NATURAL RESOURCES INSTITUTE

Improving the Competitiveness and Marketability of Locally-Produced Rice in Ghana

2. Rice production systems in Ghana
A Policy Analysis Matrix (PAM) Assessment

Project R6688

Department for International Development (DFID)
Crop Post Harvest Programme

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Natural Resources Institute

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2. Rice Production Systems in Ghana - A Policy Analysis Matrix (PAM) Assessment

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Rice Production Systems in Ghana - A Policy Analysis Matrix (PAM) Assessment

1.0 INTRODUCTION

1.1 The Economy

Ghana's economy has experienced periods of prosperity and decline. Up until 1960, Ghana's Gross Domestic Product (GDP) grew by an average of 4.1 percent per annum. However, due to misaligned priorities and economic mismanagement, Ghana's economy began to decline in the early 1960s and this continued until the early 1980s.

The economic problems of the 1970s and early 1980s can be summarised as declining real output, continued budget deficits, high domestic inflation rates, persistent balance of payments deficits, overvaluation of domestic currency, a flourishing parallel market in foreign currency, and loss of domestic goods and government revenue through smuggling. During the decade before economic reforms were introduced in 1983, exports fell by 30 percent, real wages declined by 80 percent, investment rate fell from 14 percent to 2 percent of GDP, government budget deficit increased from 0.4 percent to 14.6 percent of GDP with government revenue covering just 35 percent of total expenditures, domestic savings fell from 12 percent to 3 percent, and import volume fell to one-third of its previous level and by 1982, the inflation rate had risen to 123 percent per annum.

After the introduction of the Economic Recovery Programme (ERP), fiscal deficits which

averaged more than 6 percent of GDP was reduced to a surplus averaging about 2.4 percent of GDP for the period 1986 to 1991. In 1996, the fiscal accounts revealed a deficit of 1.4 percent of GDP.

Inflation continues to be a problem for the Ghanaian economy. Since 1985 when there was a deceleration in the rate of inflation to an all time low of 10 percent, the end of year inflation has continuously accelerated reaching a high of 70.8 percent while the annual average was 56.6 percent in 1995.

Interest payments burden on public accounts has increased in recent times. Interest on domestic debt as a proportion of recurrent expenditure which was 19.1 percent in 1995 has risen to over 24 percent in 1996 (compared with less than 3 percent in 1990). In 1990, the interest payments on domestic and external debt as a proportion of recurrent expenditure was 16.7 percent but increased over the years to 32 percent in 1996.

Private investment levels have been low compared with public investment levels during the 1980s. After the introduction of the ERP, public investment grew from about 6 percent of GDP in 1986 to 8.2 percent of GDP in 1995 and estimated at 8 percent in 1996. From 1990 onwards, private investment recovered gradually and now seems to have stabilised at about 8 percent of GDP for the period 1993 to 1996. Of the total gross fixed capital formation less than 9 percent constitute agricultural sector investment.

The long-term vision is that Ghana becomes a middle income country. In specific terms, real GDP growth targets ranges from 5.5 percent in 1997 to 7.4 percent in 2000 and expected to average 6.5 percent for the period 1997 to 2000. To

satisfy these growth targets, the agricultural sector is programmed to record an annual growth rate ranging from 4.3 percent in 1997 to 4.9 percent in 2000, implying an annual average growth rate of 4.5 percent for the 1997-2000 period.

1.2 Agriculture and Role in the Economy

Agriculture is the largest and an important sector in the Ghanaian economy. The rate of the economic development has been closely linked with the performance of the agricultural sector (Ministry of Agriculture, 1991; Ghana-Vision 2020, 1995). The sector is expected to continue to play a major role in the short to medium term in the country's economic development. The agricultural sector's importance is by virtue of its contribution to several important economic variables.

In the 1980s, agriculture's contribution to Gross Domestic Product (GDP) averaged 52 percent. In the first half of the 1990's it averaged about 42 percent. In 1996, its contribution fell to 40.6 percent. The agricultural sector contribution to the GDP is likely to continue in the downward trend, particularly as emphasis on economic development shifts from agriculture to services and industry as evidenced in several developed countries.

The agriculture sector offers job avenue to a large proportion of the economically active population (EAP) mainly as farmers, farm labour and other workers in agricultural related activities. The EAP in agriculture was about 52 percent in 1987, 50 percent in 1990 and further declined to 48 percent in 1994. The decrease of the EAP in agriculture has been in terms of proportion only as the absolute number has been increasing over the years. For example, it increased from about 2.64 million in 1987 to about 2.75 million in 1990 and 2.90 million in 1994 increasing at a rate of about 1.8 percent per annum (FAO, 1995).

Agriculture contributes substantially to govemment revenue mainly through duties paid on the export of agricultural commodities, particularly, cocoa. The contribution has also declined steadily from about 26 percent in 1987 to 12 percent in 1990 and to 7 percent in 1993. However, from 1994 to 1996 it increased, fluctuating between 14 percent and 16 percent.

The agricultural sector contributes to the country's foreign exchange availability in two ways; (i) through the exports of agricultural commodities and (ii) through conservation of the inadequate foreign exchange earned by producing import-substituted food and raw materials. Until 1992, agriculture accounted for the highest foreign exchange earner by the country with cocoa being the main export. Since 1992, gold has replaced cocoa as the highest earner of foreign exchange. The sector's inability to produce adequate quantities of the import-substitute commodities, cost the country several millions of foreign exchange to import the short fall.

This sector is the main source of food for the large non-agricultural and mainly urban population. This segment of the population is not only expanding at a fast rate of about 6 percent but also acquiring new tastes and demanding diversified food products. The country has been generally self-sufficient in the production of several food commodities, particularly, roots and tubers, plantain, fresh fruits and vegetables, eggs, among others. For some other commodities, such as, wheat (not produced in the country at all), rice, meat, fish, dairy products, edible oil, sugar, etc., imports have been regular and increasing in volume in order to meet demand. Agriculture also supplies a substantial proportion of raw materials for the agro-based industries.

1.3 Crop Production System

Ghana covers an area of approximately 23.9 million sq.km. Agricultural land forms about 57 percent of the total land area of which about 18 percent were cultivated in 1990 (Ministry of Agriculture, 1991). The agro-ecological conditions divide Ghana into six distinct zones, namely, (i) high rain forest, (ii) semi-deciduous rain forest, (iii) the forest-savanna transition, (iv) Guinea savanna, (v) Sudan savanna and (vi) coastal savanna. The climatic conditions and soil types limit the type of crops that can be successfully cultivated in the agro-ecological zones. Table 1.1 shows the major crops that are grown in the agro-ecological zones.

TABLE 1.1: Major Crops Grown in the Agro-ecological Zones

	Category of Crops				
Zone	Cereals	Roots/Tubers Plantain	Vegetables	Trees	Industrial
High Rain Forest	Maize Rice	Cassava Plantain Banana Cocoyam	Okro Pepper Gardeneggs	Citrus Coconut Oilpalm Rubber	NA
Semi-Decidous Forest	Maize Rice	Cassava Plantain/ Banana Cocoyam	Okro Pepper Gardeneggs	Cocoa Oilpalm Citrus Coffee	NA
Forest-Savanna Transition	Maize Rice Sorghum	Cassava Plantain Cocoyam Yam	Tomato Okro Peper Gasrdeneggs	Coffee Citrus	Cotton Tobacco Kenaf Groundnut
Northern Savanna	Maize Rice Sorghum Millet	Yam Cassava	Tomato Onion	Sheabutter	Cotton Tobacco Kenaf Groundnut
Coastal Savanna	Maize Rice	Cassava	Tomato Shallot	Coconut	Nut

Source: Badlane, O., Nyanteng, V.K., Seini, W.A. 1992. Food Security, Comparative Advantages, and Fertilizer Use in Ghana. International Food Policy Research Institute, USA/ Institute of Statistical, Social and Economic Research, Legon, Ghana.

NA = Not Available

2.0 MACRO-ECONOMIC POLICY REFORMS

To resuscitate the economy from its downturn in the 1970s and early 1980s, the government launched a set of reforms under an Economic Recovery Programme (ERP) supported by the International Monetary Fund and the World Bank. The first phase of the ERP, which was a stabilisation policy, sought to create incentives to stimulate the productive sectors of the economy by realigning relative prices (including exchange rate and interest rate) in favour of domestic production of import-substitutes and exports, and by providing needed supplies through an import liberalisation programme. The strategy was also aimed at improving government finance and encouraging private investment. Essentially, the objectives of the ERP were as follows:

- to restore incentives for the production of food, industrial raw materials and export commodities, and thereby increase output;
- to increase the availability of essential consumer goods and improve the distribution system;
- to increase the overall availability of foreign exchange in the country, improve its allocation mechanism, and channel it into selected high priority activities;
- to lower the rate of inflation by pursuing prudent fiscal, monetary and trade policies; and
- to rehabilitate the physical infrastructure of the country.

3.0 AGRICULTURAL POLICY REFORMS

Ghana's agriculture is dominated by crop production and it is predominantly small-scale with farm sizes usually less than 5 acres. Most of Ghana's agriculture is rainfed and output is invariably related to the amount and pattern of rainfall.

Colonial agriculture sector policies were geared towards the production of industrial raw materials with emphasis on cocoa, rubber and oil palm. Soon after independence, the Government following the developmental theories of the time which advocated for the movement of labour out of agriculture for rapid industralisation, set up large scale state farms. It was not long before it was realised that the policy was in the wrong direction because the farms perpetually depended upon govemment subvention to survive. In order to finance the heavy investments in industry, the cocoa sector was excessively taxed with the result that cocoa production began to fall after 1963/64 when it reached a high of 570,000 tons.

With controls and shortages of inputs interest in agricultural production dwindled. It was not until the early 1970s when the Government spearheaded a campaign for increased food and agricultural raw material production under the Operation Feed Yourself and Operation Feed Your Industries Programmes did interest in agriculture surge. The objective of the programme was to increase production by peasant farmers through acreage expansion.

When the ERP was launched in 1983, the need for agriculture to lead any sustained overall economic growth was recognised and so emphasis was placed on the sector. Incentives for the production of food, industrial raw materials and export commodities were restored as short-term measures. The sector, aided by favourable weather, responded positively by increased output of the basic staple crops, cocoa and industrial raw materials.

Prior to the exchange rate reforms which began in April 1983, implicit subsidy on fertilizer was 40 percent. The subsidy rose to 66 percent when Ghana adopted a two-tier exchange rate system, costing the govemment roughly US$5 million a year. In 1987, the subsidy level was reduced to 42 percent. In 1988 the subsidy level was further reduced to 30 percent. There was a further reduction to 15 percent in 1989 and subsidies were eliminated completely in 1990. As expected, demand for fertilizer consumption fell from over 50,000 tonnes in 1989 to about 23,000

tonnes in 1990.

The Ministry of Food and Agriculture is gradually divesting from direct production and marketing activities where public participation was a hindrance to private sector involvement and to concentrate on policy formulation and creating an enabling environment for active private sector activities. In 1988, the Ministry began a programme of privatizing fertilizer supply and distribution on a pilot basis in two regions and extended it to other parts of the country in the following year. A similar privatization scheme has been devised for the production and distribution of certified improved seed.

In order to consolidate the gains achieved in the agricultural sector under the ERP the Government in conjunction with the World Bank has developed a medium-term strategy which it is hoped will lead to a sustained growth in the sector and help to alleviate poverty. It is the policy of the Government to increase agricultural production through productivity increases while recognising autonomous area expansion.

4.0 RICE POLICY IN GHANA

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 emphasied. 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.

Following a change in government in 1966, a two-year development plan (1968-1970) was launched. The main thrust of the plan was on correcting the disequilibrium in the economy through import liberalisation, devaluation of the cedi, and deflationary monetary and fiscal policies. The plan discouraged state involvement in industry and instead concentrated in hamessing the potentials of the private sector for economic development. 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.

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.

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 subsidies on machinery, and other agricultural chemicals continued, though on a reduced scale.

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.

5.0 RICE PRODUCTION IN GHANA

Rice is one of the major food crops next to wheat which is imported in Ghana (MOA, 1991). 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 (Apau et al., 1996).

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 the Northern and Southern Ghana).

The first two ecologies account for nearly 90 percent of total production (Otoo, 1994). 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. According to Apau et al., (1996) some of factors which account for this. low yields include; high cost of inputs, lack of adequate and dependable water supply, ineffective weed control measures, poor soil drainage and fertility management practices.

5.1 Hydromorphic Rainfed Upland

In the Northern region the core of farm work force are made up of family members. A bulk of the national supply of cereals emanates from northern Ghana comprising Northern Region, Upper East Region and Upper West Region.

Ecological adaptability influences greatly the types of crops farmers can grow in the Northern part of Ghana. Due to differential properties of soils in the upland compared to lowlands, specific crops are supported. In the upland conditions, farmers cultivate cereals, legumes and root/tuber crops. Farmers in Northern Ghana cultivate mainly what they term "lowland and upland rice fields" which technically are reffered to as hydromorphic systems.

Rice fields are fallowed for between 1 to 5 years with an average of 3 years (Langyintuo, 1997). 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 (Langyintuo, 1997). There are about 9 different types of rice varieties cultivated in northern Ghana. The most common is the local Glaberima.

5.2 Hydromorphic Rainfed Lowland/Inland Valley Swamps

Wetlands, including inland valleys have the potential for agriculture, fisheries, forestry and ecosystem conservation (Otoo, 1994). In Ghana, inland valleys have been put to very little use

with only 2 percent of the total land developed (Apau et al., 1996). Majority of the farmers in the inland valleys are from Northem and Volta regions who have migrated to these places.

Farmers in the valleys mostly grow rice as a sole crop in the valley bottoms but may have upland fields cultivated to crops like cocoa, rubber, oil palm, citrus, plantain, yam, maize, among others. Rice is planted between March and June, which forms the major season. On the average, rice farmers cultivate the same piece of land for only one season and move to another field. Where, for want of land, farmers are compelled to stay on that same piece of land for long but they altemate their rice plantings with maize or vegetables.

There are basically four common methods used by farmers in the valleys to prepare their lands for planting: (i) majority of them would slash the thicket with cutlass and burn the stubble or mulch; (ii) others slash with a cutlass but leave the stubble on the land to serve as mulch; (iii) a few farmers apply herbicides; and (iv) others use power tillers to prepare their lands.

Between 1991 and 1995, majority of the farmers in the valleys have been planting the local rice varieties (oryza glabe-rrima) 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. Most of the farmers do not apply fertilizer to their rice fields. The few who do so, use more of organic manure than inorganic fertilizers.

5.3 Irrigated Systems

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 full time (Amoatin and Acheampong, 1997).

An average of 221 hectares of land is under irrigated rice as the main crop. This cultivated area forms between 90 and 95 percent of the total irrigable land of 9., and the remaining are put under vegetables.

The cropping activities 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.

Fertilizers and agro-chemicals are used and are obtained from the open market. The main type of chemical fertilizers used on all the projects for rice cultivation are NPK (15:15:15), Sulphate of Ammonia and Urea. Agro-chemicals are intensively used, and the type used depends on its availability on the market.

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.

6.0 THE PAM METHODOLOGY

The policy analysis matrix (PAM) methodology is 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 Northern Ghana.

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 (table 6.1) designed to display the financial (private) and economic (social) returns to an activity (Monke and Pearson, 1987 and 1989). 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.

Data entered in the first row (table 6.1) provide 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 in table 6.1. 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.

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

Table 6.1 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

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 (Monke and Pearson, 1989).

The PAM is suitable for this analysis because, unlike most econometric models, it is in the form of a simple accounting matrix which can easily be understood by policy-makers with little training in economics who also are largely responsible for the design and implementation of the policy reforms.

6.1 Data Sources for PAM

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 Rese arch Institute (hydromorphic lowland (inland valley) rice system), Savana Agriculture Research Institute (hydromorphic upland rice system) and Ghana Irrigation Development Authority (irrigation system) as part of the socio-economic research on rice production systems for the Natural Resource Institute (Appendix A).

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.

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.

7.0 POLICY AND INCENTIVES IN RICE PRODUCTION

The focus of this section is on the effects of govemment policies on incentives that are available to rice farmers. This discussion provides justifications for the social prices used to evaluate the efficiency of the rice production systems. The major areas of interest are price, organisational and regulatory policies in the rice markets. Of particular interest are interventions by govemment and parastatal institutions that are likely to influence post farm activities in the rice commodity markets, and hence indirectly affect farm prices, and policies for the nonagricultural sector that distort foreign exchange rate and thus implicitly tax the tradeable rice commodity.

7.1 Rice Marketing and Policy

Over the period 1963 to 1970, various food marketing institutions have existed under different titles but broadly with the same objectives; that is, to promote food production through pricing and marketing policies in favour of food producers; and to ensure effective distribution of food throughout the country. In 1971, the existing organisations engaged in food marketing, namely, the Task Force Food Distribution corporation and the Grains Marketing Board were merged under Legislative Instrument 714 to form the Ghana Food Distribution Corporation (GFDC) with similar objectives.

The GFDC concentrated its efforts on maize and rice marketing. It became the government's major food agency, purchasing maize and rice to support its minimum guaranteed price[1] and then distribute it. From its inception, the GFDC relied on the commodity pricing committee established by government to fix prices. However, the failure of the GFDC to purchase the quantity of maize and rice offered by farmers coupled with its untimely purchases, made the price support system ineffective, and in most instances actually acted as a disincentive to farmers. The cost of production approach used to determine the guaranteed minimum price assumed that all farmers applied recommended production practices. However, such price policy proved inappropriate and also unrealistic as farm surveys indicated that farmers have different production costs and yields (Armah, 1989). Also, there were other problems of wide variations between the minimum guaranteed price and open market prices.

As part of Ghana's trade liberalisation programme, the guaranteed minimum price for maize and rice were abolished in 1990 and the free market forces have been used to

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[1] Farmers were free to sell above the quoted guaranteed minimum price and could resort to selling to the GFDC only in times of difficulty.

determine their prices ever since. The producer price in table 6.1 reflect free market price for rice as represented by the average price for January, the month in which most farmers sell their rice. The real price of rice reveals fluctuations and, for that matter, relative instability in rice prices from year to year.

One commodity whose consumption is rapidly growing in Ghana is rice even though local rice production occupies only 4.1 percent of land under major food crops and 7.7 percent of land under cereals (Seini, 1997).

Rice is an important commodity in terms of providing a cheap wage good for urban consumers in addition to providing small-scale producers with additional income sources, as rice is produced primarily for commercial purposes in Ghana. A critical policy dilemma facing government is whether to aim at rice self-sufficiency or self-reliance. The former is based on meeting domestic demand through local production and stockholding, whereas the latter is based on a combination of production, stocks and trade to secure national food requirements at the lowest cost to government.

The importance of rice is underlined by the fact that its demand in Ghana is estimated to have increased by almost 80 percent from 151,840 tonnes in 1979 to 271,380 tonnes in 1992 (Levin, 1995). Imports accounted for 75 percent of total supply/consumption during that period. Three related factors will influence Ghana's rice consumption in the future, namely, urbanisation, increasing per capita incomes and growing preferences for convenience foods. Ghana's current population growth rate is estimated to be around 3 percent per annum (DHS, 1993) and its low agricultural growth rate of around 1.9 percent (World Bank, 1995) implies that the country will continue to import food, particularly rice, to meet annual food deficits. Furthermore, given projections of rapid urbanisation in West Africa by the year 2000, especially along the coastal countries like Ghana, there will be even more consumers

demanding foods that are relatively cheap, convenient, and easy to prepare, such as rice.

Consumption of imported rice has grown rapidly since market liberalisation. Commercial and food aid imports increased by 48 percent over the 1989-93 period (Levin, 1995). From 1989 to 1992, between 110,000 and 181,000 tonnes were imported per annum. Most rice is imported from the cheapest source, Asia; and rice trade in Ghana is now almost exclusively in the hands of the private sector, There are no official subsidies affecting the rice trade on Ghana's side. Import duty on rice is 25 percent of the CIF price; plus an additional sales tax of 15 percent. These taxes plus other charges for handling and others, added 43 percent to the CIF value of rice landed in Ghana. The growth in rice imports has been used to cover a cereal deficit which averaged 332,358 tonnes between 1990 and 1994.

Given the quantity of rice imports into Ghana, it is clear that local production meets only a small part of consumption. Rice production in Ghana is primarily rainfed. Four ecological rice production systems can be found across Ghana's different agroecological zones; rainfed dryland, rainfed lowland, inland swamps and valley bottoms and irrigated paddies. Dryland and lowland rainfed systems account for 75 percent of total rice production and irrigated paddies account for just 10 percent of total rice area. Rice cultivation is fairly widespread and is cropped in 34 out of 43 agricultural districts. However, it is most important as a cash crop in the "valley bottoms" in the Northern part of Ghana. Table 7.1 gives production, yield and prices of paddy rice in Ghana for the period 1981-1995.

TABLE 7.1: Paddy Rice Hectarage, Production and Prices, 1991-1995

Year	Area ('000 Ha)	Production ('000 Mt)	Yield[1] (Mt/Ha)	Producer Price (Cedis/100 kg)	
				Current	Real[2]
1981	46.0	43.6	0.95	390	254
1982	43.8	37.1	0.85	457	146
1983	38.6	26.9	0.70	2154	302
1984	68.8	76.0	1.10	4095	491
1985	87.0	89.0	0.92	2184	349
1986	76.1	69.6	0.91	2902	319
1987	72.0	80.7	1.12	4589	367
1988	116.6	105.0	0.90	8296	498
1989	74.4	67.0	0.90	8296	415
1990	88.3	81.0	0.92	9600	384
1991	94.9	150.9	1.59	9143	274
1992	79.7	131.5	1.65	9796	245
1993	77.2	157.4	2.04	12551	289
1994	80.9	162.3	2.01	14059	323
1995	100.0	221.0	2.21	24250	485

Source: Ministry of Food and Agriculture, PPMED, Accra

1. Pure stand equivalent
2. 1980 constant prices

Rice production grew at around 5 percent per year from 1970 to 1990 registering the highest growth among cereals even though production declined by about 2 percent per year in the late 1970s. Variability in rainfall account for the fact that production levels have not increased at a constant rate from 1980 to 1992. Most of the increase in this period was due to weather related shocks and recovery from drought years.

From table 7.1, it is clear that the observed growth in rice production from 1981 to 1992 has come about from area expansion and not yield increases. Yields have, however, increased appreciably from 1993 to 1995. On the whole, the average national yield in low at about 1.5 tonnes per hectare, mainly due to the high percentage of rice grown in the rainfed ecologies, where yields average 0.5 to 1.1 tonnes per hectare. In the irrigated ecologies,

yields range between 3.5 to 7.0 tonnes per hectare.

Like much of Ghana's agricultural sector, rice production is characterised by a low level of land and labour productivity. This is related to the use of traditional low input technology, an understaffed and overburdened extension network and inadequate moisture for plant growth during some parts of the year and during periods of drought. Biological constraints, related to inappropriate development and distribution of modem seed varieties account for one of the biggest obstacles to increasing productivity among small scale farmers. Although 95 percent of rice farmers use modern varieties, new varieties have not been developed that are suitable to specific ecological problems. Modem varieties which are available from seed distributors and farmers' own stocks are often impure.

Farmers also face technological and institutional constraints, including a lack of appropriate technology and poor extension service to disseminate new technology. Formal institutions such as the National Agricultural Research System (NARS) and agricultural extension services are not functioning as well as they would, leading to inefficient and ineffective services (Levin, 1995). Furthermore, informal institutions, such as farmers' groups lack a clear voice to make their needs heard and do not have the power to influence community level changes in their interest.

Poor marketing and transport infrastructure increase farmers' transaction and information costs of getting goods to the market. The low level of modem inputs also reflects the inadequate incomes of resource poor farmers and poor access to credit for purchasing necessary inputs. Several years after input markets have been liberalised, farmers continue to face high input cost and inadequate quantities and poorly timed delivery of inputs. Of immense importance is the debate surrounding the impact of trade and market liberalisation on domestic rice production. In 1994, there were concems that cereal imports of rice and

wheat were acting as disincentive to local food production in Ghana. The Ghanaian press have suggested that rice imports have a negative effect on the local rice production sector. Although statistics show a large shortfall between the quantities of rice produced domestically and domestic demand, one side of the policy debate argues that macroeconomic trade liberalisation policy under the structural adjustment programme (SAP) has led to large imports of rice, which may be acting as a potential disincentive for rice production in Ghana. On the other side of the debate is the argument that rice imports are not acting as disincentive to increasing domestic production. It is simply a case that current production levels cannot keep up with current demand. In any case there is no reason to believe that imported rice has created a market supply surplus, depressed local produce price or created disincentives to local producers. Interviews with private traders revealed that the availability of domestic supplies is frequently a problem even in the north of the country where much of the rice is produced. Traders have indicated that they prefer distributing imported rice over locally produced rice, as supplies are more dependable (Seini, 1997).

7.2 Social Prices

As a result of structural adjustment and trade liberalisation, it is generally accepted that policy does not interfere directly with the price of rice. Attempts are however made to promote domestic production of the import-competing rice. Thus policy does not influence directly the price determination of rice commodity systems. Price distortions are also not significant for tradable inputs such as fertilizer and mechanisation that are used in rice production. Import parity values for rice are based on world market prices converted at the interbank exchange rate.

Collection of efficiency price data was based at the port of Tema where the relevant c.i.f prices were established. The Customs, Excise and Preventive Services (CEPS) was the principal source of this information. Supplementary data were also collected from parastatals such as National Procurement Agency (GNPA) as well as the relevant departments of the Ministry of Food and Agriculture. Adjustments for port handling, storage, transportation costs and other miscellaneous charges were then added to the world market value to determine the import parity price. The transport cost estimates are based on the use of road transport (by articulated trucks) from Tema to Accra, the major area of rice consumption.

In the data anaysis, a real interest rate of 9 percent was estimated taking into account the nominal rate of interest and the rate of inflation prevailing at the time of the baseline surveys. A 15 percent opportunity cost for capital was assumed since that is the rate used in official circles.

7.3 Factor Markets

Factor markets play an important role in determining the adequacy of supply response to policy reforms in the agricultural sector. Land may not necessarily be a major constraint in terms of availability but its tenural arrangements, acquisition, inheritance, ownership and title to land remain unclear. Also, there are no proper agricultural land markets. In addition, capital and labour market constraints tend to exacerbate the low supply response of agriculture, in general, to policy reforms.

7.3.1 *Land*

The most important factor in agricultural production is land. Land tenure in Ghana is largely communal in nature, in which the community own the land, usually held in trust for the

community by the traditional rulers, while individuals or families in the community have usufructuary rights to the land.

In spite of the largely communal nature of land tenure in Ghana, land has come a long way from the days it was largely or wholly the property of the whole community or village. In most communities, the farm or holding comprises two or more parcels; the rights embodied in these parcels often differ in the degree to which they have been privatised or individualised. The modus of acquisition of these parcels, therefore, usually differs. Thus studies by Migot-Adholler et. al (1990) stress that farm land as a communal property no longer exists in some areas. Most farm lands are either inherited, rented or purchased.

Although subjected to considerable pressure in the past, indegenous tenure systems have generally provided adequate security so long as land remains abundant. It is, however, doubtful whether they are sufficiently resilient to accommodate transformation necessitated by more capital intensive agriculture and long term investments in soil conservation as land becomes increasingly scarce.

It is important to introduce title to occupancy of land for agricultural purposes which, at the moment, is non existent for all farmers, including rice farmers. On irrigation schemes, land is managed by the Ghana Irrigation Development Authority.

For the purposes of this study, land is considered to have negligible value. However, the value of irrigation infrastructure on land are included in the analysis in the case of irrigated rice.

7.3.2 *Capital*

Like most other sub-saharan countries, the capital market in Ghana is segmented into a formal market of recognised institutions that serve larger borrowers and an informal market on

which most farmers and small-scale entrepreneurs are dependent. For the period 1980 to 1984, the formal capital market was characterised by interest rate restriction. However, the determination of interest rates was liberalised by the central bank in 1985.

The Agricultural Development Bank (ADB) is the principal lender to agriculture in the formal credit market. However, loans to small-scale farmers has virtually evaporated after the liberalisation of interest rates. The evaporation of loans to small-scale farmers has also been attributed to the high rate of default by such farmers.

As part of attempts to finance agriculture, rural banks were introduced into Ghanaian rural areas in the early 1970s. However, this source of formal finance for agriculture has also virtually died. The average size of loans of farmers from this source was ¢20,000 by 1988, and this was more than 500 percent smaller than the average size of agricultural loans in 1977, in real terms (Aryeetey et. al, 1990).

The principal sources of finance for small-scale farmers (including rice farmers) are self-finance and loans from relatives and friends. These sources have long dominated rural finance in Ghana. Often proceeds from one commodity or livestock are used to finance another commodity. Off farm income from family members working in the urban areas are also used to finance farm needs, especially seasonal credit requirements.

7.3.3 *Labour*

Agricultural production in Ghana is dominated by small-scale farmers. Therefore, family labour assumes greater importance. The composition of household labour includes adults, youth and children of both gender (Seini, 1985). Apart from family labour, unskilled labour is sometimes hired to ease peak labour demand periods. Most demand is therefore for seasonal and casual

labour. Labour exchange and labour work groups are also commonly used in most areas in Ghana to ease peak labour demand periods. The size and manner of operation of such groups vary considerably from one area of the country to another. Most operate as purely labour exchange groups and cash payments are not made.

Casual labour market is quite active in almost all regions of Ghana and there is little or no unemployment in peak seasons for agricultural activity where seasonal demands create the possibility of temporary unemployment, the local work-force is often linked to off-farm activities. The bimodal rainy season in the forest areas also provide opportunities for labour to migrate seasonally from the North to the southern sector of the country.

Even though there are regional, commodity and activity wage differences, they need not be considered to represent market imperfections once labour mobility within Ghana is unhindered. Even migrant labour is often received as far up field as Burkina Faso, Ghana's northern neighbours. Casual workers are usually well aware of wage rates and employment opportunities elsewhere and decisions to migrate are often based on perfect information rather than ignorance about opportunities (Seini, 1997). It can thus be concluded that agricultural labour markets in Ghana are highly competitive and the observed wage rates in the baseline rice surveys could be used to represent the efficiency cost of labour. The official minimum wage rate in Ghana (in 1997) is ¢2,000 per man day but this rate normally has no influence in rural agricultural wages as do most official pronouncements and legislations.

8.0 EFFECTS OF POLICY REFORMS

In this section a complete analysis of the economic efficiency of domestic production of the two major rice production systems in Ghana is undertaken using the PAM approach. The

approach combines extensive micro and macroeconomic information is an easily intergrated framework based on standard budgeting techniques. The analysis enables one not only to study the efficiency of the domestic production of the rice systems, but also their relative comparative advantage in relation to the use of domestic resources.

8.1 Macro-Prices

The PAM incorporates a set of assumptions regarding key macroeconomic and sectoral parameters. These are mostly representative nominal prices and their shadow values. Ideally, these prices must be chosen to reflect long term price relationships, as well as reflect price levels within the period under study, namely, the 1996 season. This task is, however, complicated by the continuous depreciation of the local currency and high rates of domestic inflation.

The key macro-prices used in the analysis include an exchange rate of 1,657.22 cedis per United States dollar, and a real interest rate of 9 percent per annum. The estimation of the real interest rate took into account the average nominal rate of interest and the average rate of inflation in the five years leading to the base year (inclusive). A 15 percent opportunity cost for capital was assumed. The range 10 to 15 percent has been given as a reasonable estimate of the social cost of capital in Ghana by most economists. The 15 percent rate may thus be interpreted as the gross rate of return which could be expected from a normal new investment (Steel, 1972). Other prices include the wage rate, intermarket marketing margin, retail marketing margin, world price, and producer price.

8.2 Policy Effects

It is useful to start with a note on how current policies are expected to affect the rice production systems in terms of their impact on production costs within the framework of the PAM budgets. Table 8.1 presents an inventory of such impacts. Post structural adjustment policy reforms and public interventions are generally limited to import taxes on inputs and the rice commodity.

TABLE 8.1: Policy Effects on the PAM

Policy Effects	Level (Percent)
Subsidies on Input:	0
Import Taxes on Input:	
Fuel	32.5
Lubricants	32.5
Truck Transport	57.5
Import and Sales Tax	43.0

Source: Seini, A. Wayo (1997); Impact of Policy Reforms on Ghana's Agriculture: with Applications of the Policy Analysis Matrix.

8.3 Private Production Costs

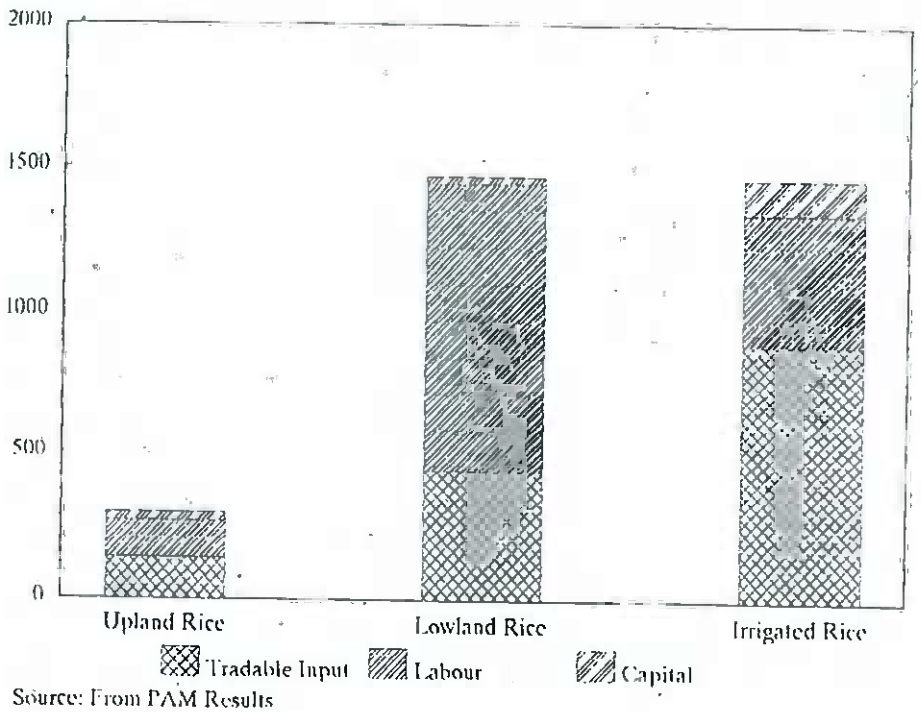
Figure 8.1 indicates the pattern of private costs facing producers of the rice commodity systems. Categorising the commodities by cost level and cost structure helps to identify potential cash-flow and credit constraints on the commodity systems (Pearson et al, 1987).

The cost levels indicate that hydromorphic upland rice is a lower cost production

system with about ¢290,000 per hectare than the lowland and irrigated rice systems which have almost the same cost level of about ¢1.5 million per hectare. The hydromorphic upland rice system may be lower because of its very long history of cultivation in Ghana. It is the most widespread, contributing the highest to the volume o f domestic production (over 75 percent). The scale of production probably results from mastery in the technology of production involved, resulting in the lowering of costs.

Figure 8.1

Private Costs by Input Type at Farm Level (Thousand cedis/Hectare)



Source: From PAM Results

With respect to resource use, tradable inputs claim the highest share in the cost of production of all the rice systems. The tradable input costs of the irrigated rice systems are, however, over six and one-half times those of the hydromorphic rice systems. This is an indication of a wide use of modern inputs in the irrigated system. Labour costs follow next in magnitude of

costs for all systems. However, the hydromorphic lowland rice system is more labour intensive, accounting for over a million cedis per hectare of labour. This is hardly surprising since lowland rice is grown in the forest areas of Ghana where tree crops compete heavily for available labour. The working capital needs of both rice systems appear to be low. Here too, the working capital needs of the irrigated system is over four times those of the hydromorphic rice systems. Thus in terms of resource use, the irrigated rice system is a very high cost system in all respects.

8.4 Profitability Of Rice Systems

The competitiveness of the rice commodity systems can be measured by the profits they generate given current technologies, output values, input costs and policy. In this context, profits are total revenues from the primary product at the farm level, and at the post harvest and system levels less total production costs, where production costs include non-cash factors such as family labour and the value of working capital. Profits are reported in table 8.2 (see appendix B1 and B2 for details).

TABLE 8.2: 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

Profits in private prices provide a measure of the short to medium-term financial viability of the commodity system from the operator's perspective, and suggest to what degree the system may attract further investment. At the system level, all rice commodities generate positive profits. This implies that marketed production offer higher profits than that destined for on-farm consumption (Randoli, et. al, 1995). However, the irrigated rice system is the most profitable, generating a system profit which is over sixteen time the profit generated by the upland rice system and about six times that of the lowland system. This is hardly surprising as the irrigated system does not only provide higher yields per crop, but can be cropped twice in a year. It is pertinent to note that the irrigated rice system also generates profits that are several times higher than those generated by the hydromorphic rice systems at both farm and post harvest levels as indicated in table 8.2

An observation which is worth emphasising is the almost non-profitability of the lowland rice system at the farm level even though it is profitable at both post harvest and systems levels. This seems to suggest that activities of merchants and processors are not well integrated with farm level operations so as to pass on some of the merchant's and processor's profits back to the initial points of production.

Social profits on the other hand, are indicators of the longer term economic sustainability of the commodity systems. Estimates of social profits for the three rice systems indicate that the irrigated system generates profits that are more than 3 times higher than their upland counterpart and about 17 percent higher than the lowland system. Thus, in both private and social prices, the irrigated rice system is far superior to the hydromorphic system in terms of profitability.

8.5 Policy Transfers

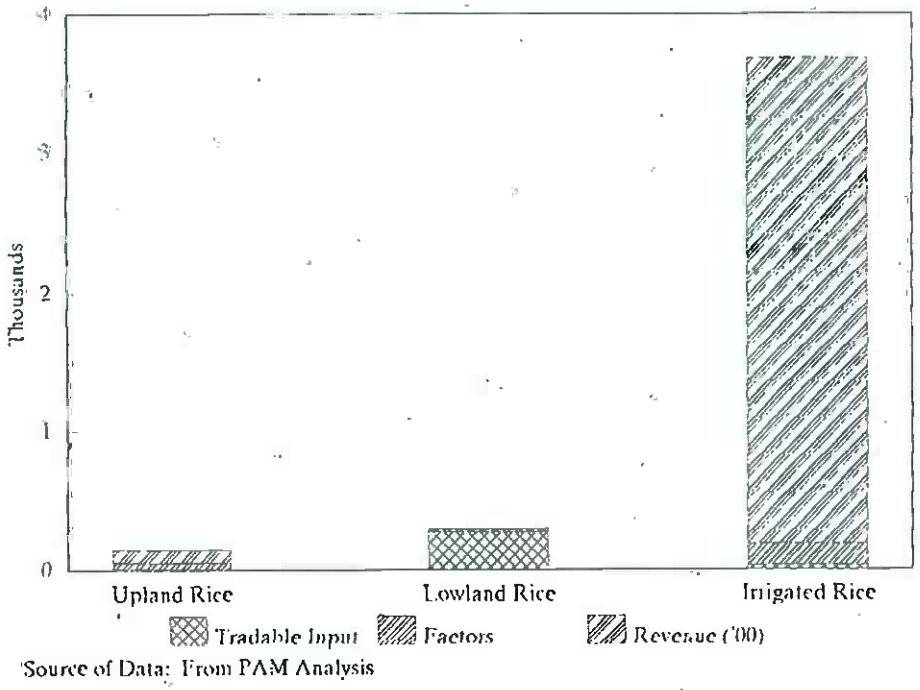
The PAM quantifies divergences between costs valued in private prices versus social prices associated with policy-induced distortions and market imperfections. Such divergences can be interpreted as transfer between groups within the society. Transfer per hectare for each of the three rice commodity systems are displayed in figure 8.2. The most import transfers occur in terms of revenue for every commodity system. These transfers are positive and huge for all rice systems indicating that operators in both systems receive prices that are higher than the parity value of the systems. The transfer to operators in the irrigated and lowland systems is, however, much higher than that of the upland system. The positive transfers reflect tariff protection on domestic rice production which constituted a transfer from consumers to operators within the sector (Randolph et. al, 1995). Figure 8.2 shows minor divergences within production costs. Operators in all rice systems pay more for domestic factors than for tradable inputs. This probably reflects lower social cost attributed to capital.

8.6 Private And Social Indicators

The PAM also offers indicators which allow the impact of policy on commodity systems to be further studied. These indicators are presented in table 8.3. The nominal protection coefficient (NPC) in the table is a ratio that contrasts the observed (private) commodity price with a comparable world (social) price. This ratio indicates the impact of policy that causes a divergence between the two prices (Monke, et. al, 1989). The NPC is above one for all the rice commodity systems. This implies that policies are increasing private revenues or the market prices of rice, making them higher than world prices of these commodities. The increases in revenue are more than six times higher for the irrigated rice than for hydromorphic rice systems. Domestic operators in the rice industry therefore appear to be enjoying substantial subsidies from the society.

Figure 8.2

Divergence Between Private and Social Profits (Thousand cedis/Hectare)



Source of Data: From PAM Analysis

TABLE 8.3: Private and Social Indicators of the PAM

Indicator	Upland Rice	Lowland Rice	Irrigated Rice
Nominal Protection Coefficient (NPC)	1.50	1.50	5.95
Effective Protection Coefficient (EPC)	1.51	1.52	6.42
Private Cost Ratio (PRC)	0.08	0.11	0.03
Domestic Resource Cost (DRC)	0.12	0.17	0.17
Subsidy Ratio to Producers (SRP)	0.50	0.49	4.95

Source: From PAM Results

The effective protection coefficient (EPC), one of the indicators of incentives, is the ratio of value added in private prices to value added in world prices. This coefficient measures the degree of policy transfer from product market policies. The EPC is also above one for all the rice commodity systems. The implication is that rice still enjoys a lot of protection on the tradable inputs employed by operators in the rice systems even under policy reforms. It should be noted that EPC, like the NPC, ignores the transfer effects of factor market policies and is therefore an incomplete indicator of incentives. This is a major disadvantage of the PAM.

The private cost ratio (PCR) and the domestic resource cost ratio (DRC) are ratios of domestic factor costs to value added in private and social prices, respectively. The DRC, in fact, is a proxy measure for social profits and therefore of comparative advantage of the commodity systems.

The PCR is less than one for all rice commodity systems confirming that private profits are being maximized. The DRC is also less than one for all the rice systems indicating that social profits are being maximized. The DRC also allows us to rank systems from efficiency point of view. This makes the hydromorphic upland rice system, which has the lowest DRC, the most efficient system. The irrigated and the hydromorphic lowland systems seem to operate at the same level of efficiency.

Another incentive indicator from the PAM is the subsidy ratio to producers (SRP), the net policy transfer as a proportion of total social revenues. It shows the proportion of revenue in world prices that would be required if a single subsidy or tax were substituted for the entire set of commodity and macroeconomic policies (Monke et. al, 1989). SRP permits comparisons of the extent to which all policy subsidises agricultural systems. From table 8.3, it is clear that policies continue to subsidise all rice systems as they all have a positive SRP.

8.7 Sensitivity Analysis

The concern in this section is to find out the levels of factors and investments that might result in a more efficient market for the rice commodity systems. The level of yields and output prices that will result in more efficient rice commodity systems is an additional concern.

Sensitivity is captured by elasticities computed for system-level DRCs with respect to changes in the factor parameters, and break-even values, defined as the value that yield and output price parameters would have to attain for the commodity system to become socially unprofitable. These values are presented in table 8.4

TABLE 8.4: Sensitivity Analysis of Social Profitability to Changes in Key Parameters

Parameter	Upland Rice	Lowland Rice	Irrigated Rice
	DRC Elasticities		
Unskilled Labour	0.05	0.09	0.03
Skilled Labour	0.05	0.07	0.04
Capital	0.90	0.85	0.93
	Break-Even Value		
Factor Costs (Percent)	851	593	581
Yield (MT/Ha)	7.28	37.15	30.59
Output Price (Percent)	-38.09	-28.16	-21.12

Source: From PAM Results.

The results of the sensitivity analysis indicate that all the commodity systems are generally less sensitive to assumptions regarding wage rates for both skilled and unskilled labour and also to the price of capital. A 1 percent increase in wage rate for both types of labour results in a 0.03 to 0.09 percent increase (worsening) in the DRC coefficients for all the rice commodity systems. Even though the increases of the DRC coefficients are significantly small, they still represent a worsening situation. On the other hand, a 1 percent increase in the cost of capital will result in a 0.90, 0.85 and 0.93 percent increase (worsening) of the DRC coefficients for upland, lowland and irrigated rice systems, respectively. The response (worsening) is much greater for the cost of capital than it is for unskilled and skilled labour.

The break-even analysis shows that yields should be kept relatively high for the rice systems to remain socially profitable. These yields are 7.28 tonnes per hectare, 37.15 tonnes per hectare and 30.93 tonnes per hectare for the upland, lowland and irrigated rice systems, respectively. For output prices, the break-even values do not fall within the range of values considered in the three rice commodity systems. Prices will have to fall by over 38, 28 and 21 percent for upland, lowland and irrigated rice systems, respectively, for the rice systems to become socially unprofitable. Similarly, for factor costs, the break-even values do not fall within the range of values considered in the three rice commodity systems. Factor costs will have to rise substantially for the rice systems to become socially profitable.

8.8 Policy Implications from PAM

The divergence between private and social values indicate that world market prices for rice are lower than the price of domestically produced rice. Thus, the net effect of policy reforms is the increase of the domestic market price and revenue above the world price of rice. 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. This, on the other hand is a disincentive to domestic producers of rice.

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.

The PAM analysis has shown 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.

8.9 Recommendations

The high private and social profits for the rice production systems underline the competitiveness of domestic production of rice. This suggests that policy reforms have made rice production generally efficient from both private and social points of view. However, huge transfers from the economy to operators in the rice systems suggest that policy reforms seem to be protecting the rice industry, indicating some degree of policy failure. In particular, the high private profits suggest some market imperfections, and for that matter market failure, in the rice commodity systems. Further reforms are necessary to correct these policy and market failures. Incentives, by way of credit schemes for rice farmers in particular will probably help the expansion in domestic rice production and lower private prices and profits. For the domestic rice production systems to become more efficient, divergences will have to be reduced to the minimum.

APPENDIX A

CROP BUDGETS FROM THE BASELINE SURVEYS OF GIDA, SARI AND CRI

APPENDIX A1. IRRIGATED RICE

1. Cost	Item	Unit	Quantity	Price	Value
a. Imputs					
	seed (Paddy)	bag	1	54,000.00	54,000.00
	compound	bag	7	34,444.00	241,108.00
	urea	bag	2	20,444.00	40,888.00
	ammonia sulphate	bag	3	11,056.00	33,168.00
	insecticide	lits	4	16,167.00	64,668.00
	rodenticide	kg/lt	1	5,000.00	5,000.00
	fungicide	kg/lt	7	6,278.00	43,946.00
	sacks	singles	84	1,539.00	129,276.00
	tools	lump sum			30,167.00
sub total					588,221.00
b. Labour	transplant/broadcast	ha	1	43,886.00	43,889.00
	spraying	ha	1	23,222.00	23,222.00
	weeding	ha	1	97,778.00	97,778.00
	bird scaring	ha	1	73,222.00	73,222.00
	cutting	ha	1	62,917.00	62,917.00
	threshing	ha	1	60,028.00	60,028.00
	winnowing	ha	1	15,389.00	15,389.00
	drying and bagging	ha	1	30,389.00	30,389.00
	carting fertilizer to field	bag	12	283.00	3,396.00
	Carting paddy from field	bag	54	394.00	21,276.00
	Other costs	ha			38,000.00
sub total					469,506.00
c. Machinery					
	land preparation	ha	1	158,333.00	158,333.00
d. Irrigation services charge	pump/gravity	ha	1	106,889.00	106,889.00
total imputs cost					265,222.00
e. Interest charge		ha	1	269,199.00	269,199.00
total costs					**1,322,949.00**
2. Revenue	paddy	bag	54	42,444.00	2,291,976.00
Gross Margin					**969,027.00**

Source: Amoatin and Acheampong, 1997.

APPENDIX A2: UPLAND RICE

Variable	NR
Labour imput (man-days	
Broadcast of seed	2.00
Weeding	50.00
Fertiliser application	1.00
Bird scaring	15.00
Harvesting	18.00
Threshing and winnowing	15.00
Total labour	101.00
Ploughing and harrowing of field by tractor	90,000.00
Cost of seed (100 kg)	50,000.00
Cost of transporting grain from farm to house	3,500.00
Sub-total	143,500.00
Cost of capital 35% for hald a year	24,395.00
Cost of production excluding value of labour	167,895.00
Value of Labour	121,200.00
Cost of production including value of labour	289,095.00
Output (kg/ha) paddy	1,150.00
Value of output @ ¢425	488,750.00
Profit	199,655.00

Source: Langyintuo, A. 1997.

APPENDIX A.3: Costs and returns local rice trade in northern Ghana (¢/bag)

Variable	NR
Farm gate price (80 kg paddy rice)	34,000.00
Transport cost from farm village to store[1]	500.00
Cost of processing[2]	4,500.00
Transport cost from will to market	1,000.00
Marketing costs	350,00
Nominal selling price of rice by assembler	64,000.00
Margin to assembler (for 1 bag of paddy rice)[3]	-2,000.00
Effective selling price of rice by assembler[4]	57,142.85
Transport and storage costs[1]	440.00
Price at the retail level	66,000.00
Effective margin to wholesaler[5]	8,857.15
Transport and marketing costs	300.00
Consumer price	68,000.00
Margin to the retailer	2,000.00
Value of milled rice from 1 bag paddy at retail level[3]	34,000.00
Marketing margin from a unit (1 bag) of paddy rice	0

Source: Langyintuo, A. 1997.

Notes:

Includes loading and off-loading charges - over a 30 km radius
Includes cost of transportation to mill, milling and winnowing charges
Conversion factor from paddy to milled rice is 50%
Wholesalers measure out 40 bowls (each of 2.8 kg on average) as a bag full (112 kg).
Wholesalers reduce the weight of the bag at assembler level from 112 kg to 100 kg.

APPENDIX A.4: Lowland/Inland Valley Rice

ACTIVITY/INPUT	RATE	UNIT COST (¢)	TOTAL COST(¢)
Land preparation (power tiller)	contract		50,000
Leveling (harrowing)	contract		40,000
(Trans) Planting from nurseries	20 man-days	4,500	80,000
First weeding	20 man days	4,500	80,000
Second weeding	-	-	-
Fertiliser application (mixture			64,000
Harvesting	20 man-days	4,000	80,000
Bird scaring	30 man-days	3,000	90,000
Carting of produce home	contract		20,000
Threshing (17 maxi-bags paddy)	Free at milling site	-	-
Milling (17 maxi-bags paddy)		2,000	34,000
Transport of paddy to mill site	free	-	-
Sub Total			538,000
INPUTS			
NPK	1 bag		38,000
Ammonia	1 bag		26,000
Seed	20kg		20,000
Sub Total			84,000
Total cost of Production			622,000

INCOME

Yield per acre	=	17 maxi-bags paddy
Milling ratio (2:1)	=	8.5 bags milled
Average Price/bag (milled)	=	¢100,000.00
Gross Revenue/acre	=	100.000 x 8.5
	=	¢850.00
Net Revenue	=	850,000-622,000
	=	¢228,000.00
Net Revenue/ha	=	¢570,000

Source: Opoku-Appau, A and Otoo, E. 1997

APPENDIX B1
PAM Baseline Results for Rice Commodity Systems

Thousand Cedis/Hectare	Private Values				Social Values				Divergences			
Commodity System	Output Revenue A	Input Costs B	Factor Costs C	Profit D	Output Revenue E	Input Costs F	Factor Costs G	Profit H	Output Revenue I	Input Costs J	Factor Costs K	Profit L
Hydromorphic Upland	28.11	0.42	2.20	25.49	18.76	0.41	2.16	16.19	9.351	0.009	0.045	9.297
Hydromorhic Lowland	83.09	2.05	9.23	71.81	55.45	2.02	9.01	44.42	27.637	0.023	0.225	27.390
Irrigated	419.37	6.06	11.26	407.06	70.45	6.03	11.09	53.34	348.92	0.039	0.169	348.722

Source: From PAM Results

TABLE 1: Irrigated Rice
SYSTEM
SUMMARY UNITS: Cedis per Hectare

	PRIVATE MEASURES						SOCIAL MEASURES						EFFECTS OF POLICY & MARKET FAILURES					
	FARM	Budget #2	Budget #3	Budget #4	POST FARM	COMMODITY SYSTEM	FARM	Budget #2	Budget #3	Budget #4	POST FARM	COMMODITY SYSTEM	FARM	Budget #2	Budget #3	Budget #4	POST FARM	COMMODITY SYSTEM
1.TOTAL REVENUE	2291.98	44788.36	**********	**********	**********	**********	2291.98	44788.36	89576.71	70454.49	44034.05	70454.49	0.00	0.00	89576.71	**********	**********	**********
(main output)	2291.98	44788.36	**********	**********	**********	**********	2291.98	44788.36	89576.71	44034.05	44034.05	44034.05	0.00	0.00	89576.71	**********	**********	**********
(other output)	0.00	0.00	0.00	*********	0.00	*********	0.00	0.00	0.00	26420.43	0.00	26420.43	0.00	0.00	0.00	*********	0.00	*********
2. TOTAL COSTS	1462.56	3749.98	**********	**********	18146.79	17317.38	1312.64	3706.24	**********	89808.55	18098.17	17118.84	149.92	43.74	89576.71	89581.59	48.62	198.54
A.RAW MATERIALS		2291.98	44788.36	*********	2291.98			2291.98	44788.36	89576.71	2291.98			0.00	0.00	89576.71	0.00	0.00
(tax+,subsidy-)		0.00	*********		0.00	*********	0.00											
B.TRADABLE	889.72	772.74	4309.85	86.18	5168.76	6058.48	860.18	772.74	4309.85	86.18	5168.76	6029.94	29.54	0.00	0.00	0.00	0.00	29.54
C.FACTORS	572.84	685.26	9850.25	150.54	10686.05	11258.90	452.46	641.52	9850.25	145.67	10637.44	11089.90	120.38	43.74	0.00	4.88	48.62	169.00
(unskill labor)	433.23	0.00	0.00	0.00	0.00	433.23	361.51	0.00	0.00	0.00	0.00	361.51	71.72	0.00	0.00	0.00	0.00	71.72
(skilled labor)	20.91	395.66	0.00	45.90	437.56	458.47	20.91	379.08	0.00	42.28	421.36	442.26	0.00	16.58	0.00	1.63	16.21	16.21
(capital)	118.70	291.60	9850.25	106.64	10248.49	10367.20	70.04	262.44	9850.25	103.39	10216.08	10286.12	48.66	29.16	0.00	3.25	32.41	81.08
PRE-TAX PROFIT:	829.41	41038.38	**********	**********	**********	**********	979.33	41082.12	**********	**********	7567.96	53335.65	-149.92	-43.74	0.00	**********	**********	**********
direct taxes:	0.00	0.00	0.00	0.00	0.00	0.00									(+=tax,-=subsidy)			
AFTER TAX PROFIT:	829.41	41038.38	**********	**********	**********	**********												

TABLE 1. Hydromorphic Valance-Rice

SYSTEM

SUMMARY UNITS: Cedis . per Hectare

	PRIVATE MEASURES						SOCIAL MEASURES						EFFECTS OF POLICY & MARKET FAILURES					
	FARM	Budget #2	Budget #3	Budget #4	POST FARM	COMMODITY SYSTEM	FARM	Budget #2	Budget #3	Budget #4	POST FARM	COMMODITY SYSTEM	FARM	Budget #2	Budget #3	Budget #4	POST FARM	COMMODITY SYSTEM
1.TOTAL REVENUE	486.92	2873.99	11495.99	28112.90	27286.05	28112.90	486.92	2873.99	5747.97	18761.77	11726.11	18761.77	0.00	0.00	5747.97	9351.13	15559.94	9351.13
(main output)	486.92	2873.99	11495.99	27286.05	27286.05	27286.05	486.92	2873.99	5747.97	11726.11	11726.11	11726.11	0.00	0.00	5747.97	15559.94	15559.94	15559.94
(other output)	0.00	0.00	0.00	826.85	0.00	826.85	0.00	0.00	0.00	7035.66	0.00	7035.66	0.00	0.00	0.00	-6208.81	0.00	-6208.81
2. TOTAL COSTS	289.06	592.28	13356.36	11866.09	2822.63	2622.97	247.40	589.18	7608.39	6109.18	2810.80	2569.28	41.66	3.10	5747.97	5756.91	12.03	53.69
A.RAW MATERIALS		488.92	2873.99	11495.99	488.92			488.92	2873.99	5747.97	488.92			0.00	0.00	5747.97	0.00	0.00
(tax+,subsidy-)		0.00	8621.96	0.00	8621.96	0.00												
B.TRADABLE	135.76	54.78	0.00	230.19	284.97	420.73	-126.76	54.78	0.00	230.19	284.97	411.73	9.00	0.00	0.00	0.00	0.00	9.00
C.FACTORS	153.31	46.58	1860.41	139.95	2048.94	2202.25	120.65	45.40	1860.41	131.02	2036.91	2157.56	32.66	3.10	0.00	8.93	12.03	44.69
(unskill labor)	117.07	0.00	0.00	0.00	0.00	117.07	97.68	0.00	0.00	0.00	0.00	97.68	19.39	0.00	0.00	0.00	0.00	19.39
(skilled labor)	7.05	27.91	0.00	80.40	108.30	115.39	7.06	26.87	0.00	77.42	104.29	111.38	0.00	1.03	0.00	2.98	4.01	4.01
(capital)	29.19	20.67	1860.41	59.55	1940.64	1969.79	15.88	18.60	1860.41	53.60	1932.62	1948.50	13.27	2.07	0.00	5.96	8.02	21.29
PRE-TAX PROFIT	199.86	2281.71	-1860.41	10246.81	16668.11	25489.93	241.52	2284.81	-1860.41	12652.58	13076.98	16192.49	-41.66	-3.10	0.00	3594.22	15547.91	9297.44
direct taxes:	0.00	0.00	0.00	826.85	826.85	826.85												
AFTER TAX PROFIT:	199.86	2281.71	-1860.41	13419.96	15841.26	24663.08									(+:tax,-:subsidy)			

TABLE 1: Hydromorphic Lowland/Inland Valley
SYSTEM
SUMMARY UNITS: Cedis per Hectare

	PRIVATE MEASURES						SOCIAL MEASURES						EFFECTS OF POLICY & MARKET FAILURES					
	FARM	Budget #2	Budget #3	Budget #4	POST FARM	COMMODITY SYSTEM	FARM	Budget #2	Budget #3	Budget #4	POST FARM	COMMODITY SYSTEM	FARM	Budget #2	Budget #3	Budget #4	POST FARM	COMMODITY SYSTEM
1.TOTAL REVENUE	1470.00	8494.05	33976.20	83087.50	80643.75	83087.50	1470.00	8494.05	16988.10	55450.29	34656.43	55450.29	0.00	0.00	16988.10	27637.21	45987.32	27637.21
(main output)	1470.00	8494.05	33976.20	80643.75	80643.75	80643.75	1470.00	8494.05	16988.10	34656.43	34656.43	34656.43	0.00	0.00	16988.10	45987.32	45987.32	45987.32
(other output)	0.00	0.00	0.00	2443.75	0.00	2443.75	0.00	0.00	0.00	20793.86	0.00	20793.86	0.00	0.00	0.00	*********	0.00	*********
2. TOTAL COSTS	1469.50	1470.00	41201.20	56562.75	11281.55	11281.05	1284.90	1470.00	24213.10	19512.23	11219.13	11034.03	184.60	0.00	16988.10	17050.52	62.42	247.02
A.RAW MATERIALS		1470.00	8494.05	33976.20	1470.00			1470.00	8494.05	16988.10	1470.00			0.00	0.00	16988.10	0.00	0.00
(tax+,subsidy-)			0.00	25482.15	0.00	25482.15	0.00											
B.TRADABLE	438.00	0.00	0.00	1608.57	1608.57	2046.57	415.50	0.00	0.00	1608.57	1608.57	2024.07	22.50	0.00	0.00	0.00	0.00	22.50
C.FACTORS	1031.50	0.00	7225.00	977.98	8202.98	7234.48	869.40	0.00	7225.00	915.55	8140.55	9009.95	162.10	0.00	0.00	62.42	62.42	224.52
(unskill labor)	954.60	0.00	0.00	0.00	0.00	954.60	797.00	0.00	0.00	0.00	0.00	797.00	157.60	0.00	0.00	0.00	0.00	157.60
(skilled labor)	51.40	0.00	0.00	561.82	561.82	613.22	51.40	0.00	0.00	541.01	541.01	592.41	0.00	0.00	0.00	20.81	20.81	20.81
(capital)	25.50	0.00	7225.00	416.16	7641.16	7666.66	21.00	0.00	7225.00	374.54	7599.54	7620.54	4.50	0.00	0.00	41.62	41.62	46.12
PRE-TAX PROFIT:	0.50	7024.05	-7225.00	46524.75	46323.80	71806.45	185.10	7024.05	-7225.00	35938.07	35737.12	44416.27	-184.60	0.00	0.00	10586.68	45924.89	27390.18
direct taxes:	0.00	0.00	0.00	2443.75	2443.75	2443.75												
AFTER TAX PROFIT:	0.50	7024.05	-7225.00	44081.00	43880.05	69362.70									(+=tax,-=subsidy)			

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