"Fufu" flour processing in Ghana: Costs, returns and institutional support expected to encourage young entrepreneurs

I. S. EGYIR & B. A. YEBOAH

Department of Agricultural Economics and Agribusiness, School of Agriculture, University of Ghana, Legon, Ghana

ABSTRACT

The introduction of "fufu" flour is an innovative business venture that young entrepreneurs should explore. However, the level of costs and returns as well as institutional support to sustain the industry is not well understood. This study was conducted to determine the profitability of "fufu" flour and the strength of the institutional framework. The criteria of Net Present Value (NPV), Internal Rate of Return (IRR), and Benefit-Cost Ratio (B-CR) were used for the investment analysis at 20 per cent discount rate. The results showed that the IRR was 57 per cent, and the NPV and B-CR were positive. As the project appraisal indices show worthiness, it can be concluded that "fufu" flour processing is economically feasible. A fairly developed institutional framework already exists (policy, regulatory agencies, and input and output markets); this enabling environment needs to be strengthened.

Introduction

Fufu" is a staple diet for most Ghanaians. It is mainly prepared from the combination of plantain and cassava, plantain and cocoyam, or yam alone. In the south and middle belts, plantain-cassava "fufu" is popular. The fresh foodstuffs are peeled, cut into pieces, and boiled. "Fufu" is pounded with a wooden pestle and mortar, and it usually takes the energy of two individuals to pound, which is a tedious task. One normally stands and powers the pestle downwards into the mortar in rhythmic trumps with full bodily force; and the other sits at the mortar, introducing the cooked foodstuffs along with water and turns the "fufu"

inside the mortar expertly, avoiding crushing the hands. The mixture is pounded to obtain a dough-like substance (paste), which is soft enough to swallow. The process could take a minimum of 1 h to prepare "fufu" for four people.

The laborious and time-consuming preparation of "fufu" is decreasing the frequency of consumption gradually amongst middle class working couples in the city (Johnson *et al*., 2003). The problem is that many women who used to be housewives have joined the workforce and have less time to prepare meals for the family; much of their time is spent commuting great distances to and from work. In addition, living spaces in the city are smaller and often not equipped with kitchens or outdoor cooking spaces. These factors influence how and why food is accessed in the urban context, resulting in the dependence on pre-prepared or convenience foods (Kennedy, 2003). This created a demand gap or an opportunity for the lovers of "fufu" to be provided with a kind that is convenient to prepare within a short period. Innovation in "fufu" flour production, therefore, becomes a paramount issue.

The experiments of the Food Research Institute (FRI) of the Council for Scientific and Industrial Research (CSIR) in the 1980s were, thus, firmed in 2000. The Agricultural Services Sub-sector Investment Programme (AgSSIP)-sponsored "Development of Small and Medium-scale Enterprise Sector", with the aim of producing cassava, plantain and other tuber-based products to meet emerging urban demand, was implemented to support the research efforts of the emerging "fufu" flour industry. Morrison & McDonald (2003) indicated that powerful long-run technological and social changes, leading to adaptations in production processes and food consumption pattern, have increased the demand for processed agricultural materials by changing the structure of food processing industries. Similarly, the use of the industrial "fufu" flour supposedly makes the preparation of "fufu" easier and faster.

The increase in demand for "fufu" flour would establish a large market for cassava, cocoyam, plantain, and yam (the principal raw materials). In accord with Ugwu & Ukpabi (2002), a widespread production of the cassava-plantain-based, high-grade product can, therefore, contribute significantly toward improving the stagnating trend in the production of these food crops in Ghana (Fig. 1). In addition, the excessive post-harvest loss would be curbed and business opportunity created for the private sector, especially young university graduates of agribusiness orientation.
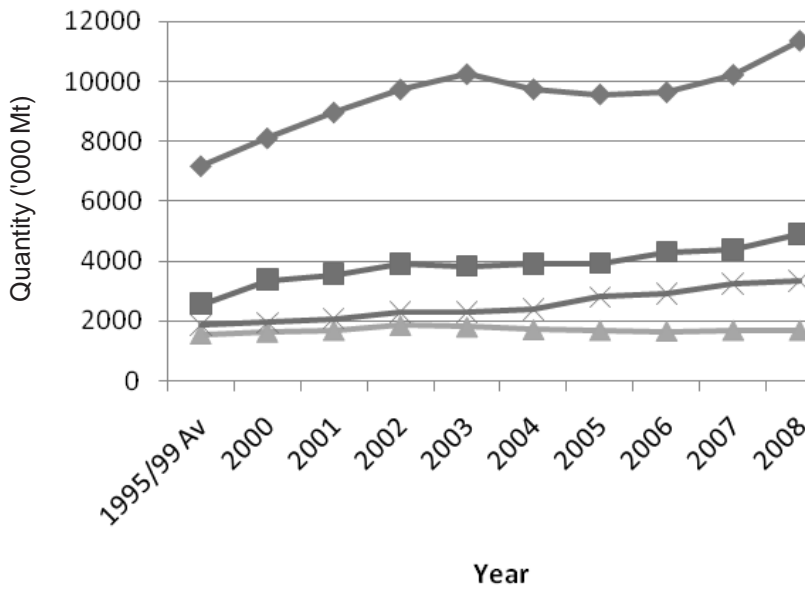
Fig. 1. Production of cassava, yam, cocoyam, and plantain in Ghana (1995-2008)

Source: Data for the Statistical Research and Information Directorate, Ministry of Food and Agriculture, Accra

Today, private sector participation is limited to a few companies: ELSA Foods Ltd, Leehouse and Chemicals Ventures (LCV), Neat Foods Limited, Tropical Foods Limited, and Sankofa M. A. Quality Foods. More investors, especially young entrepreneurs, are needed to be part of the plantain-tuber innovation system (plantain-cassava, plantain-cocoyam, plantain-yam). The young entrepreneur here refers to the fresh graduate with limited resources (technical knowledge, financial capital and managerial competence).

Such group of people are vulnerable and need to understand the wide range of opportunities in the business environment, especially one related to agriculture, the backbone of the economy of Ghana. The scope of agro processing industry encompasses all operations from the stage of harvest till the material reaches the end-users in the desired form, packaging, quantity, quality and price. In India, the importance of agro processing has been described as the sunrise of the economy, considering its large potential for growth. The socio-economic impact, specifically on employment and income, has been recognized (Kachru, 2001). Yet, only 14 per cent of the total workforce in developing countries is engaged; the potential for growth cannot be over-emphasized.

The value that is added to food and non-food products during processing enhances the income of producers if there is marketability and profitability (UNESCAP, 2003). Austin (1992) also asserts that effective agro processing is supported by linkages that ensure the flow of logistics, processing and market services in the product value chain. Four types of linkages identified are the Macro-Micro, Production Chain, Institutional, and International. The macro-micro linkage shows how national macroeconomic and sectoral policies create an incentive structure for firm-level activities by especially the private sector. The production chain linkages show how decisions made at the procurement, operations, warehousing and marketing and sales are interdependent and create value at different

stages of production. The institutional linkages show how organisations for markets, transportation and cooperatives act to facilitate production and marketing. International linkages concern elements such as make the relationship between the domestic and global market work. This study is concerned more with the production and institutional linkages.

The major objective of the study is to provide information about the cost and return elements as well as institutional framework to be expected.

Materials and methods

Conceptual framework

Measures of financial returns in this study border on production costs and benefits. In considering the cash flows of costs and benefits arising from investing in a "fufu" flour processing set-up, the time value or time preference of money needs to be considered (GH¢ 100.00 received today will be preferred to GH¢ 100.00, even at real prices, received a year later due to time preference). Hence, to find out whether benefits of investing in such a set-up outweigh its costs, a viability analysis is undertaken by computing the present values of the cash flows of costs and benefits through discounting. Calculating present values faces the challenge of choosing appropriate discount rates.

A discount rate reflects the riskiness of the project or events leading to the cash flows. One view is that this rate should reflect the opportunity cost of capital; but given the institutional and market rigidities characteristic of developing countries, to arrive at the correct opportunity cost of capital is no easy task (Ninan *et al.*, 2000). It is, however, assumed to vary between 8 and 15 per cent in real terms in developing countries (Gittinger, 1996). A second proposition is to consider the borrowing cost of capital. Many businessmen tap into the domestic financial market to finance projects in Ghana; so the going lending rate, which is estimated at an average of 19 per cent in Ghana, could be adopted. The third proposition is that it should reflect the social

time preference rate; that is, the rate at which society weighs future consumption *vis-a-vis* present consumption. This is assumed to reflect the market rate of interest. The maximum interest rate on time deposit for major banks in Ghana in 2008 was 15 per cent per annum, while some non-bank financial institutions pay interest rates of up to 20 per cent. In the analysis of this work, a discount rate of 20 per cent has been used. Another important variable in viability analysis is the economic life of the project or investment. The longest lifespan of the core equipment needed for "fufu" flour processing (mechanical dryer, disc mill, mechanical sieve and sealing machine) was taken as the economic life of the project beyond which there would be the need for fresh investment into capital equipment. The economic life of this project was taken to be 15 years.

Method of viability analysis

A technology is profitable if the net return on investment per annum is positive. The immediacy of benefits from a technology is also an important factor of technology adoption. Hence,

Net return = Gross return – cost of production; where, returns measure the value of gains due to processing, and the cost of processing is the accounting cost estimated from the sum of cost of capital, cost of machinery, and cost of structures and packages.

Some methods developed to aid decisions concerning technology adoption are (a) threshold models, (b) partial budgeting, and (c) cost-benefit analysis.

In the threshold model, the principle is simply that for any action; an entrepreneur should not act unless the benefit from acting is at least as high as its cost. The principle applies more to the profitability of pest management (Saphores, 2000). Partial budgeting is a standard technique of assessing the net benefits of a change in a farm enterprise. This method compares the profitability of one alternative, typically what is now being done, with a proposed change or new

alternative. Consideration of whether better alternatives exist, the risk involved, and the transitional costs and their effects on liquidity are necessary for final decision-making (Crawford, 1999). In this study, the "fufu" flour production is considered an innovation for consideration. No alternative is considered; hence, partial budgeting cannot be applied.

Cost-benefit analysis, also known as investment analysis, an aspect of capital budgeting, is the process of determining the profitability of an investment or comparing the profitability of two or more alternative investments (Gittinger, 1996). This profitability measure assists in deciding whether any particular investment will help a firm in maximising the value of the future cash flow, and requires that all costs and benefits be reduced to a single figure. In investment appraisal methodology, investment covers more than short-term or annual investments. It refers to the addition of intermediate and long-term assets to business. The method of appraisal required is, therefore, one which can be applied to a range of investment decisions. Most firms have used appraisal methods such as Pay Back (PB), Accounting Rate of Return (ARR), Net Present Value (NPV), Internal Rate of Return (IRR), and Benefit-Cost Ratio (B-CR). It has been emphasised that none of the above procedures makes a decision for the manager (entrepreneur); they only serve to provide information to the decision-maker. The use of any of these methods requires quality information that is reliable and consistent. Data requirements involve:

1. immediate cash outlay of investment (i.e. total cost of establishing a plant for processing),
2. net cash flow (i.e. periodic inflow and out-flow of costs and returns),
3. periodic depreciation of the fixed assets,
4. salvage value of plant (if any, at the end of its useful life), and
5. economic life of the project.

The PB method, which considers the number of years required for the stream of cash flows generated by the investment to equal the original cost of that investment, is simple and falls in line with ventures that require the avoidance and minimisation of risk. It is mostly useful as an initial screening advice before methods that are more appropriate are applied. Another simple method is the ARR, which considers all projects exceeding a 'target' rate of return as viable. However, like PB, it fails to recognise the time value of money; but it is still capable of providing an acceptable basis for deciding on relatively minor short-term investment projects.

The NPV and IRR approaches are appraisal methods that explicitly allow for the time value of money. The NPV method consists of discounting all future cash flows to the present value by means of some appropriate rate of interest. This rate of interest should reflect the minimum rate of return acceptable to the firm (or entrepreneur). Projects are worthy if the NPV is zero or positive. The NPV is calculated as the present value of benefits minus the present value of costs of investing in "fufu" flour processing. Current 2008 prices are used; cash flows are summed up for 15 years. It involved taking the current investment (in this case establishing the "fufu" flour processing plant) and projecting the future net income from the investment. The calculation includes the price received for the sale of the "fufu" flour in 2008 on the income side of the equation, and input costs and facility expenses on the expense side to arrive at the net value. Hence, the NPV is calculated using the formula:

$$NPV = \sum_{t-1}^{T} \frac{C_t}{(1+r)^t} - C_o$$

where, r is the discount rate, t is time in years, C_o is initial investment (building/land and equipment costs), and C_t is the net benefit in year t.

The IRR is the discount rate, which will cause the NPV of an investment to be zero. It is equal to the interest rate (r) that makes summed discounted benefits and costs equal.

However, the IRR has been described as

unreliable in ranking projects in which either different outlays are involved, or projects are mutually exclusive; because the IRR approach assumes that the reinvestment rate is equal to the indicated rate of return over the remaining life of the project. The NPV method requires reinvestment at a rate equal to the required rate of return used as the discount rate, which approximates the opportunity rate for investment.

The B-CRs of alternative investments in a business can also be compared. It is expected that investors will implement options with B-CR equal to or greater than one for all the appraisal models. Actual estimation of each variable is dependent on the economy. The discount rate is a measure of the opportunity cost of capital. Conceptually, the discount rate is the rate of return on the firm's best alternative (Crawford, 1999); it is usually taken to be the interest rate charged by the most common credit sources in the area of study, or the inter-bank interest rate on savings (Crawford, 1999). The consistency of firm level time series data required for analysis of discounted flow methods may limit the applicability of such methods. Monthly or yearly records on all activities concerning the processing and marketing of "fufu" flour with a particular technology ought to be available. However, isolating costs of specific activities is not a difficult venture for firms whose operations are carried out as a business. Yet, confidentiality claims by many of the firms (4 out of 5) visited by the researchers did not allow for multiple sources of data; as a result, this study is dependent on only one company's practice and validation of prices at market level. The company's name is Leehouse and Chemicals Ventures (LCV) Ltd.

Current investment evaluation

This section provides information on the profits gained for processing a batch (1050 kg) of "fufu" flour, using simple margin analysis. (A batch of "fufu" flour by LCV consisted of 1500 pieces of 0.70 kg boxes. The total weight of a batch is 1050 kg). The Profit formula is given as:

$$\pi = \text{TR-TC}$$

where π = profit,

TR = total revenue, the product of unit price and quantity sold of a batch (in January 2008, the price of a 0.70-kg Leemex "fufu" flour was quoted as GH¢ 2.65), and

TC = total cost, the sum of all variable cost and depreciation of fixed cost items.

The cost centres as well as their relative importance in the budget would be evaluated.

Following Austin's (1992) typology of cost centres, the "fufu" floor systems are categorized into three operating activities: Procurement, Processing, and Marketing. Austin (1992) explains that these operations involve the production, processing, transport, storage, financing, marketing, and regulation of the world's food and fibre products. Along these three operating activities, value is added to the raw materials. The value added as a result of the processing is used as part of the cost of processing. (*Appendix 1* shows values for this study). Hence, the following cost centres were identified:

1. Plantain and cassava: raw material to be processed.
2. Transportation: movement of cassava and plantain from major producing areas (e.g. Kumasi) to the processing site in Accra.
3. Energy: electricity for drying and other administrative activities.
4. Water: for washing
5. Labour cost
6. Machines and equipment: machines such as slicer, blancher, mechanical dryer, disc mill, hammer mill, mechanical sieve, mixer, and sealing machine. The slicer replaces the peeling process in the traditional method, the blancher is used for the cooking process, and the disc mill replaces the pounding of the "fufu" (for size reduction). The mechanical dryer is used for drying the boiled foodstuffs, the sieve is for obtaining the required flour smoothness, and the sealing machine is used to seal the polythene bags during

packaging.

7. Marketing: including packaging and distribution.

All costs, apart from that of machinery, were taken at face value. The cost of using the machines was taken as the depreciation which was calculated on the machines. The straight-line method of calculating depreciation was used.

Data collection

Data on prices and quantities were collected from the database of Leehouse and Chemicals Ventures, one of the major firms in the "fufu" flour processing industry in Ghana, in January 2008. As all the inputs were obtained from the market, the input and output markets were validated. Four major supermarkets, including one each in Madina, East Legon, Spintex and Osu, were visited to cross-check the output price. Input dealers in these locations were also visited to validate the input prices.

Three key policy documents were reviewed to determine the institutional and systems support for "fufu" flour production in the country. They were the National Science and Technology Policy (MEST, 2000) and the two Food and Agriculture Sector Development Policy 1 & II (MoFA, 2002; MoFA, 2007).

Institutional framework for "fufu" flour development

Before 2000, specific policies of agriculture and agro-based strategies were included in development plan documents. The roles that specific agricultural commodities could play in the development of industrial products were made clear when the first Food and Agriculture Sector Development Policy (FASDEP I) was developed in 2002. As part of the "Specific Commodity Policies", promotion of value addition of cassava and plantain into powder was targeted. The potential for the two commodities were seen in the current yields which were described as fair (7.8 Mt for plantain and 11.8 Mt for cassava) (MoFA, 2002). The current policy framework provides strategies which at the long run provide support for "fufu" flour processing and the agro industry as a whole.

Various technologies have been developed to aid in the processing of "fufu" flour. These include mainly the development and availability of machines and techniques that replace the traditional method of preparing "fufu"; that is, manually peeling of raw materials and pounding. These technological innovations are concentrated in the processing stage at which most of the transformation of the food crops into "fufu" flour occur. Some of these technologies are as a result of modern technological developments which support the agro food industry as a whole. Besides the fact that these innovations aid the agro food industry, they also result in value addition to the raw materials used.

For agencies and institutions, the PPMED of the MoFA collaborate with several stakeholder institutions to ensure that the policy intentions are implemented. The Food Research Institute (FRI) of the Council for Scientific and Industrial Research is leading the research into processed products. University departments offer courses in process engineering and agrifood business. Those in the University of Ghana and Kwame Nkrumah University of Science and Technology are well known. Private sector-dominated input dealers are in all the major cities (e.g. Accra, Kumasi, Takoradi). The Ghana Standards Board and Food and Drugs Board are working to monitor and enforce quality standards and food safety in processing and packaging. Supermarkets and convenience shops are springing up close to various residential areas in the city.

In short, the linkages among the private-public sector actors in the "fufu" flour innovation system are developing. All the major actors in the system are at post; *viz* research institutions, production firms, marketing firms and outlets, policy and regulatory bodies, and the final consumer. What remains to be done is a strong investment sector that uses the electronic and print media (now developed) to create awareness and ensure

increased demand for the "fufu" flour product.

The policy is developing; the technology support is improving. Before this, the question of profitability and worthiness in investing also needs to be clarified. This study seeks to determine whether there is a positive return on "fufu" flour production. The revenue generated must be able to cover the cost of raw materials, energy, transportation and marketing, among others.

Results and discussion

Table 1 shows the cost structure of "fufu". Apart from wages of staff and packaging, the cost of purchasing fresh plantain and cassava (the raw materials) are the highest cost elements, followed by distribution of final product, packaged "fufu" flour. About GH¢ 462.75 is required to purchase kilograms of plantain and cassava. The least cost item is water which was estimated at GH¢ 5.55 per batch of "fufu" flour. The least cost per batch (1050 kg), which is GH¢ 1930.15, suggests that "fufu" flour production is a capital intensive venture.

According to Ugwu & Ukpabi (2002), one way of increasing and sustaining the production of an agricultural product (such as cassava) is to process the cassava into high-grade products

with positive and high-value elasticity of demand. In their study, soy-cassava flour, a blend of cassava and soy bean flours, was produced and tested for consumer acceptability and economic viability. The production of the soy-cassava flour was identified to be profitable, with a pre-tax profit of close to ₦5,000 (equivalent to US$62.5 at a rate of US$1 =₦ 80) per tonne. They concluded that there was a high prospect for large-scale production and marketing of soy-cassava flour in Nigeria. Similarly, results of the profit evaluation show that "fufu" flour production is a profitable venture in Ghana; it has very high prospects. Using LCV January 2008 production data for a batch of "fufu" flour (1050 kg), a margin of GH¢ 844.85 was obtained (Table 2). The profit margin (ratio of profit to total revenue) was 0.30, implying that a firm makes a 30-per cent profit on each unit sale. On a tonnage basis, a total revenue of GH¢ 2,640.00 per tonne of "fufu" flour and a profit level of GH¢ 800.00 per tonne (equivalent to US$ 800 at a rate of US$ 1 = GH¢ 1.00 in January 2008).

Further analysis of results showed that in 2008 an initial fixed cost of ¢30,800.00 was acquired to start up the "fufu" flour processing plant or factory in Ghana. This included the cost of building a structure in which the equipment would be installed for production and the cost of

TABLE 1

Cost Structure for the Production of a Batch (1050 kg) of "Fufu" Flour by LCV in January 2008

Cost item	Cost incurred (GH¢)	Percentage (%)
Fresh plantain	250.00	12.95
Fresh cassava	212.75	11.02
Water	5.55	0.30
Drying of plantain and cassava	199.80	10.35
Packaging	315.00	16.32
Salary (for workers)	333.00	17.25
Depreciation on machinery for a production cycle (*Appendix 2*)	60.00	3.11
Transportation of raw materials to factory	185.00	9.58
Electricity (January 2008)	166.50	8.63
Distribution	202.55	10.49
Total cost	1930.55	100.00

Source: Survey data, 2008

TABLE 2

Estimation of Costs and Revenue from the Production of a Kilogramme of "Fufu" Flour

	Per batch	*Quantity (kg)*	*Per kilogramme*
Total cost (GH¢)	1930.15	1050	1.40
Total revenue (GH¢)	2775.00	1050	2.64
Profit (GH¢)	844.85	1050	0.80

Source: Data, 2008

Note: Total revenue, TR = GH¢ 1.85* 1500; TR: GH¢ 2,775.00

equipment themselves. The core equipment required include the mechanical dryer, disc mill, mechanical sieve, and sealing machine. In addition, there is a variable cost of GH¢14,674.00 per year, including the operational costs (cost of variable inputs). The implication it has for young, small and medium entrepreneurs that are needed to stay with such businesses is noteworthy.

The investment analysis results showed that at 20 per cent discount rate, the NPV was GH¢31,633.57 (Table 3). The positive value implies

that an investment in the "fufu" flour processing business would generate that much an amount over the period. The IRR was 48 per cent, which is much greater than the interest rate of capital. This means that the investor will make more than two times of the capital interest when they invest in the "fufu" flour processing. The B-CR (PVr/PVc) obtained was 1.33, which is greater than 1. This implies that every cedi invested will yield about 33 pesewas, making the venture a worthy one.

TABLE 3

Results of Cash Flow Analysis for "Fufu" Flour Processing (2008-2023)

Year	Fixed cost	Variable cost	Total cost	PVc	Total revenue (GH¢)	PVr	NCF
0	20000		20000	20000.00		0	-20000
1	10800	14674	25474	20728.33	27720	23187.5	1871.67
2		14674	14674	10190.28	27720	19322.92	9059.72
3		14674	14674	8491.90	27720	16102.43	7549.77
4		14674	14674	7076.58	27720	13418.69	6291.47
5	100	14674	14774	5897.15	27720	11182.24	5202.71
6		14674	14674	4914.29	27720	9318.54	4369.08
7		14674	14674	4095.24	27720	7765.45	3640.90
8		14674	14674	3412.70	27720	6471.21	3034.08
9		14674	14674	2843.92	27720	5392.67	2528.40
10	100	14674	14774	2386.08	27720	4493.89	2090.85
11		14674	14674	1974.94	27720	3744.91	1755.83
12		14674	14674	1645.79	27720	3120.76	1463.20
13		14674	14674	1371.49	27720	2600.63	1219.33
14		14674	14674	1142.91	27720	2167.19	1016.11
Total	31000			96155.46		128289.03	NPV=31633.57

Source: Data, 2008

Price of "fufu" flour = GH¢2.65 and Total Quantity produced per year = 10,500 kg

Conclusion

The introduction of "fufu" flour is an innovation in the plantain-tuber systems, and it is being embraced in all major cities in Ghana. However, the level of costs and returns as well as institutional support to sustain the industry are not well understood. Cost and return analysis using data from Leehouse and Chemicals Ventures (LCV), a major firm in the "fufu" flour industry, has shown that the initial capital (GH¢ 30,800.00) required for establishing the enterprise is high for young entrepreneurs, although the venture is profitable. It was realised that the revenue generated (GH¢2.65) is greater than the cost incurred (GH¢ 1.84) in the processing of a kilogramme of "fufu" flour. This translates to a profit margin of 0.30, which is explained as 30 per cent returns or profit made on a unit of "fufu" flour sold. When the time value of money was considered, positive NPV (GH¢31,633.57 at 20%) and B-CR (1.46) were obtained, showing that venturing into such a business was worthy (considering a 15-year lifespan). The institutional framework is fairly developed in that there are somewhat strong linkages between the actors in the plantain-tuber innovation system–people are linked to markets and the government's role in regulation, monitoring and evaluation is clear.

Four policy implications emerge: First, "fufu" flour processing is profitable, and it requires more than micro funds for successful establishment. Financial institutions are being urged to develop financial products that encourage agro processing firms such as the LCV to expand. New financial products that encourage new entrepreneurs (particularly young partners) to access funds of up to GH¢50,000.00 would be needed to start a new business. Second, the Ministry of Food and Agriculture and Ministry of Trade and Industry would be needed to step up its youth participation programmes by training young graduates of agriculture and agribusiness in diverse agrifood businesses such as "fufu" powder processing. It would be necessary for government to guarantee credit for the trained groups. Third, the Food Research Institute and the food engineering and post-harvest technology departments of various universities in Ghana need to be well equipped to strengthen training in agrifood processing and business. Finally, a sensitisation programme that draws the attention of consumers on the convenience of adding "fufu" flour to the household basket would be necessary. This should be carried out by entrepreneurs and the relevant ministries (Agriculture and Trade). When the demand side is ripe, activities of the supply side are sure to be sustainable.

REFERENCES

Austin, J. E. (1992) *Agro industrial project analysis.* The Johns Hopkins University Press, Baltimore and London.

Crawford, E. W. (1999) *Notes on an analytical framework for enterprise budgets in financial and economic analysis*. Department of Agricultural Economics, Michigan State University, East Lansing, Michigan.

Gittinger, J. P. (1996) *Economic analysis of agricultural projects.* Johns Hopkins University Press. Baltimore.

Gray, A., Boehlje, M., Amanor-Boadu, V. & **Fulton, J.** (2004) Agricultural innovation and new ventures: Assessing the commercial potential. *Amer. J. Agric. Econ.* **86** (5).

Harcourt, D. A. (2003) *Agro-food enterprises: Adding value and meeting consumer demand.* A Paper presented at Food-Africa International Working Meeting 2003, Yaoundé, Cameroun.

Johnson, P. T., Gallar, S., Oduro-Yeboah, C., Osei-Yaw, A. & **Westby, A.** (2003) *Sensory properties of instant "fufu" flour formulated from cassava starch and cassava flour of four high yielding Ghanaian varieties*. A Paper presented at Food-Africa International Working Meeting 2003, Yaoundé, Cameroun.

Kennedy, G. (2003) *Food security in the context of urban sub-Saharan Africa*. A Paper presented at Food-Africa International Working Meeting 2003, Yaoundé.

MEST (2000) *National Science and Technology Policy.* Ministry of Environment, Science and Technology, Accra, Ghana.

MoFA (2002) *Food and Agriculture Development Policy (FASDEP I)*. Ministry of Food and Agriculture, Accra, Ghana.

MoFA (2007) *Food and Agriculture Development Policy (FASDEP II)*. Ministry of Food and Agriculture, Accra, Ghana.

Morrison, C. J. & **McDonald, J. M.** (2003) Tracing the effects of agricultural commodity prices and food costs. *Amer. J. Agric. Econ.* **85**(3), 633.

Ninan, K. N., Jyothis, S., Babu, P. & **Ramakrishnan, V.** (2000) *Economic analysis of biodiversity conservation: The case of tropical forests in the Western Ghats*. Banglore: India-

Environmental Management Capacity Building Technical Assistance Project, ISEC.

Saphores, J. D. M. (2000) The economic threshold with a stochastic rest population: A real options approach. *Amer. J. Econ.* **82**, 541-555.

Ugwu, B. O. & **Ukpabi, U. J.** (2002) Potential of soy-cassava flour processing to sustain increasing cassava production in Nigeria. *Outlook on Agriculture* **31**(2), 129-133(5).

UNESCAP (2003) *Foreign direct investment in Central Asian and Caucasian economies: Policies and issues.* United Nations Economic and Social Commission for Asia and Pacific.

APPENDIX 1: Worth of Value Added in the Production Process

Stage of production	Activity	Value added (GH¢)	Total worth of value added (GH¢)
Procurement	Transportation of raw materials to factory	185	185
Processing	Water	5.55	
	Drying of plantain and cassava	199.80	
	Salary (4)	333	
	Depreciation on machinery for one production cycle	60*	
	Electricity (January 2008)	166.50	764.85
Marketing	Packaging	315	
	Distribution	202.55	517.55
Total Value Added			1467.40

APPENDIX 2: Annual Depreciation of the Machinery Used by LCV

Item	Original value (GH¢)	Useful life (years)	Salvage value	Annual depreciation (GH¢)
Mechanical dryer	8500	15	0	566.67
Disc mill	400	15	0	26.67
Mechanical sieve	1800	15	0	120.00
Sealing machine	100	5	0	6.67
Total Annual Depreciation	720			

Source: Survey data: January 2008.
Annual depreciation is GH¢ 720.00; therefore, depreciation per cycle or batch is 720/12 = 60