable Cost (cost incurred processing and marketing locust bean e. g. cost of raw materials, transportation cost).

The Gross Margin (GM) equation is given as: GM $= TR - TVC = P \times Q - TVC$, where: GM = Gross Margin (in Naira), Q = Quantity of locust beans processed (₦ / 1.7 kg "congos"), P = Price of processed locust bean (in Naira).

Benefit cost ratio (BCR): is another measure of profitability. It was used to elevate and confirm the profitability of each respondent of locust bean processors and marketers. The formula is stated as:

BCR = Total Revenue (Benefit) ÷ Total Cost.

Investment criteria require that BCR should be greater than one {BCR > 1} before a business can be termed profitable (Adegeye and Dittoh, 1985).

Rate of return on investment (ROI): is another measure used to determine the worth-whileness of a business. Rate of Return = (TR – TC) / TC; hence, the higher the rate of return, the more profitable the business is.

Results and Discussion

Demographic characteristics of the respondents

Table 3 reveals that 78.3% of the respondents are within the age range of 21-40 years who are considered to the young agile and active in production and marketing of locust beans

therefore capable of the tasks involved in the enterprise. On the average the respondent were 30.6 years old. It also shows that most of the respondents were female (88.3%) while others were male (11.7%). The table further revealed that all the respondents had education at various levels, 43.3% had primary education, 25% had

secondary education while 31.7% had Arabic education, and it shows that low level of education is responsible to some of challenges, innovation and other technology ought to put in place, which results to level of their productivity.

Table 3. Frequency and percentages distribution of respondents according to their socioeconomic characteristics

Socioeconomic characteristics	Frequency	Percentage
Age group (Years)		
<20	05	8.3
21-40	47	78.3
41-60	08	13.3
Sex		
Male	07	11.7
Female	53	88.3
Education level		
Primary	26	43.3
Secondary	15	25.0
Arabic school	19	31.7
Marital status		
Single	10	16.7
Married	45	75.0
Divorced	05	8.3
Family size		
1-5	32	53.3
6-10	26	43.3
11-15	02	3.3
Year of experience		
< 10	13	21.7
11-20	23	38.3
21-30	17	28.3
31-40	07	11.7
Total	60	100.0

Source: Field survey, 2011

It also showed that 75.0% of the respondents were married, 16.7% are single and 8.3% are divorced. In addition, the table revealed that 53.3% of the respondent had 1-5 dependents; about 43.3% of them had 6-10 dependents while 3.3% respondents had 11-15 dependents. It is obscured that larger percentages of them have reasonable family size. The table further shows that majority of the respondents 66.6% have spent between 11-30 years in production and marketing of locust bean while 11.7% spent above 30 years and the remaining 21.7% accounted for those respondents that have spent less than 10 years experience in the business.

Regression analysis and socio-economic characteristics of the respondents with their profit

Regression analysis result as presented in Table 4 shows that, the coefficients of quantity processed, family size and years of experience in the enterprises are positive and significant at 1%, 5%

and 10% level of significance, respectively while the coefficient of education level and market stall rent is negative and significant at 1% and 5%, respectively. The implication of all these is that , the higher the quantity processed, the larger the net revenue obtained; then, the more the years processor/producers spend in business, the more the net revenue. Stall rent and education level is significant but has an inverse relationship with the net revenue as expected; all these are in conformity with a-priori expectation. The coefficient determination of 0.798 implies that the independent variables explained 78.9% of the total variation in the dependent variable which is the net revenue, while the remaining 21.1% is attributed to other factors not included in the model i.e. error term. The F-value was found to be significant at 1%; this implies that all the explanatory variables taking together have significant effect on the net revenue. Therefore, the null hypothesis is hereby rejected.

Table 4. Regression analysis result

Model	Variable	Beta	t-Test	Significance
	Constant	4.788	5.039	0.00
X_1	Age	0.248	1.039	3.03
X_2	Marital status	3.208	0.402	0.689
X_3	Stall rent	-4.6	-2.065**	0.509
X_4	Quantity processed	0.957	11.376***	0.000
X_5	Years of experience	0.174	1.761*	0.099
X_6	Transportation cost	-6.35	-0.067	0.34
X_7	Education level	-0.408	-1.720***	0.285
X_8	Family size	0.876	2.646**	0.332

a. Dependant Variable: Profit

n = 60
R^2 = 0.803 = 80.3%
Adjusted R^2 = 0.789 = 78.9%
F-value = 37.742
*   -Statistically significant at 10% probability level
** -Statistically significant at 5% probability level
* ** -Statistically significant at 1% probability level

Cost and return analysis

The profitability of locust bean processing and marketing enterprise was assessed using cost and return analysis. Total cost of each respondent was computed and Total revenue was estimated to determine the profitability of the processed locust bean enterprise. From the result of the analysis, the annual total cost of 60 respondents of the locust bean processor and marketers was calculated (using straight-line depreciation method to compute the total fixed cost) and the total revenue was estimated to be:

π = TR – (TFC +TVC) = TR – TC = (4,534,180 - 2,468,026: 00) = ₦ 2,066,154: 00
GM = TR – TVC = (4,534,180 - 2,405,620: 10) = ₦ 2,128,559: 90

Investment analysis

In order to further test for the profitability of the marketers and processors in the enterprises, the benefit cost ratio analysis and rate of return to naira analysis were computed (Table 5). It could be observed from table that 68.3% of the processors and marketers operate above the breakeven point while only 5.0% operates below breakeven point and 26.7% operates at breakeven point, that is, they neither gain nor lost. This shows that the business is profitable since majority of the respondents are making profit.

Table 5. Benefit cost ratio

BCR	Frequency	Percentage
< 1	3	5.0
1	16	26.7
> 1	42	68.3
Total	60	100.0

Source: Field survey, 2011

The result in table 6 below shows that, larger percentage (48.3) of the respondents realized average profit of between 0.1 k – 0.5 k as profit on every ₦1 invested in processing and marketing and 31.7% realizes between ₦0.6 k – ₦1 on every ₦1 invested, while 15% realize more than ₦1 on every ₦1 invested and only 5% run the business at lost. This shows that locust bean enterprise is a worth-while business.

Table 6. Rate of return on investment

Return on investment	Frequency	Percentage
< 0	3	5.0
0.1 – 0.5	29	48.3
0.6 – 1.0	19	31.7
> 1	9	15.0
Total	60	100.0

Source: Field survey, 2011

Conclusion

Locust bean is discovered from the researches carried out on it to be very nutritious, because of its high protein content in it (Alabi *et al.*, 2005; Oladele *et al.*, 1995). The processing and marketing of locust bean forms an essential compound of the rural cottage industry as the processors and marketers consider the net revenue derived from the enterprise as being sustainable to cater for their immediate needs; because low investment brings about low returns. The production is low due to use of rudiment equipment, time consuming, laborious, packaging and high wood consumption. Hence, the result of the research revealed that locust beans processing and marketing enterprise in Ilorin, Kwara state, Nigeria is a small scale enterprise which contributes and provided reasonable income and employment to many household members in the study area. For instance, the annual income accruing to the people in the enterprise was ₦2, 066, 154: 00 (USD 12,913 equivalent) is not compared favourably with the National Minimum wage of N18, 000 (USD 113 equivalent). The result did not agrees with that of Breman and Kessler (1995); Tee *et al.* (2009), well it may due to inflation rate. Fundamentally, the profit from the enterprise activities revealed that the people in the business were living far below the poverty line of $11,130 per year for one person or $14, 218 per year for a couple and $17, 374 per year for a family of three (Christian Boyle and Larry Mcshame, 2011) compare with $ 370 per year in 1990's (World Bank, 1990; Hauser and Pilgram, 1999).

Recommendations

Based on the findings of the study, the following recommendations were made:

1. Make the newly discovered method of processing (de-hullers, separators and press cookers) machine developed known and adopt by the processors at affordable and subsidized price to increase production and eliminate stress associated with the crude method.
2. There is need for improved method of preservation, packaging and marketing for the product to be acceptable in international markets by reducing the odour of the product without the loss of essential nutrients and palability in order to generate foreign exchange.
3. The tree with its economic value is threatened in its alternate uses as fuel-wood and charcoal; hence this should be guide against with rules and regulations.
4. Effort should be directed towards growing more of the tree to increase production of the seeds.

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