

AGRO-ALLIED INDUSTRIAL PROJECT PROFILES -  
A SMALL-SCALE RICE MILLING  
PROJECT IN GHANA

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## 1. RICE MILLING PROJECT

### 1.1. Project objectives

- To establish a small scale plant to produce milled rice from paddy.
- To stimulate increased production of paddy locally and thereby reduce dependence on imported rice.
- To conserve foreign exchange.
- To provide employment to rural population and thus assist in the control of rural-urban migration.

### 1.2. The Product

Milled rice from this project is for human consumption and has the following characteristics:

- white to creamy in colour
- not more than 20% broken grains.
- free from contamination with stones, insects, weeds and other foreign matter.
- free from contaminants which may be injurious to health.

### 1.3. Scope of Product Development

With the introduction of additional equipment, rice of a higher grade could be produced for a more sophisticated market if the demand so indicates. Furthermore, inclusion of parboiling processes will enable production of an additional product to satisfy another segment of the market.

## 2. THE MARKET

### 2.1. Consumer Analysis and Demand Forecasting:

#### 2.1.1 Potential Consumers

Rice is consumed in most parts of Ghana especially in the urban centres where its consumption is on the increase. Reasons for this increase in demand are attributed to

- (a) its durability which makes it easy to store in the home.
- (b) its ease of preparation into a variety of staple dishes, and
- (c) its readily acceptable flavour (taste and aroma) to most consumers.

These attributes make rice popular with prepared-food vendors and restaurants that cater for consumers of all income levels. The most popular rice-based dishes include:

rice-water :- a porridge that is usually flavoured with sugar and milk and taken with bread as breakfast.

jollof rice:- rice that is boiled in meat/fish stew with vegetables such as tomatoes, onions, chillis, etc.

wakye :- boiled rice and cowpea

plain boiled rice:- eaten with fish or meat  
soup or stew which may  
include leafy vegetables.

omo tuo :- boiled rice moulded into  
soft balls. Usually eaten  
with palmtree/agushie or  
groundnut soup.

Per capita demand for paddy rose from 12.2kg/head/yr in 1975 to 12.7kg/head/yr. in 1985 and is projected to reach 13.3kg/head/in 1990. Production levels within the last decade or more, have recorded shortfalls. The Ministry of Agriculture recorded a shortfall of 85,000 tons in 1988. Increasing demand for rice, in the absence of equivalent domestic production, has led to increased imports. FAO Food Aid figures (1988) indicate a sharp increase in rice shipment to Ghana from 11,200 tons in 1980/81 to 30,200 tons in 1986/87 from countries such as Australia, the EEC countries, Japan and the United States of America. These shipments exclude imports by private companies into the country.

Ghana was exporting rice to neighbouring countries in West Africa in the early 70s when domestic production was far in excess of demand. These export markets currently rely, to a large extent, on rice imports under various Food Aid agreements. As shown on the table below, the United States of America, Japan and the EEC countries are major donors under these agreements.

Rice "Food Aid" Shipment to Some  
West African Countries 1986/87

Recipient Country	Quantity '000 tons	Donor Country
Burkina Faso	4.6	Japan
Gambia	12.4	U.S.A, Japan, Norway
Guinea	59.3	USA, Japan, EEC, Australia
Guinea Bissau	6.2	EEC, Japan, Netherlands
Liberia	0.7	Australia
Mali	5.8	Japan, Switzerland, USA
Niger	5.5	Japan
Senegal	39.6	USA, Japan, Switzerland
Sierra Leone	31.7	USA, EEC, Italy, Japan
Togo	0.7	World Food Programme purchases

2.1.2 Sources of Data and Market Information

The Planning, Monitoring and Evaluation Division of the Ministry of Agriculture compiles monthly statistical data on wholesale and retail prices of major agricultural commodities in the district and regional centres of Ghana.

Internal and external trade statistics are available at the Statistical Services Division of the Ministry of Finance and Economic Planning.

Research institutions such as the Food Research Institute and the Institute for Statistical, Social and Economic Research have extensive information on market systems in the country.

2.2. Competition and Product Environment

2.2.1 Competitors/Manufactures

The Ghanaian market is presently supplied by both local and imported rice. Production of milled rice ranged between 46,000-56,000 tonnes in 1986 while consumption for the same year was 80,000 to 100,000 tonnes (WARDA). Imported rice forms a significant proportion (42%) of rice consumed in Ghana.

Of the 58% that is locally produced, the bulk is handled by small scale mills which are distributed in the rice-growing areas. These mills are concentrated in the northern part especially Tamale and its surrounding villages as well as in the southern towns such as Dawhenya, Ada, Asutuare, Kpong and Afife.

Some of these mills are jointly owned by private foreign companies with government as a shareholder. The others, privately owned by Ghanaians are mostly small scale. A few medium scale mills are owned by public institutions such as the Volta River Authority, Grain Warehousing Company, the Ghana Food Distribution Corporation and the University of Ghana Agricultural Research Station (Kpong).

#### 2.2.2. Substitute Products

Among the cereals produced locally for human consumption are maize; sorghum, millet and rice in order of significance in dietary patterns. Most of these other cereals are used for traditional staple dishes the preparation of which is laborious and time consuming.

### 2.3. Marketing Strategy

Locally milled rice is purchased at the mills in sacks (50kg each) and transported in trucks by distributors comprising the departmental/grocery shops and individuals. The shops sell in sacks at wholesale prices to retailers and consumers or they may re-pack the rice in household sizes of 2-5kg and retail it to consumers.

Individual distributors (mostly women) transport milled rice by road to wholesale markets where the product is sold to retailers. In the markets, rice is sold by the volume using various measures to suit the needs of individual customers. Some of the women distributors purchase and transport paddy from the farm gate to service mills where it is dried if necessary and milled for a fee. The milled rice is then transported to the wholesale markets for sale. It is estimated that at least 60% of locally produced rice is marketed by these middlewomen.

Imported rice makes up 42% of total national consumption. The bulk of imported rice received under Food Aid agreements is centrally controlled with the Ghana National Procurement Agency (GNPA) responsible for its storage and distribution.



Rice may be purchased from private importers at wholesale or retail prices depending on quantities purchased. The wholesale price of milled rice of the grade with 20% broken is US\$30-35 per bag of 50kg (1988).

A total annual output of 336,000kg (80% capacity utilization) is estimated as the minimum economic scale of production.

At a competitive ex-factory price of US\$29.0 per bag the milled rice is marketed to distributors to be sold on the nearest wholesale market.

### 3. THE PROCUREMENT

#### 3.1. Raw material

Paddy production and size of cultivated land during the period 1984 to 1987 are as shown below:

<u>Year</u>	<u>Area Cultivated (Hectares)</u>	<u>Production M.T.</u>
1984	69,000	76,000
1985	87,000	80,000
1986	76,100	69,000
1987	81,000	88,000

In the early seventies the northern parts of the country emerged as the major rice-growing area. Other areas with significant production levels include, Dawhenya, Asutuare, Kpong, Akuse, Ada, Afife and Afienya.

Currently the Irrigation Development Authority (IDA) of the Ministry of Agriculture has stations at Ashiaman, Dawhenya, Asutuare and Afife where local rice farmers operate under an irrigation programme. Local rivers have been dammed to irrigate these farms. Other inputs received by farmers include, machinery for land preparation, supply of improved seeds, fertilizers, herbicides, insecticides, and other chemicals needed for production. Financial support for the IDA projects is provided by a consortium of banks.

The four major systems under which rice is cultivated and proportion of cultivated land covered by each of these are irrigated area 5%, rain-fed upland 15%, rain-fed lowland 65% with the remaining as inland swamp.

The bulk of paddy produced in Ghana is milled locally for human consumption in the form of various local dishes.

Both paddy and milled rice are highly susceptible to deterioration during storage as a result of infestation caused mainly by rodents, insects and mould. Paddy is generally stored at moisture content of about 12% after sundrying for a period of 2-3 days. Effective storage techniques are employed on-farms and in the mills.

The Ghana Food Distribution Corporation has storage facilities in the various production centres in the country. Commodities stored by this public institution include maize, rice, cowpeas and groundnuts. The storage capacity of the corporation's facilities amounts to less than 5% of total national production of the commodities. Small on-farm storage cribs and warehousing at the mills account for the bulk of paddy that is stored prior to milling.

With the exception of the large mills that have purchasing centres in production areas, marketing and distribution of paddy is largely handled by itinerant middlewomen who transport paddy by road to milling centres or to wholesale markets.

For this project, raw material (paddy) is supplied by middlewomen at an agreed price based on quality and moisture content of the paddy. In addition a procurement officer employed by the mill travels by public transport to farms within  $\frac{1}{2}$  mile radius to organise the purchase and transportation of paddy to the mill.

#### 4. THE TECHNOLOGY USED AND LABOUR REQUIREMENT

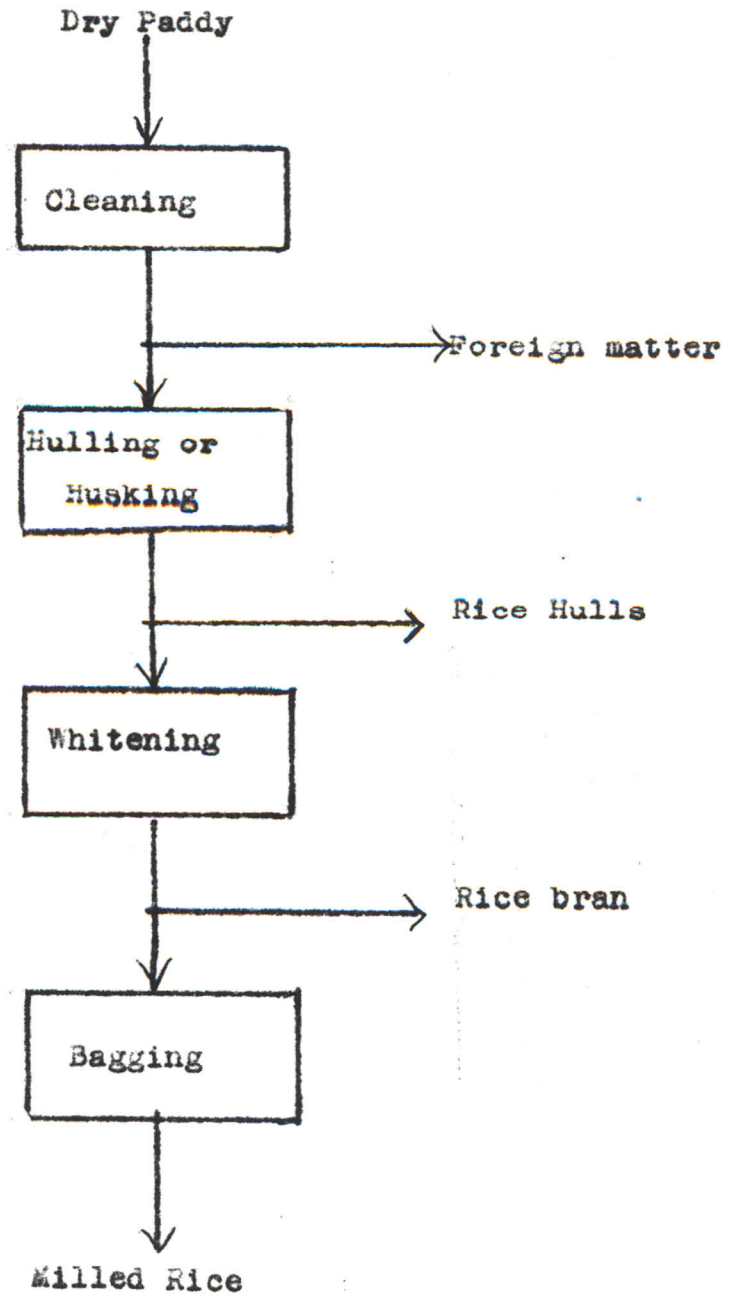
Technological options for the milling of rice range from pounding of paddy by hand to fully automated milling. Selected technology should meet quality of product that the market demands. Unnecessary investments can be avoided by matching sophistication of selected technology to market demands of product quality. The less sophisticated the market, the simpler and less expensive the technology. The technology selected for this project is to produce milled rice for the low to medium income groups.

Direct labour requirement is 4. The mill owner supervises milling operations and handles administrative work. Details of labour requirement are indicated below.

MANPOWER REQUIREMENT 1988

<u>Direct Labour</u>	<u>No.</u>	<u>Cost (US\$)</u>
Mill supervisor/operator	1	540
Mill operator	1	420
Unskilled labour	<u>2</u>	<u>720</u>
	4	US\$1680
 <u>Indirect Labour</u>		
Procurement officer	1	<u>420</u>
		420

Diagram Showing Stages in Rice Milling



Process Description of Small Scale  
Rice Milling

Drying

Harvested paddy is sun-dried on concrete floors or on tapolin to a moisture content of 13% to ensure safe storage.

Cleaning

Harvested paddy may contain weed seeds, stubble straw, stones, immature<sup>grain</sup> and iron objects (where harvesters are used). These foreign matter need to be removed before storage or before the milling operation. With proper harvesting techniques levels of these foreign matter may be minimised.

The IDA project provides mobile hand operated paddy cleaners to farmers for a fee. In these cleaning machines paddy is blown through an air flow to separate dust and lighter material; immature grains and cleaned paddy. In most small scale operations in Ghana, winnowing is predominantly used for the cleaning of paddy. The degree of cleaning is reflected in the quality of milled rice with respect to level of contamination. This is largely dictated by market requirements.

### Hulling or Husking

Hulling or husking removes the outer covering (hulls) of the paddy. The objective is to achieve this without breaking the brown rice grain. The husk makes up about 20% of the grain.

### Whitening

This operation involves the removal of bran and germ in order to produce clean creamy/white rice kernels. Bran together with the germ is separated as a by-product and these together make up about 10% of paddy. Bran is sold as a feedstuff for the poultry and animal industry.

A mixture of whole white grain (head rice), large brokens and small brokens are obtained from the whitener. The yield of this mixture is 70%.

In this project, both the hulling and whitening operations are performed in one machine which contains a rubber-roll huller and a steel roll whitener. Additional unit operations that are carried out in more sophisticated operations such as polishing and grading are eliminated from the technology selected for this project.

### Bagging

Both the milled rice and the bran are bagged separately in bags of 50kg and 25kg respectively.



LIST OF SUPPLIERS OF RICE MILLS

Manufacturer/Supplier	Throughput/Cost	Components	Year of Quotation
Leroy International Corp. P.O. Box 58071 Taipei, Taiwan Republic of China	300kg/hr. US\$4450 (in Ghana)	huller and whitener	1988
Alvan Blanch Development Co. Ltd., Chelworth, Malmesbury (SN16 9SG) Wiltshire, U.K.	up to 1 tonne per hour	cleaning machines	
Lewis C. Grant Ltd. East Quality Street Dysart Kirkcaldy KY1 2UA Fife, Scotland, U.K	100kg - 1 tonne per hour	cleaning machine huller, whetener, grader	
Rajan Trading Co. P.O. Box 250 Madras, 600 001 India	100kg - 1 tonne/lr.	hullers, whitening machines, grading machine	

Manufacturer/Supplier	Throughput/Cost	Components	Year of Quotation
John Gordon & Co. Ltd 196A High Street Epping CM16 4AQ Essex, U.K	up to 1 tonne/hr. 100kg to 1 tonne/hr. "	cleaning machines hullers whitening machine	
Satake Engineering Co. Ltd. Ueno Hirokoji Building Ueno 1-19-10 Taito-ku Tokyo, Japan	up to 1 tonne/hr. 100kg - 1 tonne/hr. "	cleaning machines huller whitening machine grading machines	
Henry R John & Son Inc. 140 Cedar Street New York N.Y 10006 U S A	100kg - 1 tonne/hr. " "	hullers whitening machine grading machine	

5. PLANT LOCATION

The rice mill is located at Afife a production area where small scale farm holdings operate under an irrigation scheme. Harvesting is done twice in the year. Access roads from this town lead to various production areas and markets for milled rice.

Infrastructure such as electricity, and water are available within a quarter of a kilometre from the nearest point. Facilities for housing are available within the township.

INITIAL FIXED CAPITAL 1988

<u>Item</u>	<u>Cost (US\$)</u>
Land ( $\frac{1}{2}$ acre) and site preparation	3,000
<b>Building:</b>	
Paddy Store           (140 <sup>m2</sup> )	
Milling Room         (25 <sup>m2</sup> )	
Milled rice store } (25 <sup>m2</sup> )	
Rice bran store    } (25 <sup>m2</sup> )	<u>10,000</u>
	13,000
<b>Equipment and Machinery:</b>	
1 Rice Mill comprising a rubber roll huller and a steel roll whitener with electric motor and a set of fittings.	4,450
Installation Cost	<u>223</u>
TOTAL FIXED CAPITAL	US \$ 17,673
WORKING CAPITAL (2 months)	28,999
PRE-OPERATION COST	<u>300</u>
TOTAL CAPITAL INVESTMENT	<u>46,972</u>

Estimated Production Costs (1988)

It is assumed that the plant has an installed capacity of 300kg/hr, operates 8 hrs. per day for 250 days a year.

Item Quantity per 100% utilization	COST (US \$)		
	80%	CAPACITY 90%	USED 100%
Raw Material 300kg/hr.	149,268	167,927	186,585
Packaging Material (8400 pieces)	4,032	4,536	5,040
Direct Labour (4)	1,680	1,680	1,680
Electricity 8 KW	690	776	862
Water (12,000 gals)	321	321	321
Administrative Cost (Labour, insurance 3%, (interest on ₦20,000.00 { at 21%; transportation, (stationery	9,990	9,990	9,990
Depreciation (10% building, (10% machinery)	3,067	3,067	3,067
Maintenance (5% Building, ) (10% machinery)	2,417	2,417	2,417
Total Production Cost (US\$)	171,465	190,714	209,962
Less cost of bran (10% yield) (US\$)	5,760	6,480	7,200
Actual Production Cost (US\$)	165,705	184,234	202,762
Total output of milled rice (kg) (70% yield)	336,000	378,000	420,000
Cost per kilo milled rice (US \$)	0.49	0.49	0.48

6.1. Estimated Working Capital - Rice  
(2 months)

I t e m	C O S T (US \$)		
	C A P A C I T Y		
	80%	90%	100%
2 months production cost	27,618	30,706	33,794
5% Contingency	1,381	1,535	1,670
Total Working Capital	28,999	32,241	35,464

6.2. Sources of Finance

The development banks such as the Agricultural Development Bank, the National Investment Bank, the Social Security Bank as well as the Commercial Banks are possible sources of financing.

Equity for the project could be obtained through shareholdings owned by Ghanaians.