A cost-benefit analysis of the processing of a shelf stable cassava *fufu* in Nigeria

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Introduction

Cassava (*Manihot esculenta* Crantz) is the chief source of dietary food energy most widely grown in Nigeria (Dipeolu *et al*., 2003). *Fufu* (fermented cassava wet paste) is a widely consumed cassava product in southwest Nigeria, usually in the cooked ready-to-eat form. Other products like *gari* and *lafun* are the two most popular cassava products. The reason for this is that *gari* and *lafun* have a considerably longer and more stable shelf life than *fufu* (Dipeolu *et al*., 2001; Henry and Westby, 1999). *Fufu* production in its present forms (either the intermediate fermented wet paste or the ready-to-eat cooked forms) have been found to be a profitable venture (Dipeolu *et al*, 2000) and an enterprise that has significantly improved the livelihood of the processors in Nigeria (White *et al*., 2002). Nevertheless, one of the most important problems raised by the *fufu* processors is the low shelf life of *fufu*. In order to tackle this problem, Dipeolu *et al*., (2001) recommended the development of a shelf-stable, easily marketable form of the product that will also have the added advantage of improving the economic base of processors. In furtherance of this effort, the current study developed the dried *fufu* (dried cassava *fufu* paste) through an intermediate technology development process and pilot level validation. Apart from being more shelf stable, dried *fufu* has the added advantages of ease of preparation into the consumable form, and it is less bulky. Despite all these advantages, the adoption of dried *fufu* production as a new technology by the cassava processors is hinged especially on its profitability. This study therefore seeks to investigate the profitability of dried *fufu* production as a shelf stable product option for the consideration of cassava *fufu* processors in Nigeria. The study also determined the cost structure of production as well projected the cost-benefit analysis through a five year project period.

Material and Methods

Dried *fufu* was developed through the local fabrication of a Rotary Drier which uses electrical motor (to rotate the drying chamber or drum) and charcoal as the heat source for drying. Cassava wet pastes were purchased from trained processors in the rural locations close (about 3km) to the processing plant. These pastes were pressed to about 40% moisture content using a hydraulic press and grinded before the drying process. At the pilot level, the drying process took an average of three days per batch of 240kg of wet paste and a total of 480kg of wet paste per week. Dried *fufu* produced were grinded again and packed into 1kg polyethylene bags and sold at the rate of N100.00 per kg.

Data on the output produced, input used, cost incurred in servicing equipment used in the production process and the revenue generated from the sale of output from the pilot level production were taken on daily basis. Analysis of costs and return was done per year to determine the profitability of the project, while the measurement of the project worth was determined using Cost-Benefit analysis (Gittinger, 1982).

Results

Results

Table1: Table showing the analysis of cost and return of dried *fufu* production

Revenue	**₦**	% of TFC	% of TVC	% of TC
10,200kg of dried *fufu* at ₦ 100 per kg	**1,020,000.00**			
COSTS				
a) Fixed Costs				
Rotary Drier	26,666.67	74.89	-	3.08
Hydraulic Press	1,333.33	3.74	-	0.15
Grating Machine	4,666.67	13.11	-	0.54
Sealing Machine	845.50	2.37	-	0.10
Plastic Bowl	1,095.00	3.08	-	0.13
Rent on building	1,000.00	2.81	-	0.12
Total Fixed Cost (TFC)	**35,607.17**			**4.11**
b) Variable Costs				
Fufu wet paste	347,000.00	-	41.80	40.08
Polyethylene bags	7,500.00	-	0.90	0.87
Coal	37,400.00	-	4.51	4.32
Transportation	15,890.00	-	1.91	1.84
Staff salary	360,000.00	-	43.37	41.59
Dry milling of *fufu*	12,070.00	-	1.45	1.39
Maintenance and repairs	19,915.00	-	2.40	2.30
Electricity bills	14,400.00	-	1.74	1.66
Water bills	13,200.00	-	1.59	1.53
Miscellaneous	2,685.00		0.32	0.31
Total Variable Cost (TVC)	**830,060.00**			**95.89**
Total Cost	**865,667.17**			
Profit	**154,332.83**			
Profit per Kg	15.13			
Return to Investment	1.18			

Source: Computed from data collected at the pilot plant (2004)

Table 2: Table showing the cash flow analysis of dried *fufu* production for the first year

	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
A) INFLOW												
Output (Kg)	812	720	785	890	860	920	960	850	880	745	888	890
Revenue	81,200	72,000	78,500	89,000	86,000	92,000	96,000	85,000	88,000	74,500	88,800	89,000
B) OUTFLOW												
1. Overhead Costs												
Rotary Drier	400,000											
Hydraulic Press	20,000											
Grating machine	70,000						1,200					
Sealing machine	8,455											
Plastic bowls	990											
Rent paid on building	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Overhead Cost	**500,445**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**2,200**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**
2. Operational Costs												
Fufu wet paste	31,800	22,000	30,000	32,000	30,000	37,000	34,000	26,000	30,000	22,000	25,200	27,000
Polyethylene bags	7,500											
Coal	4,500	2,500	2,000	2,730	3,000	3,500	2,500	2,400	2,000	2,300	3,400	4,550
Transport	1,250	1,800	800	1,720	1,200	950	400	600	2,000	1,250	3,420	500
Staff salary and wages	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000
Milling of *fufu*	830	620	580	720	850	1,200	950	1,300	1,200	1,000	860	1,750
Maintenance & repairs	1,590	1,805	1,700	1,680	1,550	3,200	1,250	1,220	1,180	1,300	1,640	1,800
Electricity bills	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200
Water bills		1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100
miscellaneous	1,100	250	360	120	180	125	100	180	250	125	140	485
Operational Cost	380	**61,275**	**67,740**	**71,298**	**69,080**	**78,275**	**71,600**	**64,200**	**68,930**	**60,275**	**68,960**	**68,366**
Net Flow	**80,170**											
	-	9,725	9,760	6,710	15,920	12,725	22,300	19,800	8,070	13,225	18,840	19,635
	499,415											
CUMULATIVE NET FLOW	- 499,415	- 489,690	- 479,930	- 463,220	- 447,300	- 434,575	- 412,275	- 392,475	- 374,405	- 361,180	- 342,340	- 322,705

Source: Computed from laboratory experiment, 2004

Table 3: Table showing the measurement of project worth of dried *fufu* production over five years

Year	Overhead Cost (OC)	Incremental Cost (IC)	Gross Cost (GC) (OC+IC)	Gross Revenue (GR)	Incremental Net benefit (GR-GC)	Discount Factor (21%)	Discounted Gross cost	Discounted Gross Revenue	Discounted Incremental Net benefit
1	512,645.00	830,060.00	1,342,705.00	1,020,000.00	-322,705.00	0.826	1,109,074.33	842,520.00	-266,554.33
2	"	850,450.00	850,450.00	1,250,000.00	399,550.00	0.683	580,857.35	853,750.00	272,892.65
3	"	860,123.00	860,123.00	1,632,450.00	772,327.00	0.565	485,969.50	922,334.25	436,364.75
4	"	890,225.00	890,225.00	1,650,253.00	760,028.00	0.467	415,735.03	770,668.13	354,933.07
5	"	950,630.00	950,630.00	1,823,400.00	872,750.00	0.386	366,950.09	703,832.40	336,882.31
Total							**2,958,586.35**	**4,093,104.80**	**1,134,518.45**

Source: Computed from laboratory experiment, 2004.

NET PRESENT WORTH = ₦1,134,518.45
BENEFIT-COST RATIO = 1.38
CALCULATED INTERNAL RATE OF RETURN = 118%

Discussion and Conclusion

Profitability of dried *fufu* production: The profitability of dried *fufu* is presented in table 1. Fixed cost items as a percentage of total cost stand at 4.11%. While variable cost as a percentage of total cost stand at 95.89%. This implies that variable cost items exert more strain on the investment on dried *fufu* production than the fixed cost items. Therefore, processors should take note of these costs as very important items in the production process.

Measurement of project worth: The cash flow analysis of the project is shown in table 2. The results indicate that the project would not pay back the capital investment in year 1 but would pay back in year 2 (table 3); while for the remaining years the project would continue to yield profit. Moreover, the overall picture of the project worth is shown in table 3 where it is revealed that the project has a positive net present worth of 1,134,518.45 Naira indicating that the project is profitable. The benefit-cost ratio of 1.84 also indicates that for every N1 spent, a profit of 0.38 Naira is made. Furthermore, the internal rate of return calculated for this project stand at 118%. This is an indication that the project *ceteris paribus* can still break even if it sources loan at an interest rate of 118%, but this is impracticable since the un-official interest rate for bank lending in Nigeria is between 35% and 45%.

Despite the fact that production was not done at full capacity at the pilot level of this project, the overall picture of the dried *fufu* production gives an indication that it would be a worthwhile intervention towards improving the livelihoods of cassava processors in Nigeria because it was found to be a profitable venture. This suggests that it will be worthwhile if this technology is introduced to the target processors as a way of improving their livelihood and also chart a new development in the utilisation of cassava through value addition. Success of this intervention at the processor level however calls for intervention in the areas of availability of constant supply of electricity, cassava roots for the wet paste, a ready market and funding.

References

Dipeolu, A. O., Ayinde, I.A., Adebayo, K., Oyewole, O. B., Sanni, L. O., Pearce, D. M., White, J. L. and Westby, A. (2000). "Viability analysis of cassava processing in south-western Nigeria". Report submitted to the Department For International Development. Project A0898, December, 2000.

Dipeolu, A. O., Ayinde, I.A., Adebayo, K., Oyewole, O. B., Sanni, L. O., Pearce, D. M., Wandschneider, T. S., White, J. L., Tomlins, K. and Westby, A. (2001). "Commercialisation of *fufu*: Some issues of marketing in Ogun and Lagos States of Nigeria". *African Crop Science Conference Proceedings*, Vol. 5. pp 739-745. African Crop Society.

Dipeolu, A. O., Ayinde, I.A., Adebayo, K., Oyewole, O. B., Sanni, L. O., Pearce, D. M., Wandschneider, T. S., White, J. L. and Westby, A. (2003). "Challenges facing the cassava industries in meeting urban food needs in Nigeria". Paper presented at the Food Africa International Working Meeting, 5-9 May, 2003, Yaounde, Cameroon.

Gittinger, J. P. (1982). *Economic analysis of agricultural projects*. Second edition. Baltimore: The John Hopkins University Press for the Economic Development Institute for the World Bank.

Henry, G. and Westby, A. (1999). *Global cassava end uses and markets: Current situation and recommendations for further study*. FAO, Rome, Italy.

White, J. L., Adebayo, K., Dipeolu, A. O., Ayinde, I.A., Oyewole, O. B., Sanni, L. O., Westby, A., Wandschneider, T. S., and Tomlins, K. (2002). "*Fufu* processing and livelihoods in Ogun State, Nigeria". Report of a baseline study as part of Project A0898 carried out for the United Kingdom's Department for International Development (DFID). April 2002.

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