

**IMPROVING THE COMPETITIVENESS AND  
MARKETABILITY OF LOCALLY-PRODUCED  
RICE IN GHANA**

**DEPARTMENT FOR INTERNATIONAL DEVELOPMENT  
(DFID)**

**CROP POST HARVEST PROGRAMME**

**PROJECT R6688**

**FINAL TECHNICAL REPORT**

**Research carried out during 1996 - 1998**

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# CONTENTS

	<b>Page</b>
<b>Executive Summary</b>	<b>1</b>
<b>Background</b>	<b>3</b>
Regional context	<b>3</b>
Rice Production	<b>4</b>
<b>Rice Policy in Ghana</b>	<b>5</b>
Researchable constraints	<b>6</b>
<b>Project Purpose</b>	<b>7</b>
<b>Research Activities</b>	
Phase 1 - Marketing and Production System studies 1996/97	<b>8</b>
Phase 2 - Post harvest System Technical and Socio-economic studies 1997/98	<b>10</b>
<b>Outputs</b>	
Rice Marketing in Ghana	<b>11</b>
Marketing chains	
Marketing margins	
Prices/trade flows	
Summary of findings	
Rice Production Systems in Ghana	<b>14</b>
Survey results	
Profitability of rice production systems	
Policy Implications	
Postharvest assessment	<b>16</b>
Postharvest practices	
Losses	
Consumer preferences	
Rice processing	
<b>Contribution of Outputs</b>	<b>22</b>
<b>Project Reports</b>	<b>24</b>

## Executive Summary

1. This research was funded by the Department for International Development's Crop Post Harvest Programme.
2. The objective of the research was to assist in the development of a post-harvest strategy for local rice production, based on validated research information, which would help support improved and sustainable small-scale processing of rice in Ghana.
3. Major activities conducted were:
  - Appraisal of the rice marketing, pricing and distribution system.
  - Rice production system identification and survey.
  - Assessment of comparative profitability of rice production systems
  - National survey on postharvest practices in the rice industry.
  - National survey of consumer preferences and price/quality relationships for rice
  - Loss assessment survey in selected regions.
  - Techno-economic evaluation of rice processing enterprises.
  - Presentation of findings and recommendations to key focus group
4. The project confirmed that, under the present liberal trading regime, rice consumption was increasing by over 20% per year and that most of this increase was being met by imports. The net effect of these increasing imports was that the quality levels and price of imported rice were now dictating the price of locally-produced rice with an increasing trend for Ghanaian consumers to demand better quality.
5. Local rice from the major irrigation schemes processed in modern commercial mills was found to be of acceptable quality and was marketed successfully against the 'non-premium' imported brands in Accra. Outside of the major irrigation schemes in the south the marketing system is mainly in the hands of small women traders buying relatively small lots. The marketing system does not appear to send price signals down to the farmer offering reward for quality.
6. Margins in the system appeared fair and reasonable with farmers getting 70% of the retail price, traders 10 to 12%, millers 2 to 4% and retailers 9% to 10%. At wholesale and retail levels price differentials did operate between rice samples of different quality. These were most pronounced in the Upper East and Upper West Regions and least noticeable in the Northern Region. It was reported that the major problem in quality was the dirt and foreign matter that the rice contained resulting from deficient postharvest operations.
7. Whilst farmers could easily dispose of their crop, the poor quality of the rice produced for sale resulted in a low retail price with knock back effects on subsequent farm prices.

8. In the production systems survey data was assembled for:

- cropping systems
- resource allocation
- farmers' practices
- farm budgets
- major constraints

9. In the northern areas yields were said to be stagnating or even decreasing due to lowering soil fertility although total production was thought to be increasing due to growing numbers of migrant farmers and increasing awareness of marketing opportunities. Similarly, in central inland valleys, a majority of farmers claimed that rice production was increasing and associated this increase with rising profitability of the crop.

10. Crop budget data generated by the baseline surveys of the rice production systems was analysed using a Policy Analysis Matrix (PAM) model approach. Estimates of social profits for the three rice systems indicated that the irrigated systems generated profits that were more than 3 times higher than their upland counterparts and about 17 percent higher than the lowland systems. The divergence between private and social values indicated that world market prices for rice are lower than the price of domestically produced rice.

11. The PAM analysis showed that all domestic rice production systems are privately and socially profitable. The implication is that Ghana has the comparative advantage to produce rice. The comparative advantage seems to be largely influenced by high domestic prices of locally produced rice, in spite of the high tariffs on imported rice.

12. Postharvest studies concluded that, although some physical loss of paddy occurs during harvesting, threshing, drying and storage, the loss is generally low or well contained. There is wider concern about the qualitative loss of paddy and, more particularly, milled rice. Extensive qualitative loss occurs during harvesting, threshing, drying and parboiling.

13. Not all local rice was of poor quality. Some of the irrigated rice schemes with industrial milling facilities produced a good quality rice with low levels of brokens which could compete favourably with some lower quality types of imported rice. In northern Ghana, especially in Upper East and Upper West regions, good quality, parboiled rice was available and, in some areas, buyers are known to pay a premium for the quality product.

14. The main problem with local rice as perceived by consumers is poor quality as exemplified by poor visual appearance, (colour), high levels of foreign matter and a high proportion of broken grains. Traders also identify the degree of milling as an important characteristic and consumers are concerned about the cooking qualities such as expansion ratio and aroma. Notwithstanding the perceived poor quality, local rice finds a ready market. In a survey of rice consumer preferences, the proportion of respondents reporting that they regularly purchase/consume local rice, in three major cities, Tamale, Accra and Kumasi, was 74%, 40% and 38.1% respectively.

15. Most of the rice produced in Ghana is processed by small-scale operators. Simple technology, available on a custom basis, generates considerable employment and profits for the informal sector. Ease of entry is substantial due to the relatively low initial investment costs. While it appears there is a ready market for the local product it appears that millers and parboilers do not have access to information on how to improve their practices.

16. Mills are under utilised and most operators have not been trained in use and adjustment of mills which affects both rice quality and outturn quantity. Locally fabricated spares are often of poor quality and mills equipped with aspirators are very rare. As there were no millers found to be buying paddy and milling it for retail sale, there is currently little incentive for them to maintain and adjust their mills to produce good quality rice. Profitability of operations was very difficult to assess as no records were kept of throughput, takings and expenditure. Although the steel huller mills make a lower profit per bag than the rubber roll mills the project study estimated their daily operating costs are about one-third that of rubber roll mills. It is proposed that it is at the milling level that significant qualitative improvements could most cost-effectively be made.

17. Parboiling of rice, particularly in the north, is widespread. If family labour was valued at its opportunity cost, parboilers in the Northern region would be making a loss on each bag of rice sold. There is considerable regional variation in parboiled rice quality resulting from minor differences in technique with parboiling almost exclusively carried out at village level. Resource constraints of labour, water and fuel were all cited.

18. The studies conducted under this project suggest that rice produced by smallholders in the inland valley and upland systems is meeting a localised market demand for niche products and is not in a position to compete in terms of productivity or quality with imported rice. Although the better quality raw rice from the irrigation schemes in the south has been shown to compete for market share in urban markets, there remain question marks concerning the real profitability of irrigated rice when all development, or sunk, costs are factored into the analysis. Notwithstanding the narrow profitability issue, attempts to improve competitiveness in this irrigated sub-sector may be overshadowed by government policy to favour the development of more valuable cash crops in the irrigation schemes at the expense of rice.

19. Within the constraints of the local rice industry as defined by the project the research has highlighted the following areas for further research, innovation and policy change:

*Seed quality; Harvesting; Threshing; Parboiling; Milling*

## **Background**

### **Regional context**

20. Prior to the start of this project it had been established that rice was rapidly becoming the preferred staple for urban populations throughout the West African Region; and as domestic production had not kept pace with the increase in demand, imports of rice into the region had increased dramatically. The region, with a population of somewhat less than 30 percent of Africa's total population, was importing around 60 percent of Africa's total rice imports at an annual cost of around \$645 million in 1994. The imports as a whole represented about 30 percent of West Africa's demand for rice, and the disparity between production and imports was likely to grow in order to meet the escalating requirements of urban consumers.

21. In the early 1970's, the 15 member countries of the West Africa Rice Development Association, WARDA, imported about 26 percent of their rice requirements; by the early 1990's, these countries were importing around 34 percent of their requirements.



22. In the specific case of Ghana, the situation was even more marked than that noted for the Region as a whole. In the early 1970's Ghana imported somewhat less than 20 percent of its rice requirements whereas by the early 1990's imports accounted for around 75 percent of the country's rice consumption. Rice was becoming increasingly more important in the Ghanaian diet, especially among urban consumers. Statistics from the Ministry of Food and Agriculture (MOFA), Accra, showed that the total rice demand increased from 113,000mt in 1989 to 122,000mt in 1992. However a 1994 study suggested that rice demand had been growing at an even faster rate than that indicated by MOFA. Using rice import and production statistics gathered from various sources the study suggested that the total rice supply/consumption was twice that estimated by MOFA. This study, commissioned by USAID, estimated that the rice demand increased by almost 80 percent from 151,840mt in 1989 to 271,380mt in 1992. Whilst estimates of rice imports varied, all sources indicated that the trend was increasing. Depending on the source, the 5-year average from 1988 to 1992 for rice imports was between 110,000mt and 181,000mt

### Rice production

23. Rice is one of the major food crops in Ghana. Its popularity is increasing among both rural and urban dwellers due mainly to the ease of its preparation. Per capita consumption is about 8kg/head/year. Estimates for local rice production in recent years vary from 80,000 tonnes to as high as 200,000 tonnes with a latest 1996 estimate of 140,000 tonnes. Some 60-70% of the rice grown in Ghana is produced in three regions, the Northern, Upper East and Upper West (Table 1) It is not clear what proportion is currently grown on small scale farms, or processed using small scale technology in any of the regions. Recent market survey work had found that rice from the Upper East region was considered to be of better quality than rice produced in the Northern region, although historically more rice is produced in the northern region. Market appreciation of variations in quality of locally produced rice also increases as you go north and as competition from imported rice decreases.

Table 1- Area of Rice Production by region

Western	10,900 ha
Central	600 ha
Eastern	8,000 ha
Greater Accra	700 ha
Volta	7,800 ha
Ashanti	6,400 ha
Brong-Ahafo	6,700 ha
Northern	24,000 ha
Upper West	3,000 ha
Upper East	31,800 ha
<b>GHANA</b>	<b>99,900 ha</b>

Source: PPMED for year 1995 quoted from GLG-SOFRECO (1996)

24. In Ghana, rice is produced in three major ecologies:

- (i) hydromorphic rainfed upland (mainly in Northern Ghana)
- (ii) hydromorphic rainfed lowland - inland valley swamps (mainly in Southern Ghana)
- (iii) under irrigation (in Northern and Southern Ghana).

25. The first two ecologies account for nearly 90 percent of total production. Yield levels are generally very low, 0.5 to 1.1 tonnes per hectare except under irrigation where 3.5 to 7 tonnes per hectare are obtained. Some of factors which account for these low yields are reported to include; high cost of inputs, lack of adequate and dependable water supply, ineffective weed control measures, poor soil drainage and fertility management practices.

26. In these three ecologies the main harvest season for both rain fed (be it classified as upland, hydromorphic or inland valley) and irrigated rice is during the dry season in November/December. Prevailing weather conditions at this time necessitate parboiling of the paddy to ensure a reasonable head rice yield. Only the second crop from the irrigated schemes may be milled raw therefore it is assumed that most of the rice coming out of these growing areas is parboiled.

### **Hydromorphic Rainfed Upland**

27. Farmers in Northern Ghana cultivate mainly what they term "lowland and upland rice fields" which technically are referred to as hydromorphic systems. Rice fields are fallowed for between 1 to 5 years with an average of 3 years. The use of tractors for land preparation is popular, accounting for 73 percent of all rice fields cultivated in northern Ghana. Hoe users account for about 20 percent and the remaining 7 percent use bullocks. There are some 9 different types of rice varieties cultivated in northern Ghana. The most common is the local *Oryza glaberrima*.

### **Hydromorphic Rainfed Lowland/Inland Valley Swamps**

28. Farmers in the valleys mostly grow rice as a sole crop in the valley bottoms but may have upland fields sown to crops like cocoa, rubber, oil palm, citrus, plantain, yam, maize, among others. Rice is planted between March and June and, on average, rice farmers cultivate the same piece of land for only one season before moving to another field. Where, for want of land, farmers are compelled to stay in one place for prolonged periods they alternate their rice plantings with maize or vegetables.

29. The majority of the farmers in the valleys plant the local rice varieties (*O.glaberrima*) which are either white or slightly red in colour and mature within 5 to 6 months. The few improved varieties planted mature within 4 to 5 months.

### **Irrigated Systems**

30. The Ghana Irrigation Development Authority (GIDA), the organisation that oversees all irrigation projects in Ghana, has 20 on-going irrigation projects scattered throughout Ghana. This covers an area of about 8,000 hectares. The area developed for irrigation forms about 0.07 percent of the total agricultural land area of Ghana. Irrigated rice projects are found in the different agro-ecological zones in the southern and northern sectors of Ghana. Most of the farmers, about 82.7 percent, on the rice projects are engaged full time in rice production.

31. Cropping activity is determined by the onset of the rains, with the major seasons beginning in March/April for the southern sector and May/June for the northern sector. The second seasons (minor) begin from September/October and ends in January/ February in the southern sector.

32. There are about 13 different varieties of rice cultivated on the various rice projects in Ghana. These are all improved varieties obtained by GIDA from sources such as IITA, WARDA and the University of Ghana Research Station at Kpong. Rice yields vary from 4

mt/ha to 6 mt/ha with an average of 4.6 mt/ha. Yield levels are directly related to the amount of water available.

## **RICE POLICY IN GHANA**

33. When Ghana became independent in 1957, the new government inherited a ten-year development plan from the colonial administration in which expansion of rice production was emphasised. Subsequent development plans like the seven-year development plan (1963-1970) specifically recognised rice as one of the cereals to be developed and its production later increased substantially. Targeted figures indicate that rice was projected to increase by 188 percent while maize and other cereals (sorghum and millet) were projected to increase by 60 percent and 24 percent, respectively. Rice from the public sector was to increase by 100 percent. In order to realise the goal of modernising agriculture and increase food production (including rice), the government encouraged large scale farming (mainly by the state) and irrigated rice production, particularly in Northern Ghana where conditions were relatively more favourable. The Government established the State Farms Corporation (SFC) in 1962 as part of the programme to modernise agriculture. Three state farms were set up for large scale rice cultivation, in addition to other crops and animal husbandry.

34. Following a change in government in 1966, a two-year development plan (1968-1970) was launched. The rice industry featured prominently under the agricultural sector of the plan. Seed multiplication programmes were started for foodgrains (including rice), and the Agricultural Development Bank was established to provide credit to farmers.

35. In January 1972, the then government, the National Redemption (NRC) launched the "Operation Feed Yourself (OFY)" programme to increase food production. Rice, maize and sorghum were the major food crops which featured in the OFY programme.

As part of the ERP which was launched in 1983, a programme for the agricultural sector: Ghana Agricultural Policy - Action Plans and Strategies (1984-86)" was implemented. Highlights of the plan included self-sufficiency in the production of cereals; maintenance of adequate levels of buffer stocks of grains, particularly maize and rice, to ensure availability of food during the lean season (March - July); price stability and provision of maximum food security against unforeseen crop failure and other natural hazards.

36. The second phase of economic reforms (1986-88) emphasised increased productivity and internal price stability in the agricultural sector. The government actively promoted cereal production in pursuit of food security objectives. For example, every year the government raised the guaranteed minimum price for maize and rice, which had been in operation since the late 1960s.

37. Under the third phase of the adjustment process (liberalisation and growth phase), which started in 1989, the major goals included deregulation of commodity and service markets to reduce domestic price distortions, as well as liberalisation of export and import markets. The food and agricultural development strategy of the government was set out in the "Medium Term Agricultural Development Programme (MTADP)". As part of the liberalisation programme, the guaranteed minimum price for maize and rice were abolished and all subsidies removed, including subsidies for agricultural inputs, notably fertilizers and insecticides.

38. As of 1995, MOFA outlined specific policies centered on the production, importation and marketing of rice:



- \* In the short run, use unrestricted rice imports to meet current demand
- \* In the long run, promote increased production of rice in order to reduce rice imports to save scarce foreign exchange
- \* Deregulate the pricing system to engender competition which promotes efficiency and higher rewards for quality products
- \* Strengthen the process of technology transfer by reorganising the extension services and linking it more effectively with research and farmers
- \* Provide financial assistance to small-scale and resource poor farmers to support rice production
- \* Assist in marketing locally produced rice.

### **Researchable constraints**

39. In attempts to define a coherent research strategy for the rice sub-sector, an international workshop in 1994 had addressed the theme 'Towards Rice Self-Sufficiency in Ghana' and had identified a number of anomalies in prevailing views. One of these concerned an on-going debate concerning the impact of trade and market liberalisation on domestic rice production. Given statistics showing a large shortfall between domestic production and domestic demand, it was argued that macroeconomic trade liberalisation policy under the Economic Recovery Programme had led to large imports of rice, which, in turn, could be acting as a potential disincentive for rice production in Ghana. The other side of the debate argued that imports were not acting as a disincentive claiming simply that current production levels could not keep up with current demand. A recent survey had indicated that the market prices for Ghanaian rice compared favourably with those of competing imported grades and that domestically produced rice could, therefore, be compared with imports of similar quality.

40. Interviews with private traders had revealed that the availability of domestic supplies was frequently a problem, even in the north of the country where much of the rice is produced. Traders had indicated that they preferred distributing imported rice over locally grown rice, as supplies were more dependable.

41. In regard to post-harvest issues, it was known from an earlier NRI study that problems existed at all stages of the rice processing and marketing chains. Amongst the more notable of these were: (a) information on the rice quality characteristics demanded by West African consumers; (b) the lack of reliable and quantified data concerning product losses from harvest to consumer; and (c) the relatively poor quality of locally produced rice when compared to the general quality of imports.

42. Whereas rice had been identified as a focus crop in the National Agricultural Research Plan (NARP) launched in 1994, the ensuing research programme concentrated its activities on production and breeding topics to the exclusion of postharvest problems. The DFID Plant Science Research Programme had been identified as a funding source in support of some of this work.

## **Project Purpose**

43. To assist in the development of a post-harvest strategy for local rice production, based on validated research information, which will help support improved and sustainable small-scale processing of rice in Ghana. The project was aimed at appraising pre- and post-harvest factors potentially responsible for the poor marketability of locally produced rice against imports, as a **first step** to redressing the situation.

## Research Activities

### Phase 1 - Marketing and production system studies. 1996/97

#### *Overview*

44. An initial workshop held in mid-1996 introduced the project to potential collaborators and representatives of the national rice research programme. The project suffered in its initial phase from difficulties encountered in establishing contractual relationships with NARP institutions which delayed the start of scheduled socio-economic activities.

45. Working together with three collaborative institutes, NRI marketing economists coordinated a series of informal and formal surveys of all important rice production systems and limited rice marketing studies in the important trading areas. A further agreement was concluded with a fourth collaborator for the assessment of comparative advantage of the different production systems using project data entered into a policy analysis matrix model. A second workshop was held to ensure consistency of methodologies adopted by the socio-economic collaborators and to confirm policy analysis matrix model requirements. The senior scientist leading Ghana's national rice research programme (NARP) was contracted as local project coordinator to ensure consistency and continuity of research outputs.

46. Revisions and additions to earlier formal production system survey and marketing reports were completed by collaborators and a re-run of the policy analysis matrix model, incorporating updated material, was also completed.

#### *Rice Marketing in Ghana (see project report No. 1 and collaborators' contributing reports 1.1/1.2/1.3)*

47. The overall purpose of this study was to investigate the production economics and marketing factors thought to be responsible for the poor marketability of locally produced rice in Ghana as a first step to redressing the situation.

48. The study attempted to describe the marketing system from field to final consumer for locally grown rice in the three systems - irrigated in the South, inland valleys of the Centre and inland valleys of the Northern area. The study objective was to identify the actors involved and the margins at each point in the marketing chain as well as to highlight those areas where improvements could be made in the marketing chain to enhance the value of locally produced rice.

49. For the purpose of the study, the country was divided into 3 regions - covering the different farming systems. The south-east irrigated schemes were surveyed together with socio-economists of the Ghana Irrigation Development Authority (GIDA), the central belt of the country practising "inland valley systems" with Crop Research Institute (CRI), and the northern system inland valleys with the Savannah Agricultural Research Institute (SARI). The study was carried out in November and December 1996 by NRI economists collaborating with the above institutions. CRI and SARI continued field work into the first quarter of 1997.

50. Information was gathered by the use of semi-structured interviews of key informants, including rice farmers, rice wholesalers, rice retailers, rice millers and staff from GIDA, CRI and SARI. Direct observation of rice marketing, post-harvest practices, weights and measures and prices also provided important sources of information for describing the marketing system.

*Rice Production Systems in Ghana (see project report No. 2 and collaborators' contributing reports 2.1/2.2/2.3)*

51. For this study component three collaborators assembled socio-economic data for the major rice production systems, both from existing secondary sources and from primary data obtained from commissioned informal and formal surveys. Data from the earlier rice marketing studies were also used. Data sets were assembled in accordance with the established requirements for a policy analysis matrix model construction with the format for the formal survey components based on a modified 'SARI' survey model for consistency. Additional socio-economic data to enable more general comparisons of the viability of the different rice production systems was also obtained.

52. In addition to the full spectrum of crop budget data and allied costs the following requirements were identified:

- farmer preferences for varieties in different seasons
- seasonal effects - yield differences in main and off-season
- returns to water - gross margin/quantity water delivered in irrigation schemes
- opportunity costs - costed options if farmers not growing rice
- constraints associated with rice production

53. Respondents were randomly sampled and interviewed through semi-structured questionnaires. At each survey site a minimum of six farmers and a maximum of ten was selected with farmers interviewed either in their fields or at home. Visits to farms where production activities were on-going provided first-hand information to the survey team on aspects of cropping/cultural practices.

54. The policy analysis matrix (PAM) methodology was employed in this study to analyse the impact of policies on the major rice production systems in Ghana, namely irrigated rice and hydromorphic rice production systems. The irrigated rice system represents small-scale irrigation systems in the southern part of Ghana while the hydromorphic system represents what is commonly called "valley bottom" rice production systems in central and northern Ghana.

55. The PAM approach is basically an application of social cost-benefit analysis and the basic concepts of trade theory to policy analysis. It is a methodology particularly suited to this study since the study aims at isolating the impact of policy reforms on domestic rice production which has to do with production costs, benefits and trade. The basic PAM is a three by four accounting matrix designed to display the financial (private) and economic (social) returns to an activity. The basic PAM model consists of two components: (i) the profitability identity in which profits are identically equal to revenues less costs, which includes tradable inputs and domestic factors and enables us to isolate private profits ( $D=A-B-C$ ) from social profits ( $H=E-F-G$ ); and (ii) the divergence identity which measures divergence between observed private price and estimated social price. It is explained by the effect of policy or by the existence of market failures.

56. Data entered in the first row (Table 2) provide a measure of private profitability. The term private refers to observed revenues and costs reflecting actual market prices received or paid by farmers, merchants, or processors in the commodity system. The second row of the accounting matrix utilises social prices as indicated. These valuations measure comparative advantage or efficiency in the agricultural commodity system. Social profits, H, are an efficient measure because outputs, E, and inputs, F+G, are valued in prices that reflect scarcity values or social opportunity costs. For output (E) and inputs (F) that are traded

internationally, the appropriate social valuations are given by world prices - c.i.f import prices for goods or services that are imported or f.o.b prices for exportables.

57. The second identity of the accounting matrix concerns the differences between private and social valuations of revenues, costs and profits. For each entry in the matrix - measured vertically - any divergence between the observed private (actual market) price and the estimated social (efficiency) price must be explained by the effects of policy or by the existence of market failures. This critical relationship follows from the definition of social prices. Social prices correct for the effects of distorting policies - policies that lead to an inefficient use of resources.

**Table 2 - The Basic Policy Analysis Matrix Model**

	Costs			
	Revenue	-----		Profits
		Tradable Inputs	Domestic Factors	
Private Prices	A	B	C	D
Social Prices	E	F	G	H
Effects of Divergence and Efficient Policy	I	J	K	L

58. Data on farm level inputs, output and factor costs associated with the rice commodity systems were based on secondary data, utilising mainly the data from baseline surveys carried out by the Crops Research Institute (hydromorphic lowland (inland valley) rice system), Savanna Agriculture Research Institute (hydromorphic upland rice system) and Ghana Irrigation Development Authority (irrigation system). Where there were data gaps from the main source, they were supplemented with the most realistic data from crop budgets compiled by the Ministry of Food and Agriculture and from other published materials. These particularly applied to fertilizer application and cost for the hydromorphic upland system and to milling costs for the hydromorphic lowland (inland valley) system.

59. Data on interest rates, inflation and world market prices which were used to translate private prices into social prices were collected from various sources including the Ghana Statistical Services, Bank of Ghana, Ministry of Finance, Ministry of Trade and Industry, the World Bank office in Ghana and the Ghana National Procurement Agency.

## **Phase 2 - Post-harvest system technical and socio-economic studies. 1997/98**

### *Overview*

60. The Food Research Institute (FRI) was contracted as senior collaborator for the largely technical second phase of the project and assisted in drafting terms of reference and local budgets for all Phase 2 study components. The FRI coordinator visited NRI for training in rice analysis methodologies and laboratory equipment was shipped to FRI and commissioned with NRI assistance. Three NRI specialists worked with FRI and other collaborators in Ghana to refine field study methodologies and assist with initial field work programmes. Surveys for loss assessment, consumer preferences, post-harvest practices and techno-economic assessment of rice processing enterprises were all conducted.



## Outputs

### 1. Rice Marketing in Ghana

#### 1.1 Marketing chains

61. The study confirmed that imported rice accounts for half or more of the rice sold in Ghana with some ten large private importers controlling 80% of the imports. Much of the balance is imported through the Ghana National Procurement Agency (GNPA).

62. Rice is imported in large shipments usually in the form of milled, polished white or raw rice in 50 kg polypropylene sacks. The marketing chain is quite short, with importers selling to distributors located in the main markets who sell to wholesalers or direct to consumers. Most of the rice is sold in Accra and the main towns of the Central and Ashanti region. Only a very little goes to the north. Three types of imported rice can be defined. Poorer quality (25% broken, often of Vietnamese or Pakistan origin), good quality rice (Usually American and branded), and at the top end of the market, Thai fragrant rice, often pre-packaged in mini-sacks of 5 or 10 kg. Importers and wholesalers reported that it could be difficult to sell the poorer quality rice. When a large consignment of such rice arrived, it would have a damping effect on existing stocks and traders were sometime forced to sell this type of rice at a loss. The better quality rices sold faster, and demand for them was increasing.

63. The marketing chains for local rice vary greatly in Ghana. Partly depending on location and production system and partly on whether the rice is to be parboiled. The major chain variants are shown diagrammatically as follows:

#### A. Irrigated Marketing System

Farmer → Farmers Association → Industrial Mills → Major distributor / Institutional clients

#### B. Traditional Market Chain

Farmer → Village trader → Small mill → Itinerant Wholesaler → Large city wholesaler / retailer

#### C. Paddy milled in Main Town

Farmer → Itinerant Wholesaler → Transport to main town → Mill → Large city wholesaler / retailer

#### D. Parboiled Rice system



Farmer → Women assemblers/parboilers → Itinerant Wholesaler → Large city wholesaler / miller/parboiler

## 1. 2. Marketing margins

64. The margins accruing to the various participants in the rice trade as determined by this study are summarised in Table 2 below:

Table 2 - Marketing margins in the rice trade as % of retail price

Players	South			Central	North	
	Case 1	Case 2	Case 3	Case 1	Case 1	Case 2
Farmer	74	77	77	71	65	59
Miller	2	3	3	4	4	3
Trader	11	9	6	10	10	20
Retailer	9	10	10	11	13	9
Other	4	1	4	4	9	8
Total	100	100	100	100	100	100

65. In the south and central region farmers received more than 70% of the retail price. In the north, as the rice has to be parboiled, farmers received a margin of 60 to 65%. The farmers in the irrigated schemes in the south received the highest unit price and got the maximum yields per ha. but their margins are very slim due to their high recurrent costs.

66. On the whole margins to traders appeared to be in the region of 10% although the margins can be distorted by the way paddy and rice are measured out at buying and selling transactions.

The cost of milling represented between 2 and 4% of the retail price. In the irrigated south milling rates were considerably lower than those obtaining in Kumasi and the north. The annual throughput of a mill can vary greatly. In the irrigated areas, two crops a year can result in better utilisation. The capital cost of a mill varied greatly depending on whether the equipment was new or old. The buildings in which mills were housed varied from solid constructions, to temporary shacks, depending often on the status of ownership of the land.

67. Retailers in the outdoor and roadside markets made a margin of about 9 to 10%. Retailing usually takes the form of sale by volume measures based on heaped reused empty tins or bowls, with rice packaged in small plastic bags following measuring which is undertaken in front of the customer. Commonly, a retailer will have a selection of three or four imported rice brands at different prices, along with a local rice usually originating in one of the irrigation schemes. Retailers purchase imported rice from wholesale shops, and local rice from market women who usually deliver.

## 1. 3. Prices and trade flows

68. Rice importers reported that, as a general strategy, they attempted to time the landing of their rice to coincide with shortages in the market. If timing was right, profits of 35% or more could be made but, on average, importers expected to make 10 to 15% with losses incurred on some consignments. Traders handling imported rice anticipated an increase in demand prior to Christmas, otherwise, they did not report any marked seasonality in demand.

They also noted that demand is stronger for the better quality types of rice and especially the perfumed rice brands. Brand loyalty is strong, and some importers were able to sell rice consistently under their own label.

69. The prices for the most popular US Lucky brand (cedis/50 kg bag) of imported rice in December 1996 in the three most important national markets were as follows:

	Accra	Kumasi	Tamale
US Rice	62,000	65,000	68,000

70. In an assessment of wholesale price data obtained from the Ministry of Agriculture for a period of one year (95/96) Bolga (northern) rice and Kumasi (central) rice appeared to sell at a premium price on the Accra market, whereas prices for Techiman seemed to fluctuate alternately above and below the Accra price. Techiman is the main market for rice coming from the north for sale in the southern part of the country. Prices in Tamale and Koforidua (near to Accra) however, were consistently below the Accra price suggesting potential for rice to move from these centres to the Accra market. A further reason for the lower price for northern rice is that it is parboiled and thereby considered inferior by consumers in the south of Ghana.

71. It was noted that in the south east, much of the local rice was being retailed side by side with imported rice. In Kumasi, in the centre of the country, more than 90% of the rice in the market was imported rice. In Tamale market, 70% of the rice was local rice and in Bolga 92% of the rice was local.

72. The majority of rice produced in the irrigated area of the south-east was marketed in the Accra, Ashaiman and Tema areas. The irrigated rice sold at the lower end of the market although one or two imported rice brands were sold at a lower price. Nonetheless, the market for Ghanaian irrigated rice did not appear to be constrained - if there were more production, it could most definitely find a market at the right price. It was concluded that improvements in irrigated rice production and market practices which would improve quality, would certainly enable Ghanaian rice to compete more effectively with imported rice.

73. Rice from the central inland valley production areas such as Brong Ahafo moved largely to Kumasi and to Obwasi ( a mining town with a high concentration of northerners). It appeared that paddy grown in the northern part of Western region and Eastern Ashanti was going to Kumasi market for processing whereas paddy from south Ashanti moved to the coast. Rice grown on the eastern side of Ashanti and Volta was routed to the Accra market.

74. In northern areas the best quality rice from inland valley production originated in the Upper East where the better quality rice was retained for local consumption and the balance sold in Navrongo for onward transit to Bolgatanga and then southwards to Tamale. Whilst a proportion of this rice was sold in the market towns on the way south, the major exit point for northern rice was the Techiman market.

#### 1. 4. Summary of findings

75. This study confirmed that, under the present liberal trading regime, rice consumption was increasing by over 20% per year and that most of this increase was being met by imports. The net effect of these increasing imports was that the quality levels and price of imported rice were now dictating the price of locally-produced rice with an increasing trend for Ghanaian consumers to demand better quality. Traders reported that inferior quality brands which previously had a ready market were now difficult to sell and that locally-produced rice was generally considered by consumers to be inferior in quality.

76. Conversely, local rice from the major irrigation schemes processed in modern commercial mills was found to be of acceptable quality and was marketed successfully against the 'non-premium' imported brands in Accra.

77. Outside of the major irrigation schemes in the south the marketing system is mainly in the hands of small women traders buying relatively small lots. Margins in the system appear fair and reasonable with farmers getting 70% of the retail price, traders 10 to 12%, millers 2 to 4% and retailers 9% to 10%. The marketing system does not appear to send price signals down to the farmer offering reward for quality. Traders who purchase rice from farmers and sell again to wholesalers after milling have some awareness of quality and different prices, but do not admit to passing these on to the farmer. Farmers who were in credit arrangements with traders paid a relatively high price for this credit, and if forced to sell immediately after harvest, could not benefit from the increased prices expected in the "lean" season from February to June. Whilst farmers could easily dispose of their crop, the poor quality of the rice produced for sale resulted in a low retail price with knock back effects on subsequent farm prices. Although better quality rice could be achieved from newer rubber roller mills (Satake), they were only found in the southern part of the country.

78. At wholesale and retail levels price differentials did operate between rice samples of different quality. These were most pronounced in the Upper East and Upper West Regions and least noticeable in the Northern Region. It was reported that the major problem in quality was the dirt and foreign matter that the rice contained resulting from deficient postharvest operations.

## 2. *Rice Production Systems in Ghana*

### 2.1 Survey results

79. All three local collaborators compiled data by structured survey, based on a standardised questionnaire, covering production systems in the north, the central inland valleys and the southern irrigation projects. Data was assembled for:

- cropping systems
- resource allocation
- farmers' practices
- farm budgets
- major constraints

80. In the northern areas yields were said to be stagnating or even decreasing due to lowering soil fertility although total production was thought to be increasing due to growing numbers of migrant farmers and increasing awareness of marketing opportunities. Similarly, in central inland valleys, a majority of farmers claimed that rice production was increasing and associated this increase with rising profitability of the crop.

81. Major constraints for non-irrigated rice systems were listed as:

- weed infestation
- bird damage
- lack of credit facilities
- non-availability of improved seeds
- low soil fertility
- poor seed management practices/mixed varieties
- lack of a price stabilisation policy

82. For the irrigated systems constraints were ranked as follows:

- lack of mechanical services
- lack of formal credit
- poor maintenance of irrigation systems
- marketing problems
- high input prices
- shortage of labour
- bird damage

## 2.2 Profitability of local rice production systems

83. Crop budget data generated by the baseline surveys of the rice production systems was analysed using a Policy Analysis Matrix (PAM) model approach. In terms of private and social profitability the following picture was assembled:

**TABLE 3: Profitability Indicators by Commodity Systems (Cedis/Hectare)**

System	Private Prices			Social Prices
	Farm Level	Post Harvest	Commodity System	Commodity System
Upland Rice	200.0	15841	25490	16193
Lowland Rice	0.5	43880	71806	44416
Irrigated Rice	829.0	401228	402057	53336

*Source: From PAM Results*

84. At the system level, all rice commodities generated positive profits. This implies that marketed production offers higher profits than that destined for on-farm consumption. However, the irrigated rice system was the most profitable, generating a system profit which is over sixteen times the profit generated by the upland rice system and about six times that of the lowland system. It is pertinent to note that the irrigated rice system also generated profits that are several times higher than those generated by the hydromorphic rice systems at both farm and post harvest levels as indicated in the table.



85. The PAM assessment showed the almost non-profitability of the lowland rice system at the farm level even though it was profitable at both post harvest and systems levels. This seemed to suggest that activities of merchants and processors were not sufficiently well integrated with farm level operations to enable some of the merchants' and processors' profits to be channelled back to the initial points of production.

86. Estimates of social profits for the three rice systems indicated that the irrigated systems generated profits that were more than 3 times higher than their upland counterparts and about 17 percent higher than the lowland systems.

### **2.3 Policy Implications**

87. The divergence between private and social values indicated that world market prices for rice are lower than the price of domestically produced rice. The net effect of policy reforms is the increase of the domestic market price and revenue above the world price of rice and this has served as an incentive to domestic rice production. Policy reforms have also resulted in higher local prices of tradable inputs for the rice commodity systems which has acted as a disincentive to domestic producers of rice.

88. Policy reforms have, so far, largely failed to alter the generally underdeveloped domestic capital market resulting in large divergences between private and social costs of domestic factors. The implication is the likely inability of domestic producers of rice to have access to the capital market.

89. The PAM analysis showed that all domestic rice production systems are privately and socially profitable. The implication is that Ghana has the comparative advantage to produce rice. The comparative advantage seems to be largely influenced by high domestic prices of locally produced rice, in spite of the high tariffs on imported rice.

## **3. Postharvest assessment**

### **3.1 Survey findings**

#### *a) Post harvest practices*

90. The post harvest practices study confirmed that operations are broadly similar across the three rice production systems although there are minor regional differences. In the irrigated schemes in the south, farmers harvest by hand and thresh the paddy in the field. After drying, the crop is bagged for storage, or, more commonly for immediate sale either to small-scale traders or to large mills, either direct, or through a farmers' association. The majority of small-medium mills are of the Engelberg huller type and of variable quality, but there are some more modern Satake-type, rubber roll mills. The larger mills, having more sophisticated machinery, including de-stoners prior to milling and a whitener after milling, produce a better quality rice than the small local mills.

91. Farmers in the inland valleys may thresh their paddy immediately after harvest and store it in bags in the house or they may store it on the panicle in special stores, threshing small batches as and when it is needed. Threshing is usually on bare earth floors, and drying is done in the sun on the same floor or on the roadside. Consequently, soil particles and stones become mixed with the paddy, which in turn leads to damage to milling equipment and low-grade rice.



92. In the inland valleys in northern Ghana, the climate is much drier during the main harvest season (December and January) and paddy has to be parboiled to prevent breakage during milling. Parboiling is a vast cottage industry, dominated by women who buy and parboil small quantities of paddy on a daily basis. The parboiled paddy is then milled locally and sold in a market nearby.

93. Both men and women participate in the post-harvest handling of rice. Generally, men are responsible for harvesting, threshing and storage and women are responsible for cleaning (winnowing) and parboiling. In Upper West region women play a more important role in harvesting, although men alone are responsible for threshing. In Northern and Upper East regions and in at least one irrigated scheme in the south (Asutsuare in Greater Accra region), threshing is mainly carried out by women.

94. Some mechanical and combine harvesters are in use in northern Ghana but most paddy is harvested manually using a sickle or knife. Larger scale farmers in Northern region, especially in the large flood plain areas of Gushiegu-Karaga district, depend on machinery to harvest. The study has shown that severe delays in harvesting due to poor availability of combine harvesters resulted in much of the paddy being over dry (below 14% moisture content) when it was eventually harvested. The quality of combine-harvested paddy is very variable; clean paddy will be produced if the fields themselves are clean, but this is rare. It is widely recognised that rice produced from paddy that has been harvested by combine tends to have a higher proportion of broken grains than that harvested by hand.

95. In the irrigated schemes in the south of Ghana, harvesting is usually carried out when fields have been drained, although in some schemes harvesting may take place in partially drained or even waterlogged fields. There is, therefore, a risk of fungal infection and discoloration of grains; contamination with mud is common.

96. Threshing of paddy is usually carried out manually by teams of family, communal or hired casual labour. Various threshing machines have been field tested in different parts of Ghana over the years but to date none has been widely adopted. In the inland valley systems, paddy is usually threshed by beating panicles with sticks on bare earth floors, thus contamination with soil particles and stones is common. This can lead to damage to milling machinery and to presence of stones in milled rice. Concrete threshing floors are often provided in the irrigated rice schemes and so contamination with soil and stones should be less of a problem in paddy from these areas.

97. The more widespread use of tarpaulin sheets at threshing, especially in the inland valley systems would minimise admixture of soil particles with paddy grains and would result in a better quality product, but farmers claim that the sheets are too expensive and therefore are rarely used. More important, perhaps, is the lack of a financial incentive to the farmer to pay attention to the condition of paddy from the field. The farm-gate price of paddy is very similar for different varieties and irrespective of the quality.

98. Generally, drying poses no particular problem for farmers in the Northern region of Ghana. Paddy is usually very dry at harvest. The main season rice and non-irrigated rice, harvested in December when the humidity is very low, may be too dry, with moisture contents of 12% or below. This will result in shattering of grains during handling and severe breakage of rice during milling. In Upper East and Upper West regions the majority of farmers sun-dry their paddy, either on the flat roofs of their houses or on beaten earth floors in the compounds, but again, drying is not a particular problem.

99. Elsewhere in Ghana, and especially in the irrigation schemes in the south, both traders and millers perceive drying as a major problem particularly during the rainy months of June/July.

Paddy is dried in the sun on beaten earth floors, on the roadside or on specially constructed concrete drying floors where, if the drying surfaces are not well prepared, paddy may be admixed with soil particles, stones and other foreign matter. However, more important is the unacceptably high level of broken rice grains that result from milling of poorly or inadequately dried paddy. Traders may not always dry their paddy to an optimum moisture content for milling. Since rice is sold by volume, they prefer to mill paddy that is not properly dried because a larger volume of rice is obtained.

100. The pattern of on-farm storage of paddy in Ghana is very variable. Some farmers may sell their entire crop immediately after harvest to repay personal loans or to fulfil other household and family commitments. Others may store all, or part of their crop, usually as threshed paddy in a loose bulk or in bags. In northern Ghana, (Northern, Upper East and Upper West regions) farmers rarely store for less than two months. The majority of farmers in Northern and Upper West Regions and many in Upper East region store up to the beginning of the next planting season (5-6 months) when paddy becomes scarce and prices rise, or until they are sure of the next rice harvest (>6 months).

101. Although insects sometimes infest farm-stored paddy, most farmers do not consider the infestation serious enough to warrant the use of insecticides. Rodents are usually regarded as the main storage pest problem. Paddy stored unthreshed on panicles tends to suffer higher levels of infestation, particularly of *Sitophilus* spp and *Sitotroga cerealella*. Infestation is generally low when paddy is stored in bags at low moisture content (<12%) as in northern Ghana.

102. Inter-seasonal storage may be undertaken by farmers' associations or by a major irrigation scheme operator to ensure that members benefit from seasonal price rises. Paddy is usually well dried (11-12% moisture content) and stored in bags in a central warehouse.

103. Parboiling of paddy is routinely practised in Northern, Upper East and Upper West regions. Most paddy destined for parboiling is hand harvested and threshed; paddy that has been mechanically harvested/threshed is purchased for parboiling only as a last resort since the process will not 'repair' the high levels of broken grains present.

104. Parboiling is more or less a cottage industry, dominated by female labour. There are slight variations in the techniques used from region to region, but in all cases the process is carried out in small batches. The women engaged in parboiling in Upper East region, especially in the Navorongo area are considered to be experts, producing a high quality, white rice, with few broken grains. Similarly, rice parboiled in Upper West region is considered superior to that produced in Northern region.

105. The rice-processing sector in Ghana is informal, mills are not licensed and there is no central register of mills. Three levels of rice processing can be identified namely: small-scale (domestic) processing mainly for home consumption; medium-scale commercial milling; and large-scale commercial milling. Rice processing in Ghana is dominated by small to medium-scale mills with a capacity of less than half a tonne per hour (5 bags per hour) with much of the milling being done on a custom basis. The majority of the mills are small Engelberg-type steel hullers; many are locally-produced, based on designs of mills originally imported from Asia and Europe. The newer Satake mini-mills using rubber rollers

yield a cleaner rice and have a higher out-turn (62-65% compared to 55-60% for huller mills).

106. Rice produced in Northern region is generally recognised as being of poor quality. The mills in Northern region were found to be in a greater state of disrepair than those in Upper East and Upper West regions hence there was a high level of broken grains. Rice from Upper East and Upper West regions is of superior quality and is often as well milled as rice from commercial mills. Large-scale commercial mills produce better quality rice, but because of financial problems, few operate outside the irrigated rice production areas and rarely on a full time basis.

*b) Losses*

107. From the results of the losses survey it was concluded that, although some physical loss of paddy occurs during harvesting, threshing, drying and storage, the loss is generally low. There is wider concern about the qualitative loss of paddy and rice. Extensive qualitative loss occurs during harvesting, threshing, drying and parboiling and is exemplified by excessive amounts of foreign matter, especially stones, in both paddy and rice, and high levels of broken grains in milled rice.

108. Quantitative losses during harvesting arise from shattering of over-ripe grains, incomplete harvesting of panicles, and loss of panicles after cutting, however harvesting losses are generally low. Losses generally ranged from 1% to 5% although higher losses were experienced with certain varieties of paddy that are prone to shattering. Losses during combine harvesting may be related to the age of the machine, the standard of maintenance, and the skill of the operator.

109. Losses occurring during threshing may be both quantitative and qualitative. Quantitative losses, consisting mainly of scattered grains, grains irretrievably mixed with the soil of the threshing floor and unseparated grains still attached to the straw, may be recoverable if threshing floors are gleaned on completion of the operation. Qualitative loss during hand threshing is usually regarded as being more important, and results mainly from contamination of paddy with soil and stones which may still be present in the milled rice. Mechanised threshing including use of combine harvesters results in high levels of cracked and broken grains, thus seriously affecting rice quality and milling out-turn.

110. The qualitative losses occurring during drying through: (a) mixing of foreign matter with paddy, and (b) high levels of broken grains in milled rice arising from poor drying, are more important than quantitative loss. Physical loss of grains from the drying floor is generally insignificant but can occur through consumption of grain by birds or domestic animals and spillage or scattering during handling.

111. Generally, storage losses do not appear to be significant and are not perceived by farmers or traders to be a problem, although rodent damage to bags and stored produce is reported occasionally.

112. Losses during parboiling are mainly qualitative though some quantitative loss occurs through paddy grains being left on drying floors or consumption of paddy by domestic animals or birds during drying. Qualitative loss is exhibited by the difference in the appearance of milled rice, ranging from the darkish parboiled rice of the Northern Region and the much lighter, and therefore more valued, parboiled rice of Upper East and Upper West regions.



113. Processing losses are both quantitative and qualitative. The Engelberg steel hullers are often poorly maintained and consequently suffer frequent and chronic maintenance problems. Shafts and screens are constantly patched up in a fairly rudimentary manner and use of genuine replacement parts is rare. Millers acknowledge that this seriously affects the quality of the milled product: the out-turn is poor and the rice dusty and may contain stones, chaff and unmilled paddy grains. The accumulation of husk and bran within the casing of these mills reduces friction and results in a low degree of milling.

*c) Consumer preferences*

114. The main problem with local rice is its perceived poor quality as exemplified by poor visual appearance, (colour), high levels of foreign matter and a high proportion of broken grains. Traders also identify the degree of milling as an important characteristic and consumers are concerned about the cooking qualities such as expansion ratio and aroma. Notwithstanding the perceived poor quality, local rice finds a ready market. In a survey of rice consumer preferences, the proportion of respondents reporting that they regularly purchase/consume local rice, in three major cities, Tamale, Accra and Kumasi, was 74%, 40% and 38.1% respectively.

115. Nationally there is generally a preference for imported rice although in northern Ghana the local parboiled rice is preferred. Local raw rice generally does not appear to compete well with imported rice in many markets yet it is still preferred by many consumers for the preparation of special local dishes. However, locally produced rice from industrial mills associated with irrigation schemes is clean, white, with a low percentage of broken grains (<10%) and is on a par with some varieties of imported rice. Indeed, some of this rice is branded and graded and marketed competitively alongside imported rice in Accra markets. In northern Ghana, especially in Upper East and Upper West regions, good quality, parboiled rice is available and, in some areas, buyers are known to pay a premium for the quality product. These examples may indicate that the opportunity exists for encouraging a change in attitude towards the quality of locally produced rice.

*d) Techno-economic evaluation of rice processing*

116. Most of the rice produced in Ghana is processed by small-scale operators. Simple technology, available on a custom basis, generates considerable employment and profits for the informal sector. Ease of entry is substantial due to the relatively low initial investment costs. While it appears there is a ready market for the local product it appears that millers and parboilers do not have access to information on how to improve their practices.

117. Information gathered during the survey does indicate that a number of improvements could be made to operating procedures. Findings are summarised below.

***Milling***

- Most operators have not been trained in use and adjustment of mills. This can affect rice quality and quantity.
- Locally fabricated spares are often of poor quality.
- Techniques such as double-pass processing are only employed in Upper West.
- Mills with aspirators are very rare.
- Mills are under utilised
- Rice millers' associations are said to exist but may not see improving product quality and working conditions as part of their role.
- No millers were found to be buying paddy and milling it for retail sales. There is currently little incentive for them to maintain and adjust their mills to produce good quality rice.

### ***Parboiling***

- If family labour was valued at its opportunity cost, parboilers in the Northern region would be making a loss on each bag of rice sold.
- There is considerable regional variation in quality resulting from minor differences in technique.
- Firewood is a big problem.
- Water availability and quality is a problem.
- Working conditions are a problem.
- Parboiling is almost exclusively carried out at village level. The only commercial parboiling plant is of very large capacity.

### ***Financial aspects***

- No records appear to be kept of throughput, takings and expenditure making it difficult to obtain an idea of capacity utilisation and profitability.
- According to data from the survey, although the steel huller mills make a lower profit per bag than the rubber roll mills their daily operating costs are about one-third that of rubber roll mills.

## **3.2 Conclusions of postharvest assessment studies**

118. It is evident that, although some physical loss of paddy occurs during harvesting, threshing, drying and storage, the loss is generally low or well contained. There is wider concern about the qualitative loss of paddy and, more particularly, milled rice. Extensive qualitative loss occurs during harvesting, threshing, drying and parboiling.

119. Not all local rice is of poor quality. Some of the irrigated rice schemes with industrial milling facilities can produce a good quality rice with low levels of brokens which can compete favourably with some lower quality types of imported rice. In northern Ghana, especially in Upper East and Upper West regions, good quality, parboiled rice is available and, in some areas, buyers are known to pay a premium for the quality product.

120. Our studies have shown that, although qualitative deterioration arises mainly from deficiencies (or inefficiencies) in the post-production system, production factors are also implicated. In the system from production to retailer critical points at which quality is lost are as follows:

- *Planting - land preparation and seed quality* - shortage of labour or machinery for land preparation may delay planting and therefore lead to delays in harvesting (see below); admixture of varieties in seed lots leads to inconsistent rice quality.
- *Early harvesting* - (especially in irrigated schemes and where farmers are dependent upon availability of machinery) leads to high levels of immature grains, problems in drying and an associated risk of fungal infection.
- *Delayed harvesting* - the main effects are high levels of broken grains and possible immature 'volunteer' seed admixture.
- *Threshing* - threshing on the ground leads to admixture of stones, soil and dust with paddy, some of which may be carried through to the milled product; high levels of broken grains are associated with combine harvesting.



- *Parboiling* - methods used in Northern region are inferior to those used in Upper East and Upper West regions, producing a darker and, therefore, less attractive rice.
- *Milling (especially huller mills)* - poor condition, poor maintenance and poor operator skill leads to high levels of brokens, dusty rice, and admixture of husk/bran.

## Contribution of Outputs

121. As outlined in this summary report and detailed in the substantive project reports, the rice industry in Ghana is dominated at all stages of the production, marketing and processing cycle by small-scale operations involving considerable numbers of rural poor and with women playing a considerable role. The results and findings from this research relate directly to the sustainability of a rural industry under considerable pressure to demonstrate a positive comparative advantage in rice production or see the urban markets, at least, become increasingly dominated by cheaper rice imports.

122. Although the better quality raw rice from the irrigation schemes in the south has been shown to compete for market share in urban markets, there remain question marks concerning the profitability of irrigated rice when all development, or sunk, costs are factored into the analysis. In addition, government is thought to favour the use of irrigation schemes for higher value crops in future plans for the sector.

123. The studies conducted under this project suggest that rice produced by smallholders in the inland valley and upland systems is meeting a localised market demand for niche products and is not in a position to compete in terms of productivity or quality with imported rice. This does not mean that the local rice industry does not present considerable opportunities for innovations which would benefit both rural women and small entrepreneurs and improve the performance and status of the industry.

124. The research has highlighted the following areas for further research, innovation and policy change:

### *Seed quality*

125. In the irrigated areas good quality seed is generally available on credit from the scheme management. Such seed is not so readily available to inland valley farmers who often rely on supplies through informal channels.

### *Harvesting*

126. Timely harvesting is made particularly difficult for those most dependent upon availability of machinery. Development of improved and appropriate machinery to allow the crop to be harvested at optimal maturity should be actively researched to optimise the profitability of mechanised schemes.

### *Threshing*

127. Reduction of the foreign matter content of paddy could be achieved by use of threshing machines or the more widespread use of concrete threshing floors or even tarpaulins. Attempts have been made in the past to introduce threshing machines but apparently with little success. The reasons for failure of such initiatives have not been documented and are perhaps worth investigation. Access to concrete threshing floors is difficult for some farmers and tarpaulins are said to be expensive and therefore rarely used

### *Parboiling*

128. There is potential for improving the quality of the parboiled rice produced in Northern region, simply by transferring the technologies used by processors in Upper East and Upper West regions. An opportunity exists for researchers to take the lead here. There is a good understanding of the differences in the parboiling processes between the regions, and techniques can be matched to production of a good quality product. In the first instance, a pilot exercise might be undertaken to introduce techniques from Upper East region to selected areas of Northern region and to evaluate uptake. Such a project might involve researchers alone or preferably a team including researchers as (facilitators) and processors from Upper East region as 'trainers'.

129. Given that the supply of paddy is not a constraint, there may be opportunities for further improving the existing technologies so that larger volumes of paddy can be processed, with the dual objective of improving quality and lowering costs. Lower costs of parboiling could lead to improved prices being paid to farmers who supply paddy.

130. An important constraint to the expansion of parboiling activities is a shortage of firewood. Firewood is becoming scarce in many areas of northern Ghana, thus increasing costs and environmental pressures. Research might therefore be usefully conducted to investigate alternative fuels, for example rice husk, and appropriate, efficient burners.

### *Milling*

131. Small-scale mills predominate in Ghana. The out-turn of rice from the huller mills is usually poor and the rice tends to be dusty, with high levels of brokens and containing stones. The quality of rice from the Satake-type rubber roll mills is better, although presence of stones will still reduce the quality of the product and increases the repair costs of the mill. A case might be made for the active promotion of rubber roll mills for processing of raw rice and the incorporation of a de-stoner to produce a stone-free rice. The use of a de-stoner would reduce operating costs (fewer repairs, less damage to rolls) and increase the out-turn of good quality rice. However, an appropriate de-stoner needs to be identified and financial analysis carried out.

132. Rice milled in huller mills in a single pass contains a mixture of husk and bran, thus necessitating winnowing and cleaning. The disposal of bran with husk has financial implications, since the potential income from sale of bran as animal feed is lost. Aspirators can be fitted to steel huller mills to remove husk and bran particles but their use in Ghana is rare. Further analysis of the costs and benefits of fitting aspirators and the potential for sale of bran is therefore required.

133. The success of milling businesses will depend on their cost effectiveness and financial management. Routine maintenance and repair costs are an important factor. Many mills, especially the huller mills, are in a poor state of repair and breakdowns are common. Repairs are makeshift and the quality of the product suffers. Few mills keep accurate records making financial assessments of the businesses virtually impossible. It is claimed that since a market exists for rice, whatever its quality, there is little incentive for mill operators to improve their practices. However, small mills offering higher out-turn and cleaner, stone-free rice should be able to charge a higher milling fee as well as incurring lower maintenance costs. It is possible that millers do not have access to information on how to improve their techniques and the likely costs and benefits. If improvements can be introduced at the processing level and processors are able to benefit from production of high quality rice they may then be in a position to encourage farmers to supply better quality paddy.

134. Quite apart from the issue of competitiveness with imports, the results of this study show that it is at the milling level that the most significant interventions could be made to improve both the financial viability and outturn quality of the local rice industry. It is suggested that policy makers could achieve maximum impact in the short term by addressing issues at this level.

#### *Dissemination of Information*

135. It is possible that rice millers' associations could provide a means of information dissemination, raising awareness of developments and market demands for quality. Stronger and more aggressive associations may be able to obtain a number of benefits for their members such as: arranging the purchase and distribution of genuine spare parts; organisation of training; facilitating technical, financial and business management advice and providing access to credit.

136. It has been mentioned that the parboiling sector is more or less a cottage industry. It is not known whether organised associations exist but it is conceivable that processors belong to informal associations or women's groups, and such groups might be used in the technology transfer process.

137. It is generally accepted that farmers pay little attention to producing quality paddy because they are usually assured of a market. However, if improvements are made in the milling sector which stimulates a demand for quality paddy, farmers will need advice and information from the Extension Department of the Ministry of Food and Agriculture. It is unlikely that the Department routinely gives such advice and specific training would be needed for extension staff operating in rice producing areas of the country.

#### **Next steps**

138. Project findings, conclusions and recommendations will be discussed in-country with a closely targeted focus group representing key sections of the rice industry, government planners and national research agencies. Collaborators will be assisted to develop any initiatives for future research or product innovation arising from these cross-sectoral discussions and deemed appropriate for submission to donors.

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