COMPARATIVE ADVANTAGE AND RICE POLICY IN GHANA

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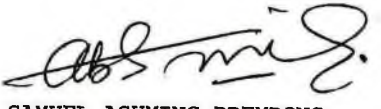
BIOGRAPHICAL SKETCH

The author was born in Kwaso (Kumasi), Ghana, on July 1, 1954. He obtained his elementary education (which he passed with distinction) from Kawso Presbyterian Primary and Middle Schools in 1968. He had his secondary education at the Presbyterian Secondary School, Bechem, which also he passed with distinction in 1974. He proceeded to the Mfantsipim School, Cape Coast for a 2-year 6th Form program, and subsequently joined the University of Ghana, Legon, Accra, where he graduated in B.Sc. Agricultural Economics with honors (2nd Class Upper Division) in 1979.

After graduation he continued with the University of Ghana as a Teaching/Research Assistant for a year. Meanwhile he had enrolled in the Gospel Revivals Ministry Bible School, Tema, during his final year at the University, and completed his ministerial training program in 1980. Since 1980 he has worked with the Gospel Revivals Ministry in Ghana as a Reverend Minister, Business Consultant and Youth Overseer until he left Ghana in May 1985 for the Philippines.

He is happily married to Stella (Andoh) Asuming-Brempong and blessed with three sons.



SAMUEL ASUMING-BREMPONG

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ASUMING-BREMPONG, SAMUEL, University of the Philippines at Los Banos (UPLB), October 1987. COMPARATIVE ADVANTAGE AND RICE POLICY IN GHANA.

Major Professor: Dr. John C. Flinn.

Even though rice is a minor staple in Ghana (WARDA estimated per capita consumption to be 6.7 kg. in 1983), and accounts for about 10% of all cereals, its imports to the country have been second only to wheat which is not grown domestically. Successive governments in Ghana have therefore decleared an objective of rice self-sufficiency. This means that the option of import-substitution for rice has been adopted as a means of conserving or generating foreign exchange. The issues that arise then are:

(a) Would domestically produced import substitute rice benefit the economy, that is, will benefits accruing from import substitution in rice outweigh the cost to the economy?

(b) How supportive are rice policies in Ghana to domestic rice production?

(c) What is the target clientele of the import substitution approach?

Following after Scandizzo and Bruce (1980), an attempt was made at answering the above questions by analysing government market intervention effects and the economic/social cost of rice production in Ghana. The Nominal Protection Rate (NPR), Implicit Tariff (IT) rate, and Effective Protection Coefficient (EPC) were estimated to determine the impact of government input-output pricing policies on the domestic rice industry; and the Domestic Resource Cost (DRC) criterion which is actually an index of the domestic cost of rice production, was used as a measure of Ghana's comparative advantage in rice production.

The study has clearly shown that Ghana has no comparative advantage in rice production for all the production systems outlined in the study, namely: Traditional (less-intensive), Improved, partially mechanized (semi-intensive), and Irrigated, fully mechanized (Intensive) systems. However, relative comparative advantage lies with the traditional system (DRC/SER = 2.86), while both the Improved (DRC/SER = -1.42) and Irrigated (DRC/SER = -1.04) systems result in absolute loss of foreign exchange. This was further buttressed by the EPC values which were positive for the traditional system and negative for the Improved and Irrigated systems.

Ironically, the NPR and IT estimates show that government policies greatly favor the rice industry. Domestic rice prices for the last decade have been 200 percent to 1700 percent higher

than comparable world prices, indicating that rice consumers in Ghana have been greatly taxed to finance an inefficient rice industry. Furthermore, government has made huge investments in irrigation and land development, and subsidized inputs to promote the rice industry. The policy thrust has been area expansion which was not matched by adequate yield increases, therefore the overall performance of the rice industry has been poor and very costly to the domestic economy. Also, by being biased towards large-scale rice production as against the small-scale farmer, government policies failed to ensure equitable income distribution as the bulk of the benefits resulting from policies accrued to large-scale farmers.

It is recommended that government rice policy must be redirected from area expansion by means of irrigation and mechanization to concentrate on yield increasing innovations for the small-scale farmer. Support price and ceiling price policies should be discontinued for the present since they have been, in general, ineffective due to financial and administrative problems in effective implementation. Meanwhile, a gradual development of the domestic rice industry should be preferred as rice imports continue to supplement the domestic effort. Also, a serious look must be taken of possible crop diversification that will direct domestic factors of production into economic activities that are more efficient in saving or generating foreign exchange.

CHAPTER I

INTRODUCTION

In many developing countries enormous socio-economic constraints confront governments which have to battle such perennial problems as lack of adequate productive resources and scarce foreign exchange. Such problems are usually compounded with ever expanding populations and inadequate job opportunities such that government efforts should be directed towards programs that make efficient use of the scarce resources to improve the lot of their people. It is against this background that successive governments in independent Ghana emphasized increasing food production, particularly rice. The objective has been to attain self-sufficiency so that rice imports in the country could be reduced and scarce foreign exchange saved, or even generated, for improving other vital areas of the economy. Even so, the issue of food security, and the import substitution approach to food requirements in the face of the downward trend of agricultural commodity prices (which is the mainstay of Ghana's economy) on the world market, lend support, on the surface, to self-sufficency in basic food needs in a developing country like Ghana.

Compared to other staple food crops produced in Ghana such as maize (averaging 350,000 tons/year) or yam (averaging 700,000 tons/year), rice production is rather low, averaging only about

70,000 tons/year of paddy in the 1970's and 60,000 tons/year in the 1980s (FAO Statistics). But of the major food items imported, rice is considered to be the crop whose production can be increased within a short period given the available technology, land, and other resources. This is one reason why rice features so prominently in government programs when it comes to improving local food production as a substitute for food imports, especially in the face of the problem of feeding a fast-growing population (particularly urban population) increasing at the rate of about 2.9% annually.[1]

1.1 Statement of the Problem

Rice has been the single crop that has enjoyed great support in the food programs of successive governments of Ghana. In 1970, the government budgetary statement indicated a desire to pursue a program of rice self-sufficiency through the introduction of machinery, fertilizers, storage, transport and milling equipments. With this combination of means, it was projected that the country could achieve a domestic rice capacity at internationally competitive prices which would eventually make unnecessary the continued importation of rice (Government Budgetary Statement, 1970/71). That same year, the government

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[1] The 1982 population of Ghana was estimated at 12.2 million. A high total fertility rate (7.0) and high crude birth rate (49/100) and a comparatively low crude death rate (13/1000) indicate a rate of natural increase of 3.6%. The overall growth rate is estimated at 2.9% per annum (World Bank, 1984).

signed a three-year technical cooperation agreement with the Federal Republic of Germany for the expansion and improvement of food production, particularly rice, in the northern parts of Ghana.

In 1972 when the military took over the reigns of government, a program code-named "Operation Feed Yourself (OFY)" was instituted to increase food production in the country. Rice was one of the crops which featured prominently in the OFY program. The government declared Ghana rice self-sufficient in 1975. Prakah-Asante and Nyanteng (1979) also projected that Ghana could be about 90% self-sufficient in rice production in 1980, and should be a net exporter of rice by 1985 assuming that expansion of cropped area and yield increases continued as in the early 1970's.

In 1980, Ghana imported 43,000 mt of rice which represented about 60% of the total rice consumed that year, and in 1985 she was still far from being self-sufficient. WARDA's (1986) estimation indicate that Ghana was only 55 percent self-sufficient in rice in 1985. Granted that such factors as adverse weather conditions and unstable political atmosphere might have contributed to the bad performance of the rice economy, the major question is: Is the government's continuing policy of self-sufficiency in rice production economically sound?

The continued support of domestic rice production by government means that scarce foreign exchange is used for the purchase

of essential machinery and fertilizer which cannot be obtained locally. Substitution of domestic production for rice imports can generate income if the country has a comparative advantage in rice because it can produce it efficiently (i.e. more cheaply than it can buy it). Alternatively, if domestic rice production is more costly than importing it, potential national income declines (Pearson, Stryker and Humphreys, 1981). On the other hand, given the fact that foreign exchange has been one of the binding constraints on economic development in Ghana, increasing foreign exchange commitments towards meeting food imports, notably rice, would only deny the necessary import level of capital and intermediate goods required for accelerating development and catching up for the past decline of the economy (World Bank, 1984). These conflicting alternatives thus bring into sharp focus the necessity for the government to base policies on the comparative advantage of the economic activities involved.

In view of the many resource limitations, it would be economically rational for the government to support only those production activities that are efficient in saving foreign exchange, and even capable of generating income. This then is the crux of the matter. Should the Government of Ghana pursue a policy of self-sufficiency in rice and invest scarce foreign exchange in developing a rice industry by expanding irrigation facilities, purchasing machinery and fertilizer, etc., because the country has a comparative advantage in rice production? Or

is it more costly to produce rice domestically as compared to imported rice, so that the government can continue to import rice and direct attention to other food crops which Ghana can produce more efficiently?

Another significant development in the Ghanaian economy which directly affects rice production is that since the beginning of the 1980's, the government has embarked on a program to phase out all subsidies on agricultural inputs. By 1983, except for insecticides, sprayers, and fertilizers whose subsidies were gradually being removed, there were no subsidies in existence on any other agricultural inputs (World Bank, 1984). This is but one example of the many reforms the Government of Ghana has initiated to overhaul the economy.

Based on the World Bank Report (1984), the government's response to the economic crisis came in the form of some fundamental economic reforms to remove the serious cost/price distortions prevailing in the economy, and realign relative prices in favor of production and export sectors. Action has already been taken in the areas of exchange rate, wage rate, energy and infrastructure prices, fiscal policy and subsidies. In this regard, this study will determine Ghana's comparative advantage (or disadvantage) of domestic rice production, and the extent of government intervention in the rice industry.

1.2 Significance of the Study

Pearson, Stryker, and Humphreys (1981) observed that the fundamental policy objectives concerning rice in West Africa are (a) generating more income, (b) distributing income in a more equitable fashion, and (c) food security. Rice self-sufficiency is considered a proximate objective which contributes to realizing the above fundamental objectives. However, in Ghana, self sufficiency in rice seems to be a fundamental policy goal in various government rice programs as evidenced in the Ministry of Agriculture Document (April, 1984) which is discussed later.

Some of the reasons why past and present governments in Ghana continued to pursue a policy of self-sufficiency in rice may include the following:

(a) the government might lack adequate information and not appreciate that import substitution for rice could be very costly,

(b) that the instability, sometimes experienced in world rice trade such as the high prices of rice on the world market in 1973-75 might have given false hope of increased comparative advantage in rice production,

(c) that the government understand the rice situation fully but hold expectations of better prospects in the future such as an increase in world price of rice, yields of improved techniques, and relative cost of domestic resources,

(d) that the government has other objectives such as income generation and income distribution as well as food security,

(e) that governmemt effort is complemented by Foreign Donor Agencies which might provide concessional assistance to rice projects including land development, provision of infrastructure, and investment in water control facilities, or

(f) that among the major imported foodgrains, rice is the crop whose domestic production could be increased most quickly to meet the increasing demand for food as a result of fast population increases.

So far, limited literature exists on the economics of rice production in Ghana. Even though rice is a minor food crop in Ghana in terms of area cultivated (only about 5.6% of the total land area cultivated under major crops) and per capita consumption (only about 6.2 kg in 1980), rice importation to Ghana is second only to wheat and, therefore, draws heavily on the country's scarce foreign exchange (WARDA, 1983). it is hoped that this study will add to the scanty literature on the economics of rice production in Ghana, and will provide some basis for the government in its future rice policies.

1.3 Objectives of the Study

The specific objectives of this study are:

(a) to determine how economically competitive the domestic production of rice is with respect to imported rice;

(b) to estimate the relative comparative advantage of the major rice production systems in Ghana; and

(c) to determine the incentives or disincentives structure created by government policy in the rice production methods.

1.4 Hypotheses

It has often been argued that in most developing countries government policies largely favor inefficient industries and production activities especially when the objective is to promote economic activities which are import-substituting. Such policies may be more politically than economically motivated, so that in terms of efficiency gross inconsistencies may exist between policy goals and policy instruments adopted to achieve such goals.

For the purposes of this study, three hypotheses are established:

(1) Ghana has a comparative advantage in rice production.

(2) Highly mechanized irrigated (intensive) rice production has a higher social opportunity cost than traditional (less intensive) methods.

(3) Government rice policy provides strong production incentives to the rice industry.

1.5 Organization of the Study

The study has four major components. The first section deals with the methodology employed for this study, and the second part concerns an overview of rice production in Ghana which encompasses the history, physical environment, production patterns and highlights of government rice policies. The results obtained from the study and their subsequent discussion are embodied in the third section. The fourth component is a synthesis of government rice policies vis-a-vis the performance of the rice economy over the years. An attempt has also been made to compare the rice industry in Ghana with those of other West African countries.

The estimation of the Domestic Resource Cost (DRC) and other incentive indicators such as the Nominal Protection Rate (NPR) and the Effective Protection Coefficient (EPC) have been the focal point of this analysis. The DRC criterion has particularly been used for this study because of its advantage as a systematic "ex-post" measure of an existing structure of protection, and its ability to capture as much as possible all the distortions in a total measure of the cost of protection. This means that the DRC becomes an index of the social cost of protection for import substitutes (or promotion for exports), thereby giving an appropriate reflection of the opportunity cost of domestic

factors of production in a protected industry (Bruno, 1963, Krueger, 1972).

As a prelude to this study, a short literature review of some of the recent studies which employed the above methodology has been provided.

CHAPTER II

REVIEW OF LITERATURE

This chapter surveys some of the recent studies which have used the Domestic Resource Cost (DRC) approach to determine the comparative advantage or disadvantage of certain productive agricultural activities. The studies reviewed here do not consider only rice but also other activities such as cotton, tobacco and livestock production.

Bruno (1963) introduced the concept of Domestic Resource Cost (DRC) in the study of interdependence, resource use and structural change in the economy of Israel. He modified the concept for use in the optimal selection of export promoting and import substitution projects in Israel in 1967. The concept of Domestic Resource Cost (DRC) has since been generally accepted by economists as a good measure of comparative advantage and has been used in studies in many countries.

In a study of the comparative advatnage of rice production in Thailand, Akrasanee (1974) used the DRC technique and established that Thailand has a large comparative advantage in rice production, and that if the government's objective was to earn foreign exchange through exports, it was very advantageous and economical for the Thai government to continue to expand production and boost up export of rice.

Using the DRC method to compare the comparative advantage of rice production among eight Thai provinces, Wattananukit (1975) found that Thailand has a comparative advantage in rice production in all the provinces, but certain provinces had higher comparative advantage than others. For example, Pathumthani province had the highest DRC coefficient while Nonthaburi had the lowest, indicating that the production of rice in Nonthaburi province was more profitable to Thailand than in Pathumthari.

Pearson, et.al. (1981) in their study of policy and economics of rice in five West African countries used the Resource Cost Ratio (RCR) technique which is analogous to the Domestic Resource Cost (DRC) to determine comparative advantage of rice production in Ivory Coast, Sierra Leone, Liberia, Senegal, and Mali. They observed that even though the policy of all these countries was self-sufficiency in rice production, only Sierra Leone and Mali possessed a comparative advantage in rice production.

In a study of the tobacco industry in the Philippines, Abad (1982) used the Domestic Resource Cost (DRC) approach and concluded that the Philippines had a comparative advantage in the production of both flue-cured tobacco and native tobacco, and that flue-cured tobacco production was a more profitable venture than the production of native tobacco.

Also in the Philippines, Balisacan (1982) conducted a study of the cotton industry using the Domestic Resource Cost (DRC)

technique as a measure of comparative advantage. He estimated that the country had a comparative advantage in cotton production, especially the production of seed-cotton. However, he concluded that seed cotton yield and world prices greatly influenced the comparative advantage or disadvantage of cotton production in the Philippines.

Similarly, Cabanilla (1983) used the Domestic Resource Cost (DRC) method to study the comparative advantage of the Philippine livestock industry, specifically poultry, hogs, and cattle. He concluded that, on the whole, the Philippines had a comparative advantage in livestock production. But whereas the country had a comparative advantage in hogs, cattle, and egg production, it had a comparative disadvantage in broiler production, due to the high import content of the feeds used in the production of broilers. This study thus shows that the comparative advantage of a productive activity (including rice) is greatly influenced by the content of traded inputs in the final output.

Unnevehr, et. al. (1984) conducted a study of the changing comparative advantage in Philippine rice production for the period 1966 to 1982, using the Domestic Resource Cost (DRC) coefficient as an indicator of comparative advantage. They concluded that technological change in rice production has increased Philippine rice production. The adoption of rice modern varieties (MVs), increased fertilizer use, and expansion of irrigated area all contributed to increased yields. The

resulting production growth led to greater self-sufficiency and reduced rice price protection by 1982, suggesting increased Philippine comparative advantage in rice production.

Past studies dealing with the comparative advantage of rice production in Ghana employed the Net Social Profitability (NSP) concept instead of the DRC concept. Prakah-Asante and Nyanteng (1979) observed that all rice production techniques in Ghana were privately profitable, but socially unprofitable, and that the fully mechanized production technique was socially the most unprofitable.

Osafo (1983) also used the Net Social Profitability (NSP) analysis as an indicator of comparative advantage and found that all rice production techniques in Ghana were privately profitable (as it was the case in most West African countries), but socially unprofitable (i.e. NSP was negative for each of the production techniques). In fact, he concluded that Ghana had the lowest rates of net social profitability in West Africa, and the domestic rice was replacing imported rice (in the context of self-sufficiency) at a very high cost to the Ghanaian economy.

Included in most of the above studies were the estimation of the social opportunity cost of producing the various products using the Net Social Profitability (NSP) approach, and the effect of government protective measures using the Effective Protection Coefficient (EPC) and/or the Nominal Protection Rate (NPR) techniques. Scadizzo and Bruce (1980) provide a general

description of the methodologies for measuring agricultural price intervention effects such as mentioned above. The importance of using economic prices rather than market prices in the estimation of indicators of comparative advantage have been highlighted by various authors including Bruno (1972), Balassa (1977), and Pearson et. al. (1976). Also, the flexibility of the DRC concept by way of sensitivity analysis which helps to capture both the static and dynamic effects of important parameters is well documented in the literature. Other empirical studies based on the above methodologies have attempted to give detailed description of the nature and extent of government intervention in agriculture. Particularly for rice, Ali (1986) has made a detailed study of the comparative advantage of rice production among eleven regions of Indonesia, differentiating between regions which have comparative advantage in rice and those which have not. Furthermore, the economic profitability for rice production as an import substitution activity was contrasted with rice production for export, and thereby suggested diversification. Gonzales (1984) provided a regional estimate of DRC for various crops in the Philippines; and Rosegrant et al. (1987) have made an extensive study of the price and investment policies for food crop sector growth in the Philippines based on the DRC criterion. All these studies which have employed the above methodologies and used the DRC criterion for investment and policy analysis lend support to the appropriateness of the methodology for this study.

The DRC has been widely used as an indicator of relative efficiency in distorted foreign trade regimes (Krueger, 1966, Bruno, 1970, Pearson, 1976, and Pearson, et. al., 1976). It is used for the evaluation of existing or planned economic activities under conditions in which foreign exchange is a constraint on economic development (such as the situation in Ghana today as has already been indicated).

Based on the availability of data and other advantages (such as its use as an index of comparison of one commodity across regions or among different production technologies, and the fact that it is independent of the unit of measurement) the Domestic Resource Cost (DRC) coefficient has over the Net Social Profitability (NSP); and also the nature of distortions in the Ghanaian economy as well as the fact that the NSP approach has been used in previous studies, this study will concentrate on the DRC as an indicator of comparative advantage.

CHAPTER III

METHODOLOGY

3.1 Theoretical Concept

According to the classical concept of the gains from international trade, a nation can increase its output from specialization and exchange. In other words, the Law of Comparative Advantage postulates that all countries consume more of all commodities, with a given amount of resource, by exchanging goods and services. The existence of comparative advantage provides opportunity for a country to import goods which cost relatively more to produce domestically and to export goods it can produce relatively cheaply. In this regard, domestic resources tend to be allocated or used in activities whereby they are most efficient or where they have a comparative advantage, if economic efficiency is the avowed objective of national policy.

Comparative advantage is the ability of a country to produce a unit of a certain commodity at relatively less social opportunity cost of all factors of production used to produce it, than obtaining it by imports or other means (Pearson and Meyer, 1974). Specifically, a country has a comparative advantage in rice production if the social opportunity costs of producing an incremental unit of rice (of comparable quality) are less than

the border prices[2] of rice. Chenery (1961) defined the "social opportunity cost" of rice production as the value of all factors of production used to produce rice in their best alternative employment.

3.2 Comparative Advantage

In measuring comparative advantage, the methods usually employed are the Net Social Profitability (NSP) and the Domestic Resource Cost (DRC) (which is analogous to the Resource Cost Ratio (RCR)[3]). Both methods for determining comparative advantage are based on a set of basic assumptions of which the major ones include:[4]

(a) The world price of the output (rice) is given exogenously or is estimable;

(b) Costs of production, determined by a given technology and an assumed set of relative factor prices, are constant, subject to sensitivity analysis to reflect changed assumptions;

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[2]The "border price" of rice refers to the f.o.b. export price if the country is an exporter of rice, or the c.i.f. import price if the country is an importer of rice.

[3]For a complete discussion on the relationship between the DRC and RCR see Pearson, Stryker, and Humphreys (1981).

[4]These assumptions were also noted by Chenery (1961), Bruno (1967), Pearson and Nelson (1974).

(c) Shadow prices of inputs and outputs, which are representatives of the true opportunity costs of factors and of the true scarcity values of commodities within the context of an assumed allocation of resources reflecting a specific set of policies, can be calculated; and

(d) The true foreign exchange cost of production can be calculated (to reflect the same assumed set of policies as in (c) above.

3.2.1 Net Social Profitability (NSP)

Net Social Profitability (NSP) is defined as the net gain (or loss) associated with an economic activity when all output and input factors of production are evaluated at their social opportunity cost (by using shadow prices) and when all external effects on the domestic economy are given a social valuation and included directly in the measure. That is, it is a measure of comparative advantage in terms of economic efficiency of valuing production cost at shadow prices or social opportunity costs. According to Pearson, Stryker, and Humphreys (1981), a technique for producing an additional unit of rice is efficient if the social value of its output is equal to or greater than the social opportunity cost of the commodities and factors of production employed in producing it. The measure of efficiency thus

defined, is the Net Social Profitability of the activity. Thus the NSP equals the difference between the import value of a kg of rice and the cost of producing it domestically, or the difference between value added in world prices and opportunity cost of obtaining this value added. Expressed algebraically:

$$NSP = \sum_{i=1}^{n} Y_{ij}P_i - \sum_{s=1}^{m} a_{sj}P_s + b_j$$

where :

Y_{ij} = the quantity of i^{th} output produced by an intermediate input used by (input having negative signs) the jth activity

P_i = the shadow price of i^{th} output or intermediate input (in domestic currency)

a_{sj} = the quantity of the s^{th} factor of production used by activity j

P_s = the shadow price of the s^{th} factor of production (in domestic currency)

b_j = a measure of the net external benefits or costs imported by the j^{th} activity on the rest of the domestic economy

Pearson and Nelson (1974) observed that if:

(a) all production units are profit maximizers,

(b) no factor or production market distortions exist,

(c) no economic rents are generated,

(d) government tax/expenditure policies do not distort relative prices,

(e) income redistribution measures are continuously enacted (or are of no concern),

(f) externalities are zero (or fortituously offsetting);

then market prices and shadow prices of inputs and outputs will be equal. In this hypothetical situation, social benefits of an economic activity would equal social costs of production, and hence the net social profitability of the activity would be zero.

As typical of developing economies like Ghana, few, if any, of these conditions exist, resulting in sometimes large differences between social costs and between actual and shadow prices. Osafo (1983) observes that in Ghana, government policies include government taxes and import licenses for foreign trade which distort product and factor prices as true measures of social opportunity costs. There is also public intervention in capital and labor markets, as well as an overvalued exchange rate which affect prices of tradable inputs and outputs. The government of Ghana has a minimum wage law and subsidizes credit through the Bank of Ghana for different sectors of the economy (even though this subsidy is gradually being faced out). Such actions of the government result in divergence between market and social prices.

There is a direct relationship between net social profitability (NSP) and Comparative Advantage. Ghana has a comparative advantage in producing rice if the NSP is positive; and if efficient economic growth is an objective, rice production methods with higher NSP should be preferred. But if NSP is negative, then Ghana is inefficient in rice production, and it will be better to employ the factors of production in some alternative use.

The main drawback of the NSP as a measure of comparative advantage is that it carries the unit of measurement of output and, therefore, varies with the measure of output of each activity. That is to say, NSP must be estimated "per ton", "per hectare", etc. For this reason, it cannot be used to rank alternative projects that are measured in different units or for evaluating past investments and the success of previous policies.

3.2.2 Domestic Resource Cost (DRC)

An alternative indicator of comparative advantage which is independent of the unit of measurement is the Domestic Resource Cost (DRC) which in this sense has some advantage over the NSP.[5]

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[5] A direct relationship exist between the NSP and DRC whereby the DRC is derived from the NSP. For detailed study of this approach, see among others Pearson and Nelson (1974), Pearson, Stryker, and Humphreys (1981).

The Domestic Resource Cost (DRC) simply defined is a measure of the social opportunity cost (in terms of domestic factors of production employed directly and indirectly) of earning a marginal unit of foreign exchange. That is, the ratio between the cost of a dollar earned or saved through domestic production and an accounting rate of exchange (shadow price). Since the factors of production are resource costs to the country, the degree of comparative advantage is evaluated by the value of domestic resource (measured at social opportunity cost) compared with the net foreign exchange earnings (value of traded output minus value of traded inputs) (Abad, 1982). In calculating the DRC ratio, the numerator which represents the opportunity costs of primary factors used in the production of a unit of the output (rice), is expressed in domestic currency, and the denominator, which also represents the world net value or net foreign exchange earnings resulting from the production of a unit of the output (rice) is expressed in foreign currency.

This can be expressed as:

$$DRC = \frac{\text{Opportunity Cost of Domestic Resources (in domestic currency)}}{\text{Net foreign exchange earned or saved (in foreign currency)}}$$

$$DRC = \frac{\sum_{s=1}^{n} Y_{sj} \, MPP_s^b \, P_s^d}{P_j^y - \sum_{i=1}^{m} a_{ij} \, P_i^y}$$

where:

Y_{sj} = quantity of primary non-traded factors (including those obtained as a result of decomposition of non-traded goods) used in the production of a unit of the j^{th} commodity

MPP_s^b = marginal physical product[6] of the s^{th} input in its best alternative use (b)

P_s^d = domestic price of the s^{th} input

P_j^y = foreign price of the j^{th} output (c.i.f. $ for imports, f.o.b. $ for exports)

a_{ij} = quantity of traded input i (including the traded elements of non-traded goods after decomposition) used in producing one unit of j^{th} output

P_i^y = foreign price of i^{th} traded input (c.i.f. $ for imports, f.o.b. $ for exports)

The DRC coefficient thus obtained can be compared with the shadow exchange rate (SER), to obtain the Resource Cost Ratio (RCR) which gives an indication of comparative advantage. The SER (or accounting exchange rate) can be considered as the

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[6] MPP_s^b is often difficult to estimate in practice and, therefore, MPP_s^b. P_s^d is usually replaced by P'^d_s which is the estimated value of marginal product of the sth resource in its next best use, net of taxes and subsidies. Also, in the absence of adequate information about marginal value products, the market price of the factor (resource) is used as a surrogate (Scandizzo and Bruce, 1980).

weighted average of the efficiency of all tradable activities in the economy, in transforming domestic resources into foreign exchange. It serves as a cut-off boundary between comparative advantage and disadvantage in the production of a unit of the commodity.

Thus, we have:

$$\frac{DRC}{SER} \begin{cases} < 1 & \text{Comparative Advantage} \\ = 1 & \text{Neutral position} \\ > 1 & \text{Comparative Disadvantage} \end{cases}$$

The DRC/SER ratio can be used to compare the relative comparative advantage of: (a) one commodity across regions within a country (Ali (1986) studied the comparative advantage of rice production in different regions of Indonesia); (b) two or more commodities within a region or country (the work of Rosegrant et. al. (1987) for the Philippines); (c) two or more production technologies (Akrasanee and Wattananukit (1976) distinguished between irrigated/unirrigated and traditional/modern rice production in Thailand); and (d) a homogenous commodity on the international level if DRC's are expressed per unit of foreign exchange in each country, measured at the SER (Monke, et. al. (1976) gave a cross country comparison of comparative advantage in rice production).

The DRC coefficient indicates relative efficiencies of alternative foreign exchange producing activities and isolate areas in which the country's comparative advantage lies, given the existence of distortion between international and domestic rates of transformation implied by the foreign exchange constraint (Monson and Rusell, 1979).

When DRC is used for investment decisions, the shadow exchange rate and other shadow prices must be assumed to be constant throughout the period considered to avoid the problem of comparing discounted DRC with several shadow exchange rates. This is necessary because of the dynamic adjustment of changing parameters such as the international prices of tradeable goods, production technologies, etc, and imperfections in empirical measurements.

Scandizzo and Bruce (1980) explained that the DRC coefficient can be obtained by computing the cost of foreign exchange saved for imported competing goods and the cost of foreign exchange earned for export. Traded final goods (e.g. rice) and non-traded goods are decomposed into traded inputs such as fertilizer and machinery and non-traded primary factors (domestic resources like labor and land). The traded inputs thus identified are evaluated at border prices while non-traded components are evaluated at accounting prices. DRC's are then measured as the ratios between the cost of domestic resources

(evaluated at accounting prices) and net foreign exchange earnings (value of traded output minus value of traded inputs). Bruno, the originator of the DRC concept, states that the cost of foreign exchange criterion "clearly measures comparative advantage", but at the base of the criterion lies two basic estimates: (a) the accounting prices of domestic resources, and (b) the accounting exchange rate to be used to convert these prices into units of international currency.

3.3 Policy Incentives

The effects of government protection policies and the impact of market intervention on rice production are determined using the Effective Protection Coefficient (also called the Effective Protection Rate) and the Nominal Protection Rate as measures.

3.3.1 Effective Protection Coefficient (EPC)

Balassa (1975) defines the EPC as the ratio of the domestic value added, obtainable as a result of the application of protective measure to value added in world market prices. The "value added in world market prices" will equal the domestic currency equivalent of net foreign exchange saved through import substitution or earned through exportation.

An EPC $>$ 1 means that at the existing official exchange rate protection measures provide positive incentives to produce

the commodity (rice); an EPC < 1 indicates that protective measures discriminate against the commodity (rice), while an EPC < 0 signifies an absolute loss of foreign exchange to the economy. It is to be noted than an EPC less (greater) than one is not necessarily an actual disincentive (incentive) only a potential one. In effect, the EPC is more a measure of the effects of protective measures on traded outputs and traded inputs, indicating the potential incentives for incurring domestic costs. It is expressed as:

$$EPC_j = \frac{Va_j^d - Va_j^b}{Va_j^b}$$

where;

EPC_j[7] = effective protection coefficient on the j^{th} activity

Va_j^d = value added at domestic price in the j^{th} activity

Va_j^b = value added at border price in the j^{th} activity

[7]The EPC is algebraically related to DRC if all importable inputs are actually imported, and could, therefore, be used as an indicator of comparative advantage under specified assumptions (Pearson, Stryker, and Humphreys, 1981).

The EPC can be decomposed into its output and input components to facilitate computation. Thus,

$$EPC_j = \frac{P_j^d - \sum_{i=1}^{k} a_{ij} P_i^d}{P_j^b - \sum_{i=1}^{k} a_{ij} P_i^b}$$

where:

a_{ij} = quantity of the i^{th} input used to produce one unit of the j^{th} output

P_j^d = domestic price of the j^{th} commodity

P_i^d = domestic price of the i^{th} input

P_j^b = border price of the j^{th} commodity

P_i^b = border price of the i^{th} input

i = 1------k = all traded inputs, direct and indirect

3.3.2 Nominal Protection Rate (NPR)

The Nominal Protection Rate (NPR) also measures the rate at which the domestic price of a final output faced by the producer deviates from the world or border price. It shows the effect of government intervention on the price of output j, but unlike the EPC, it does not consider the effect of intervention on the price of tradeable inputs which also affect profitability of a product-

ive activity. Hence the Effective Protection Coefficient (EPC) is a more complete measure of protection than the NPR.

In formula,

$$NPR_j = \frac{P_j^d}{P_j^b} - 1 \quad x\ 100$$

where:

NPR_j[8] = nominal protection rate for the j^{th} commodity

P_j^d = domestic price of commodity j

P_j^b = border price of commodity j (expressed in domestic currency).

A positive NPR means protection to domestic producers, while a negative value indicates penalty.

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[8]The above expression of the NPR depends on two basic assumptions: (a) that the commodities (rice in this case) in question are homogeneous so that there are no significant differences between domestically produced and imported rice; and (b) that reliable data on domestic and border prices exist. Even though some quality differences may sometimes be observed between the domestically produced and imported rice in Ghana, especially because of processing and handling problems associated with the domestically produced rice, it could be argued that, on the average, such differences do not significantly affect domestic market prices.

3.4 Measurement of the Shadow Exchange Rate (SER)

In an economy where there are price distortions as found in most developing countries like Ghana, the Domestic Resource Cost (DRC) coefficient must be compared with the shadow exchange rate (SER). This is because the official exchange rate (OER) does not reflect the free trade equilibrium rate or the shadow exchange rate (SER) which is neither overvalued nor undervalued. The major factors which cause distortions in the OER include export tax, import tariff, and subsidies. For example, a reduction in import tariff leads to an increase in demand for imports and, therefore, higher demand for foreign exchange. In other words, the protection system leads to an overvaluation of the domestic currency relative to its real worth in the absence of distortions, whereas the export tax implies undervaluation. As it is the case with Ghana, the foreign exchange rate still overvalues the Ghanaian cedi as opposed to the situation under free trade even though the government has drastically devalued the cedi from ¢30.00 = US$1.00 after April 1983 to ¢162.00 = US$1.00 in August 1987, representing a 440 percent devaluation.

There are two common approaches for estimating the divergence of the OER from the SER. The first method considers how much the protection structure has diverted the exchange rate from what would have pertained in its absence (Bacha and Taylor,

1971); while the other looks at the value of an additional unit of foreign exchange in terms of the incremental consumption it can provide (Dasgupta, et. al., 1972). However, both methods require such information as the elasticity of supply of the country's exports, the elasticity of demand of the country's imports, and the elasticities of demand and supply of the country's foreign exchange; which information are not readily available in Ghana now. Also, these methods estimate over-valuation at different points in time, resulting in a multiplicity of shadow exchange rates each defined as the ratio of the shadow price of the good or service to its domestic market price.

This study uses a simpler estimation method which estimates the shadow exchange rate (SER) under the assumption that the SER and the official exchange rate (OER) have been moving in a parallel fashion. This means that the SER is measured under the prevailing structure of protection existing in the economy. This method was used by Medalla (1979) and was adopted by Balisacan (1982) and Unnevehr et al. (1982). In the World Bank's study of Ghana's Economic Recovery program, this method was employed to estimate the SER for Ghana. In 1984 when the OER was ¢35.00 to

US $1.00, the World Bank estimated the premium[9] placed on foreign exchange (b) as 100%. This estimate was made by comparing the OER to the prevailing "Black Market Rate" of ¢100.00-¢120.00 to US $1.00.

The SER for a given year can be estimated by the following formula:

$$SER_t = OER_t (1 + b).$$

where:

SER_t = shadow exchange rate at year t

OER_t = official exchange rate at year t

b = premium placed on foreign exchange to correct its undervaluation (See Appendix C).

3.5 Economic Valuation of Inputs and Rice Output

The estimation of comparative advantage using the Domestic Resource Cost (DRC) approach involves the valuation of resources employed in the production process. This valuation is done in terms of social opportunity costs to reflect the value placed by society on the opportunities foregone by using scarce resources

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[9]For this analysis, which covers the 1985/86 crop year, the premium placed on foreign exchange (b) is assumed to be 50%, considering the present situation of Ghana's exchange rate (OER for 1986 was ¢90.00 = US$1.00 and "Black Market Rate" was ¢150-¢180.00 = US$1.00) and the economic recovery measures being pursued by the government.

in the sector they are employed. The principal factors of production - land, labor, capital, and other intermediate inputs (fertilizer) are valued in terms of their value if employed in some alternative activity to serve as a guide to how resources can be allocated to maximize social welfare.

There are two basic approaches adopted by economists on the social valuation of resources. The first restrictively defines shadow or social prices with economic efficiency as the sole objective at hand. The second argues that shadow prices should reflect not only economic efficiency, but also other national objectives like income distribution and growth, and, therefore, a system of weights have to be adopted in shadow pricing.

The estimation of shadow prices used in this study is based on the concept of the maximization of economic efficiency. Shadow prices of tradeable inputs and outputs equal their prices on the world market. For domestic factors of production, shadow prices are measured as the value in world prices of national output foregone by shifting these factors out of their alternative uses.

Primary Inputs

Land. For reasons of economic valuation, land is considered separately from other capital assets. When land is used for rice cultivation, the shadow price, expressed in equivalent world

prices, is defined as its return from the best alternative use. Even though land is a major input in traditional agriculture, it is generally difficult to value its services since the actual return to land which may estimate the social opportunity cost is usually not known. One approach for land valuation is to assume that the land in question has no alternative use, in which case its opportunity cost is zero. Another method normally used for land valuation is the return to land in another crop. Where there is an unsegmented or a developed market for land, the return to land in another crop could be adequately represented by the observed market rental price of land.

In this study, the shadow price of land for rice cultivation in Ghana is assumed to be zero because:

(a) land is generally in abundant supply in Ghana due to low population density. For example, in Northern Ghana where most of the rice is produced, the population density is only about 8 people per square kilometer (from 1980 population estimates).

(b) most of the areas where rice is cultivated, both in the north and Western Ghana, are flooded bottomlands and no alternative crops are cultivated.

But since not all the available land could be cultivated under rice due to lack of irrigation water, it is possible that land may become increasingly scarce in the future as farms expand

and demand on land increases. Also, particularly in Southern Ghana, where irrigated rice cultivation is expanding rapidly it may well be that land could be used most profitably for a crop like sugarcane or even maize. However, the area in question is relatively small and no data is available with which to calculate the residual return to land in these alternative uses.

Irrigation Water. Water is particularly important in irrigated rice production, but its shadow price depends on two main factors: (a) the ability to allocate or control it, and (b) the scarcity of water for irrigation. In rice production, water should be shadow-priced if the capital cost of an existing investment for irrigation is considered small and the amount of water that can be delivered to the fields is limited in relation to cultivation needs, or if the growth of irrigation demands on a river or other natural water system reaches the point at which water taken from that system becomes scarce (Stryker, et al. 1981). However, the economic value of water in rice production in Ghana is created through capital investments in control systems for allocating available water supplies. For example, pumping brings otherwise valueless water to the fields where it has value. Since allocating the water does not result in scarcity, the value equals the cost of constructing and operating the pumps and therefore it is a return to these inputs rather

than the water itself. Hence, even when water control is provided by new irrigation investments, water still has no shadow price. The shadow price of water is, therefore, assumed to be zero. Pearson, et. al. (1981) made a similar assumption in their study of rice policy and economics in West Africa.

Labor. Labor is valued in economic or social analysis within the framework of the principle of opportunity cost. The major factors which determine the shadow price of labor are whether it is skilled or unskilled, and the task that labor is employed to perform. For example, skilled labor is important where there is a high degree of mechanization.

Many factors influence the wage rate in Ghana. First, the relative favorability of ecological conditions in Southern Ghana has resulted in higher wages in the forest south than in the Savannah north. Secondly, agricultural wage rates in Ghana are influenced by the sex, age, and the labor task performed. For example, males normally receive more than women except in transplanting, weeding, and bird-watching where they are found to be as efficient, and children receive about half the men's wage. Thirdly, the wage rate depends also on the method of payment and the length of day engaged such as piece meal, per day, per week, etc., and provision of transportation cost and meals, or whether the job is for half-day or a full day as in the case of

bird-watching. For unskilled labor, therefore, labor wage rate for women is assumed to be three-quarters that of men, and children will receive half of men's wage rate.

The divergence of shadow wage and legislated minimum wage seems to be a different matter in the agricultural sector. Researches conducted in various parts of the world indicate that at least in most rural areas (where most agricultural activities occur), the labor market is fairly competitive inspite of minimum wage laws so that the prevailing market wage could be equated to the shadow wage (Balisacan, 1982). This is true in Ghana, where agricultural wages are usually higher than the official minimum wage because of the high inflation rate and labor scarcity in the rice and other cash crop sectors. Most of the labor, both family and hired labor used for rice production, are withdrawn from the cultivation of traditional food crops such as maize, cassava, yams, millet and sorghum.

With respect to the shadow price of skilled labor, two basic assumptions are relevant to the Ghanaian situation: (a) the market of skilled labor functions well so that skilled labor tends to be employed throughout the year - no unemployment exists; (b) the market rate for skilled labor is higher than the government stipulated rate. This is so inspite of the government's established wage rate schedules according to skill categories which set minimum salaries for hiring by both the

formal private sector and the government. Based on the above assumptions, the market wage rate of skilled labor is utilized as the shadow wage rate. In any case, the effect of skilled labor wage on the empirical results is minimal because it is a minor component of total costs.

Capital. Capital inputs are generally considered as physical inputs whose economic lives exceed a single production period. These may include land, farm buildings, draft animals, machinery like tractors, combine harvesters, ploughs, harrows, irrigation equipment (such as water pumps and assessories), sprayers, sickle, and other farm tools, fertilizers and insecticides. In this study, capital excludes land and recurrent inputs, fertilizers, herbicides and insecticices which are treated separately. The service cost of these inputs for a given production activity during a given production period consists of depreciation, interest cost, repair and maintenance. It is to be noted that the interest rate is very important for estimating the social costs of capital services.

In determining the social cost of capital, there is a need to select a social rate of discount at which to value the services of capital goods and also the market prices of the capital goods must be corrected for distortions in product markets. This is because the capital market in the agricultural

sector is usually highly segmented, especially in a developing country like Ghana, so that the market rate is not a reliable measure of the society's valuation of future consumption.

In Ghana, segmentation of the capital market creates a number of nominal interest rates that reduce the cost of lending to farmers in public projects and to borrowers in the commercial sector, as against selling and buying prices for traditional credit whose interest rates are widely divergent. Five identifiable segmented markets for agricultural capital include commercial bank loans, agricultural development bank loans, government or public funds, self-financed "loans", and traditional credit. Thus, interest rates paid by farmers vary widely.

For this study, the social value of capital in each segmented market is estimated separately because these imperfections in the market are likely to persist in the future. It is also assumed that interest rates that currently prevail in each market represent the shadow interest rates when adjusted for expectations concerning inflation. Also, for the traditional market, lower interest rates are assumed for self-financed investments than for short-term borrowing from money-lenders. The nominal interest rates, as summarized in Table 1, are the same throughout the country.

In computing the cost of capital services of fixed assets, depreciation cost, interest cost, and cost of repair and maintenance are considered. This is given by:

Table 1. Nominal interest rate by source of investment, Ghana, 1986.

SOURCE	INTEREST RATE (%)
Commercial Banks	23 1/2
Agricultural Development Bank	
Small scale farmers	18
Large scale farmers	23 1/2
Self-financed farmers	18
Traditional money lenders	50

$$C = K(\sigma + i) + R$$

where:

C = cost of capital services of the capital asset

K = replacement cost of capital

σ = $\frac{1}{\eta_a}$; and η_a = estimated life of asset in years

i = shadow interest rate

R = repairs and maintenance

Generally, the computation of the cost of capital services can be broken down into steps:

(1) Depreciation cost (D)

$$D = K \times \sigma$$

where K = acquisition value x inflation

Since the purpose is to obtain the current cost of replacing the capital asset, replacement cost has to be adjusted to account for increases in the prices of capital over the estimated life. To arrive at the estimated cost, the acquisition value of the fixed capital is multiplied by a price inflator (η) [Fixed assets may be considered as machinery, transport equipment, buildings, irrigation and other construction].

To further reflect the productivity change of assets over their economic life, the life of the asset is depreciated such that:

η_a = life span $(1 + 0.04)^t$

where: t = number of years used

(2) Interest Rate (I)

I = K x i

where: i = the shadow interst rate

Cost of capital is then obtained by summation:

D + Interest Cost + Cost of Repair and Maintenance.

These costs thus obtained are then allocated into their domestic and foreign costs.

Intermediate Inputs

Intermediate inputs refer to those variable inputs which are final products of other firms and industries, such as fertilizers, insecticides, herbicides, planting material (seeds), gasoline and oil, etc. These can be grouped into traded and non-traded inputs, and their shadow prices or accounting prices estimated.

The social accounting prices of intermediate inputs are equal to their border prices adjusted for the cost of internal transport and handling. For tradable goods or inputs like fertilizers, insecticides, gasoline, etc., their border prices are derived by subtracting implicit tariffs from doemstic prices since tariffs are actually transfer payments to government and

not economic cost to society. In the case of domestically produced intermediate goods like traditional tools and selected seeds which are non-traded, their social costs are calculated by disaggregating their production costs into indirect traded and primary factor components and then valued at appropriate shadow prices. Thus, the cost of resources used in the production of rice is allocated according to the sources of cost which take the form of domestic costs, foreign costs, and taxes (or subsidies).

Rice Output

The world price for the relevant quality at the assumed point of consumption, which is Tema-Accra for Ghana, is used as the accounting price of output. Ghanaian rice imports vary with country of import. Imports from the U.S.A. are usually of a higher quality than imports from China, Thailand, or Pakistan. But generally, the type of rice imported are about 25-35% broken, and, therefore, the world price of this quality is what is used in this analysis.[10]

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[10]The 1985/86 world price of US$222.20 per mt., c.i.f. Tema, or 20 cedis per kg rice is used for this analysis. This is based on Thai 25-35% broken f.o.b. Bangkok (Thai Broken, A-1 Super), valued at US$172.00 per mt. for 1985; and consistent with the Tema c.i.f. price quoted by custom officials as US$11.11 per 50 kg rice (i.e. one mini bag), which includes an estimated transport and insurance cost of about US$50.20 per mt.

For imported rice that is transported to the interior, the cost of transport and handling is added to the c.i.f. price at the port to obtain the c.i.f. price at the interior consumption centres which in this case are Kumasi and Tamale (see Table 2). [Kumasi and Tamale are the commercial centres in the central and northern parts of Ghana, respectively].

The accounting prices for domestic rice are computed on the basis of the price of imported rice at the respective centres.

3.6 Sensitivity Analysis

In the measure of comparative advantage, it is very difficult to incorporate the effects of dynamic changes in the coefficients so estimated. This, in fact, is a major limitation of a partial equilibrium analysis of this sort, and any economic analysis for that matter.

In an effort to approximate the effects of dynamic changes within the system with regard to the major variables used in these estimates, sensitivity analysis is done on these variables. The sensitivity analysis is limited to the coefficients of the Domestic Resource Cost (DRC) in this study since the DRC as a measure of comparative advantage is the most important factor being considered.

The elasticity concept is used to obtain a straight forward interpretation of the sensitivity of the DRC coefficients to a

Table 2. Import prices (c.i.f.) at selected interior consumption centers, Ghana, 1985/86.

CONSUMPTION CENTRE	PRICE IN US $/ton	PRICE IN cedis/ton	PRICE IN cedis/kg
Accra/Tema c.i.f.	222.20	19,998.00	20.00
Kumasi	-	21,998.00	22.00
Tamale	-	24,998.00	25.00

given change in parameter (Pearson et. al.,1981). The elasticity (ε_i) indicates the percent change in the DRC coefficient for a percent change in each item of the relevant parameter. The elasticities obtained in this case reveal the importance of each variable relative to the maintenance of a continued comparative advantage.

Thus,

$$\varepsilon_i = \frac{\frac{\Delta \text{DRC Coeff.}}{\text{DRC Coeff.}}}{\frac{\Delta i \text{ item}}{i \text{ item}}}$$

It is to be noted that in interpreting these elasticities reference should be made to the importance of that item or factor in the total cost. This is because the relative magnitude of the elasticity of any given shadow price depends on it. As a result, unimportant factors have low elasticities. Also, the estimates are point elasticities, and they are probably valid only for small changes in yield and factor costs.

3.7 Sources of Data, Scope and Limitations of the Study

This study is based on primary and secondary data obtained from the Ministry of Agriculture and other state and parastatal organizations involved with the rice industry in Ghana.

Data[11] has also been obtained from previous economic studies of rice in Ghana conducted by individuals and organizations such as WARDA, the World Bank, and from FAO statistics.

Financial constraints did not allow the author to conduct a farm survey, but the data obtained from other sources have been supplemented and updated with a questionnaire sent to some selected farm managers and some organizations involved with rice (such as the Irrigation Development Authority (IDA) and Crop Services Department (CSD)) in Ghana. Also, some personnel from the Ministry of Agriculture and other organizations in Ghana who came to the International Rice Research Institute (IRRI) during the period of study were interviewed on the present state of the rice economy in Ghana. Most of the background information on the rice production patterns have come from previous reports and the author's practical knowledge of the rice industry in Ghana.

Basically, the study covers the 1985/86 crop year, except in situations where averages are used when the data for that crop year are not representative enough. The different rice production techniques have been aggregated into three production systems

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[11] The main sources which have served as benchmark data are Fred Winch (1976), Costs and Returns of Alternative Rice Production Systems in Northern Ghana, unpublished Ph.D. dissertation, Michigan State University, USA; Osafo Kwaku (1983), Rice Policy in Ghana, unpublished Ph. D. dissertation, Stanford University, USA; and WARDA (1977) Large Scale Mechanized Rice Production in Northern Ghana, Case Study no. 3.

for this study, namely, the traditional (or less intensive) system, the improved partially mechanized system, and the irrigated system. These broad categories even though they may overlook some finite details (such as the differences between the traditional south (forest zone) and traditional north (savannah zone), should present a more vivid picture of the rice cropping patterns in Ghana.

Also, there has been difficulty in estimating the shadow prices of inputs and rice output mainly because of an overvalued cedi currently being devalued (about 3,200 percent devaluation between April 1983 and January 1986). Moreover, the economy is at present in a transition period from a very distorted market to a free market economy. There is also the inherent limitation in a partial equilibrium analysis of this nature.

These limitations do not, however, render the results obtained from this study valueless. They only highlight the necessity for further studies in this area in consonance with changing economic parameters.

CHAPTER IV

OVERVIEW OF RICE PRODUCTION IN GHANA

The purpose of this chapter is twofold: (a) to provide a perspective of the rice industry in Ghana so as to facilitate the understanding of rice production patterns in the country; and (b) to discuss the evolution of government rice policy in the country.

4.1 History of Rice in Ghana

Rice has been one of the traditional and leading commercial crops in Ghana since the seventeenth and eighteenth centuries. It became very important in the Ghanaian diet in the 1880s when large imports were introduced, after it had suffered a setback in the Ghanaian subsistence economy in the 1740s due primarily to the menace of the slave trade and locust invasion of Ghana which destroyed most crops. The history of rice in Ghana as related to that of West Africa dates back more than 3000 years ago (Porteres, 1976). Many different varieties of African rice species, Oryza glaberimma, were selected and established in a wide variety of habitats in West Africa many years before the arrival of any navigators to the West Coast. In Ghana, most of the indigenous cultivated upland rice were varieties of Oryza glaberimma, even though the exact date when cultivation of these varieties started is unknown. But since the fifteenth century,

most of the Oryza glaberimma varieties cultivated in West Africa have been partly replaced by Oryza sativa varieties. These were believed to have been introduced primarily from Asia after World War I, although others might have been introduced earlier by the Portuguese explorers; and by camel caravans crossing the Sahara which probably brought rice seeds from the Mediterranean coasts to West Africa. All the varieties of Oryza sativa grown in Ghana have been introduced from other parts of the world, particularly Asia; and are cultivated mainly as lowland rice (also swamp rice) while the Oryza glaberimma varieties are planted as upland rice.

The actual revival of the rice industry in Ghana can be traced to the 1920s when the government put up the first Rice Mill at Esiama (1926) in the Western Region. By then rice was grown mainly in the Western and Volta regions of Ghana, even though some other regions had minimal output. During World War II, rice imports to Ghana ceased due to the world wide shortage of food, and this coupled with high prices encouraged farmers to increase production. By 1940 the total area under rice cultivation in Ghana was estimated at 10,935 ha, (27,000 acres) with a production of some 13,000 tons of milled rice. By 1945 rice production was well established in certain parts of Southern Ghana (Nzima and Wassaw areas in the Western Region), Ashanti, Volta, Brong Ahafo, and Northern and Upper regions. Also, by

this time rice hullers and mills had been installed all over the country especially in the major producing areas. Rice acreage cultivated rose to about 19,845 ha, (49,000 acres) by 1950, and production was estimated at 22,000 tons of milled rice.

The government tried to sustain farmers' interest in rice cultivation which had resulted from the growing demand and the high prices by initiating Rice Extension Schemes through the Department of Agriculture. Government efforts paid off as area planted to rice increased by about 10 percent to some 21,870 ha (54,000 acres) and production rose about 18 percent to some 26,000 tons in the seven-year period from 1950 to 1957. In the Northern part of Ghana, for example, the establishment of the Central Agricultural Station at Nyankpala, 10 miles north-west of Tamale, in 1950, significantly boosted agricultural output in the area, particularly rice.

In the 1960s, following the socialist policies of the government, large scale mechanized farming was embarked upon especially in Northern Ghana, and rice production was greatly emphasized. With the construction of many small dams and large importation of tractors and other inputs (including more rice mills), rice production tripled to about 69,000 metric tons in 1968. The "Operation Feed Yourself" (OFY) program of the government in the early 1970s also emphasized rice production, and rice output in Ghana reached a high of 71,000 tons in 1975.

However, since the mid 1970s, rice output has been fluctuating cosiderably with an average production of about 70,000 tons annually.

4.2 Physical Environment and Rice Production Systems

Location. Ghana is located in the middle of the West African sub-region above the equator; between latitudes 4°N and 11°N, and longtitudes 1°E and 3°W. The total area is 238,500 square kilometers, of which about 60 percent is arable. The country stretches for some 640 km (400 miles) from north to south, with a coastline of some 550 km (344 miles) from east to west (Fig. 1). Ghana is divided into 10 administrative regions: Greater Accra, Eastern, Central, Western, Ashanti, Brong Ahafo, Volta, Northern, Upper East and Upper West regions.

Physical features and climate. Ghana is a tropical country, relatively low-lying with an average height of about 500 meters. The vegetation consists of a coastal Savannah (Accra-Keta plains) which is mainly scrub and grassland and stretches from 15 to 65 kilometers inland; a tropical forest belt broken by nemerous hills and rivers in the middle belt; and savannah and grassland in the north and part of the east. The

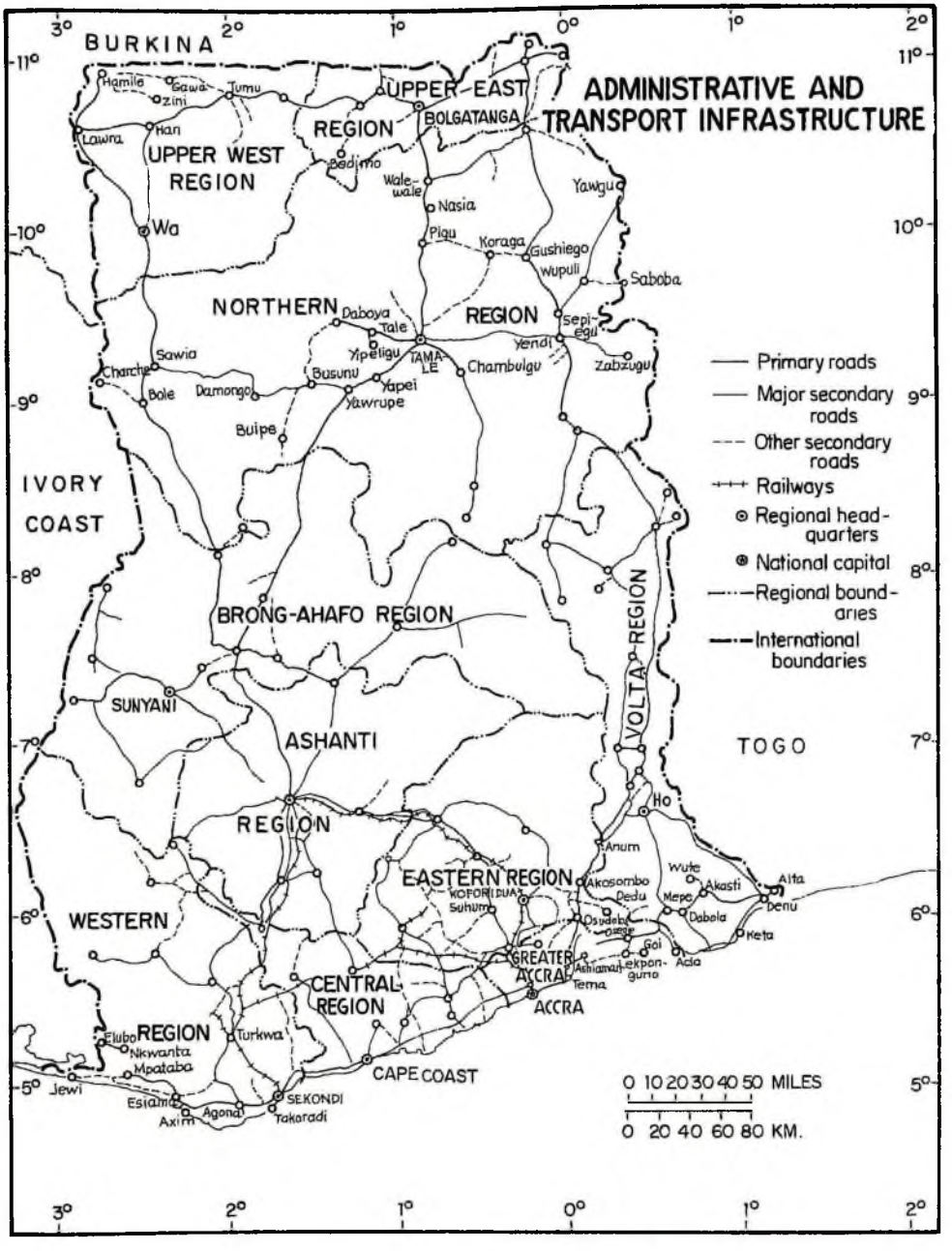

Fig. 1. Map of Ghana showing its administrative regions.

main ecological zones[12] with their approximate areas (Fig. 2) are:

Coastal Savannah (scrub and grassland)	5,723 km²
Forest	82,325 km²
Savannah Woodland	149,953 km²

The climate changes from warm and humid in the south and the middle belt to hot and dry in the north. Although average figures suggest uniformly high temperatures, variations exist due to varying altitudes in different parts of the country. The period just before the rainy season (between January and March) is the warmest months of the year.

Annual rainfall averages from 2,160 mm in the south-west which has a bimodal distribution (May-June and September-October) to about 750 mm on the south-eastern coastal plains (the driest part of Ghana), and about 1,000 mm in the north with a single peak in August-September. The high variation and uneven distribution of rainfall is one of the most important influence on Ghana's farming potential, especially because the basic nutrient value of most of Ghana's soils, particularly in the north, is poor.

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[12] D. A. Lane "The Forest Vegetation" in Agriculture and Land Use in Ghana. Edited by J. B. Wills, Accra, Oxford University Press, 1982.

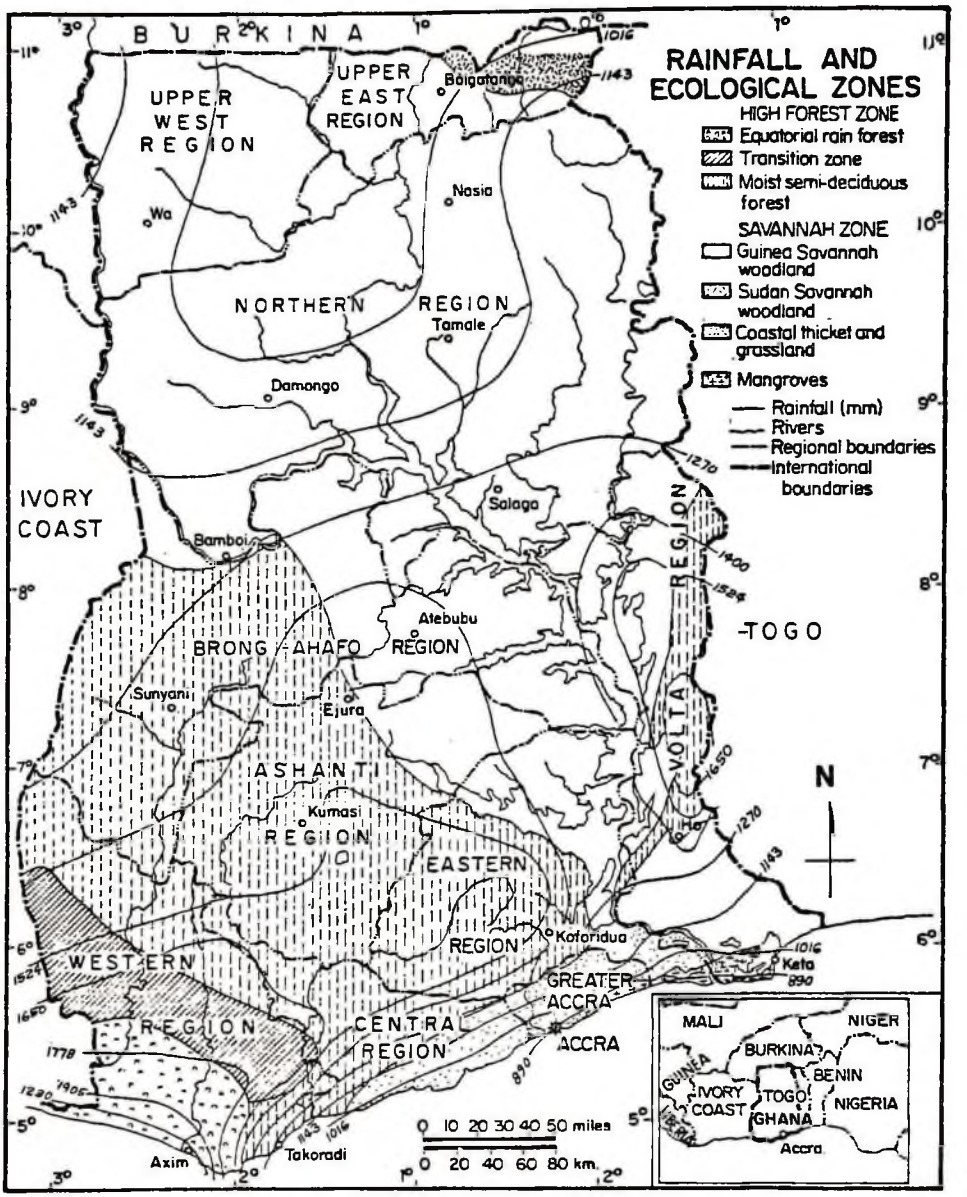

Fig. 2. Rainfall pattern and ecological zones of Ghana.

Rice Production Systems

Practically rice is grown in all the regions of Ghana. The major rice producing areas especially since the 1960s when intensive irrigated rice cultivation started to gain prominence in the country include:

Western Region	Nzima area (around Esiama), Wassaw Fiase (Dompim), Wassaw Amemfi (Asankragwa, Akropong), Aowin and Sefwi (Jabeso) Districts.
Brong Ahafo Region	Atebubu and Sampa-Wenchi Districts
Volta Region	Hohoe -Buem Sate and Keta-Afife areas.
Ashanti Region.....	Obuasi-Bekwai and Ejura Districts
Northern Region.....	Dagomba and Mamprusi (Tamale-Salaga-Yendi) areas
Upper East.....	Bawku-Navrongo Districts
Upper West.....	Wa-Lawra Districts

More recently, irrigated rice cultivation is becoming very prominent in the Accra plains (or coastal Savannah) around Kpong

and Asutsuare in the Eastern Region, Winneba in the Central Region, and Ashiaman-Dawhenya in the Greater Acera Region (Fig. 3).

In the 1920s most of the rice in Ghana was produced in the Western and Volta Regions. However, since the 1960s the bulk of Ghana's rice has come from the Northern and Upper regions. In 1970, WARDA[13] estimated that about 75 percent of the rice produced in Ghana came from the Northern and Upper Regions. By the 1980s the proportion of rice produced in the Northern Region had declined to about 60 percent of the national total as production in the other regions expanded. Upland rice varieties continue to be very important in Ghana's rice eonomy, accounting for about 80 percent of the total rice output (WARDA, 1986).

Table 3 summarizes the average rice production by regions for 1978-80 period.

The cultivation of rice in all the 10 regions of Ghana can be attributed to the great capacity of the rice crop to adapt to many varied conditions of climate, soil, topography and moisture. The major farming systems practiced for food crops including rice are (a) shifting cultivation (i.e. rotation of fields or farms), (b) rotational bush fallowing (which is more intense than

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[13]West Africa Rice Development Association (WARDA), 1977. Case Study No. 3. "Large Scale Mechanized Rice Production in Northern Ghana".

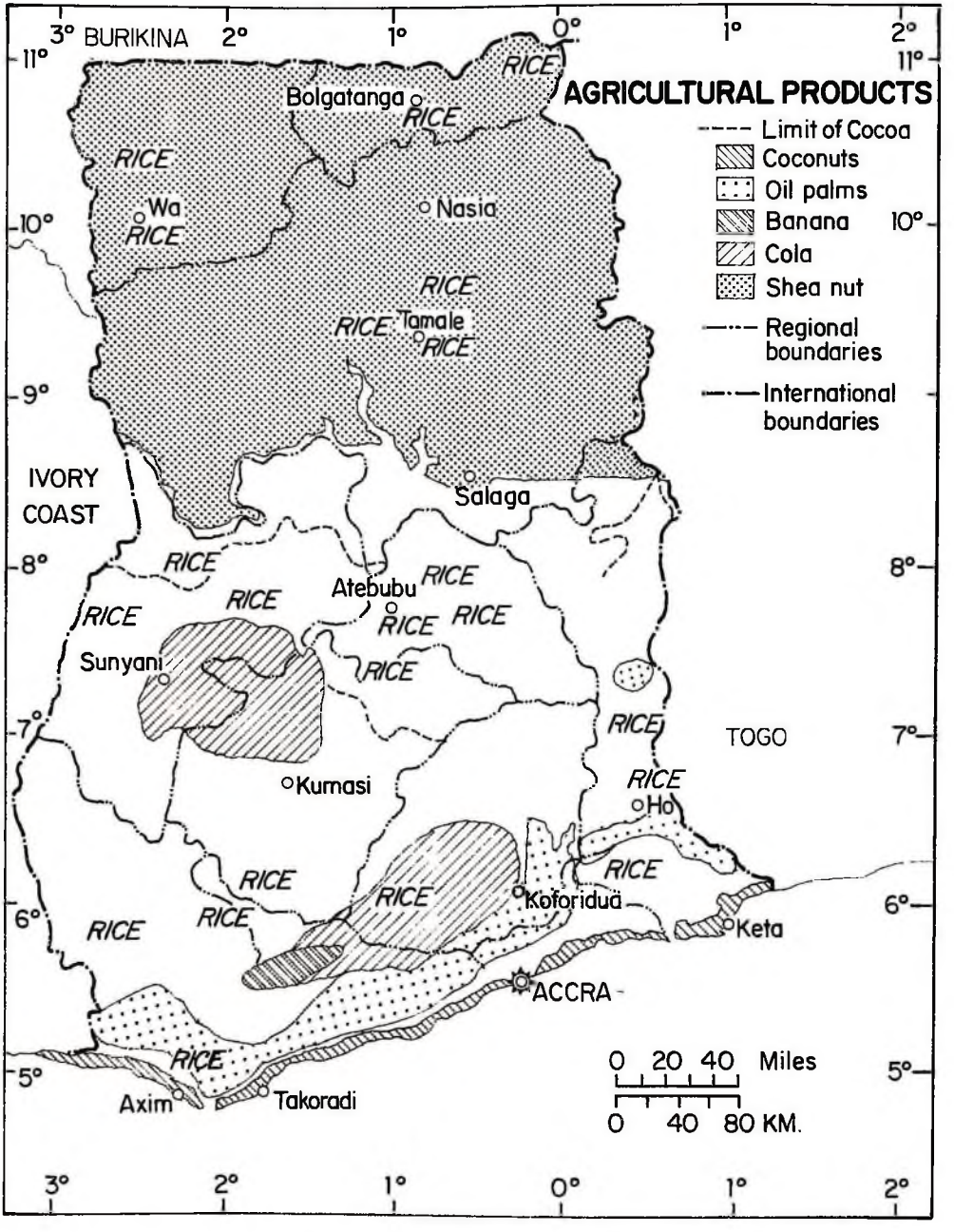


Fig. 3. Major rice growing areas in Ghana.

Table 3. Average rice (paddy) production by regions, Ghana, 1978-1980.

REGION	QUANTITY (metric tons)	PERCENT OF TOTAL
Northern	170.2	61
Western	29.3	11
Eastern	22.3	8
Brong Ahafo	20.8	8
Volta Region	14.0	5
Upper East Upper West	14.0	5
Ashanti	4.2	2
Central	4.2	2

Source: Estimates from Production Data, Ministry of Agriculture.

shifting cultivation); (c) semi-permanent cultivation (in which case the land is cropped to bi-annual crops such as plantains, etc.); and continuous cultivation whereby the land is cultivated seasonally by means of crop rotation as in the case of grains and legumes, or sole cropping such as irrigated rice. Most of the upland rice is intercropped with other food crops, such as maize or yam, or with many crops in a mixed-farming system, especially in the river valleys of the forest and transitional zones. Swamp rice, however, is usually cultivated as a sole crop. Irrigated rice cultivation is practiced mostly in the coastal savannah and northern savannah zones where there are dams and other sources of water for irrigation.

Except for most areas of the northern savannah and coastal savannah zones where the government has embarked on extensive land development for irrigated rice cultivation, the traditional methods of rice production continue to predominate in most rice production areas, especially in the forest and transitional zones.

In the Western Region rice growing is concentrated in the flat swamp lands, favorable valley bottoms and lower slopes. Here, the marsh and swamps are subject to uncontrolled flooding which occur at the peak of the rainy season. The land is cleared and burnt in about January to February, and the surface worked up to a fine tilth by hoeing to make the land ready for the early

before harvesting in October to November. The most important varieties here are Bangulam and Mendii.

The northern and Upper regions which produce the bulk of Ghana's rice consist mainly of Savannah woodland interspersed by tall trees. The topography is gently undulating peneplane with characteristic broad drainage courses stretching for kilometers on either side of shallow streams which overflow their banks at the height of the rains, resulting in fertile bottom lands. Major traditional crops have been sorghum and millet in the northern section, and maize and yams in the southern part of the area. Rice has been grown traditionally as an intercrop with yams or maize in the heavier soils, and sometimes in the bottom lands as pure stands. More recently as a result of the government's mechanization program, the northern section has become the largest rice producing area in the country. Even though upland rice is still prominent, irrigated rice production is fast expanding. The most important Oryza glaberimma varieties in the area are the Glaberimma mendii and other locals such as "Awini" and "Kotoku". The Oryza sativa varieties generally grown here are varieties released by IRRI such as IR 8; and from IITA of which FARO 15 is most important.

Similarly, government irrigation projects at Dawhenya, Ashaiman, Weija and Afife are gradually transforming the Accra-Keta coastal plains into an important rice production zone.

Except for the swampy water-logged lands in the Keta-Ada district near Afife where rice has been grown since the 1940s, rice production in the coastal plains is basically by irrigation. Intensive rice cultivation with the use of modern technology allow two crops annually (sometimes three crops in some isolated cases).

Table 4 gives a summary of the rice production patterns in Ghana.

Rice Marketing

On the average, rice marketing has posed very little problem in Ghana (except in cases where bad roads make it difficult to transport rice from producing to consuming centers) mainly because of ready markets for rice, especially in the urban South. Most farmers usually store a greater portion of their produce during the harvest period (August-November) when food is plenty on the market to avoid selling at very low prices; and sell them during the lean season (February-June) when food prices are generally high.

Rice is sold in minibags (45kg/bag) or in maxibags (82kg/bag) to middlemen who normally retail on the open market. In commercial houses or departmental stores, rice is sold in small packs (5kg/pack). Also, small scale farmers process and retail some of their rice on the local market.

Table 4 . Summary of rice production patterns in Ghana.

LOCATION	PRODUCTION SYSTEMS	LAND PREPARATION METHOD AND TOOLS	RICE VARIETY	MEAN ANNUAL RAINFALL	MONTHS SOWING	MONTHS HARVESTING	AVERAGE YIELD (mt/ha)
Nzima Area (Western Region	Swamp Rice (broadcast)	Cutlass clearing and Hoeing	O. glaberimma O. sativa	2,200 mm	March-April	Aug-Sept.	0.91 (upland) 1.15 (swamp)
Obuasi-Bekwai (Ashanti)	Upland/Swamp rice (broadcast)	Cutlass Clearing	O. sativa	1,755 mm	April-May	Oct.-Nov.	0.68
Ejira-Atebubu (Transition zone)	Upland (intercropping) (broadcast)	Cutlass Clearing	O. glaberimma	1,620 mm	May-June	Nov.-Dec.	0.46
Sampa District (Brong Ahafo)	Upland (Transplanting)	Hoeing	O. sativa	1,350 mm	June-July	Dec.-Jan.	1.7

Table 4. continued.

LOCATION	PRODUCTION SYSTEMS	LAND PREPARATION METHOD AND TOOLS	RICE VARIETY	MEAN ANNUAL RAINFALL	MONTHS SOWING	MONTHS HARVESTING	AVERGE YIELD (mt/ha)
Hohoe, Buen State (Volta Region)	Upland (Intercropping) (broadcast or dibbling)	Cutlass Clearing	O. glaberimma O. sativa	1,755 mm	July	November	1.0 (O. glaberimma) 1.15 (UO. sativa)
Northern, Upper East, Upper West Regions	(i) Upland	Hoe Clearing Bullock Plough	O. glaberimma	1,215 mm	May-June	Oct.-Nov.	1.0
	(ii) Irrigted	Bullock Plough	O. sativa		Double cropping	-	3.5
Accra-Keta Plains	Irrigated	Tractor	O. sativa	750 mm	Double cropping	-	3.5

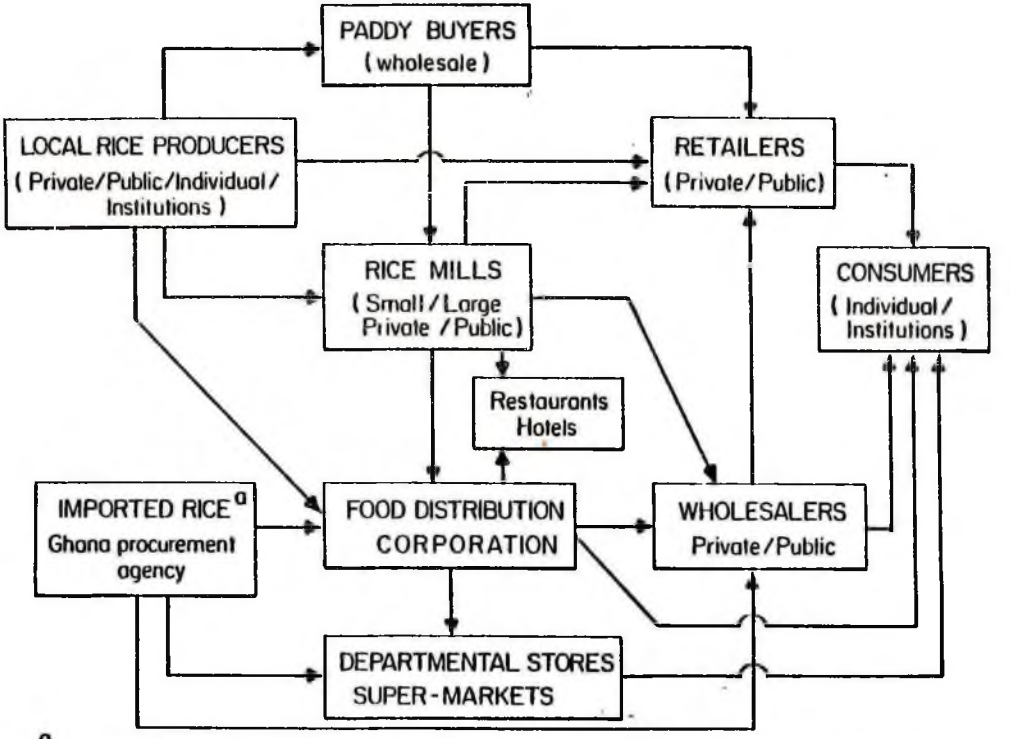
Sources: (1) The Ghana Farmer, various issues.
(2) Factors of Agricultural Growth in West Africa, Edited by I.M. Ofori, ISSER, Legon, Accra. 1973.

Since 1968, the government has had a guaranteed minimum price for paddy every year, and the rice mills, especially public mills, buy rice from farmers at this price. However, government rice mills handle only a small proportion of the total paddy output (about 25 percent) and the rest either go through the private millers and hullers or is pounded and winnowed traditionally. Particularly in the Northern and Upper regions, the middlemen composed mainly of wholesale traders and small-scale retailers buy and store most of the paddy at harvest. These are then gradually released for parboiling, milling and retail during the lean season.

Until recently, the government exercised monopoly power on rice importation through the Ghana Procurement Agency (GPA) since the late 1970s. A minimum of 20 percent of all imported rice (including rice which come in through food aid) had been distributed throughout the country by the Food Distribution Corporation (FDC) while the rest was distributed through the departmental stores and private traders. About 70 to 80 percent of all imported rice are distributed in the urban centeres. Fig. 4 provides a summary of the rice distribution pattern in Ghana.

4.3 Rice Among Other Major Crops

On the average, there are eight major food crops in Ghana: four are cereals, three are root crops, and the other is plantain.



[a] In June 1987 the government lifted the ban on rice importation to Ghana and allowed private individuals/corporations also to import rice.

Fig. 4. Rice marketing channels in Ghana.

In terms of production and per capita consumption, rice continues to be a minor food crop after maize, sorghum and millet in that order. Table 5 summarizes the five year production averages of the major food crops in Ghana.

Among the cereals, maize accounted for 58 percent of the total cereal production in 1980-84, rice accounted for 11 percent, while sorghum and millet together made up 31 percent. Moreover, the per capita consumption estimated by the FAO in 1976 was only 7.5 kg. for rice in 1972/73 as against 33.7 kg. for maize which is Ghana's major cereal, and 9.4 kg. and 8.4 kg. for millet and sorghum, respectively. The per capita consumption of rice further declined to 6.9 kg. according to WARDA's 1983 estimates. However, the average rice yield (even though still very low) has been more stable than the other cereals over the years (Tables 6 and 7). One major reason for the generally low and declining yields of cereals in Ghana has been unfavorable weather conditions (apart from failures in the input delivery system). This is particularly true for maize which is cultivated almost entirely as an upland crop in Ghana. Thus any decline in cereal production greatly affects the total amount of food available in Ghana as shown by the production indices for food and cereals in Fig. 5.

Successive governments in Ghana have recognized the danger of depending solely on rainfed agriculture to supply the food

Table 5. Food crop production (five-year annual averages in '000 tons), Ghana, 1960-84.

YEAR	PRODUCTION						
	RICE (Paddy)	MAIZE	SORGHUM/ MILLET	CASSAVA	YAMS	COCOYAMS	PLANTAINS
1960-64	35	-	176	-	1061	780	-
1965-69	47	291	179	1011	904	-	-
1970-74	61	450	298	2817	790	1210	1809
1975-79	90	300	268	1936	593	813	1037
1980-84	70	368	195	2285	610	655	662

Sources: (1) Ministry of Agriculture
(2) World Bank Tables

Table 6. Yields of major cereals (kg/ha), Ghana, selected years.

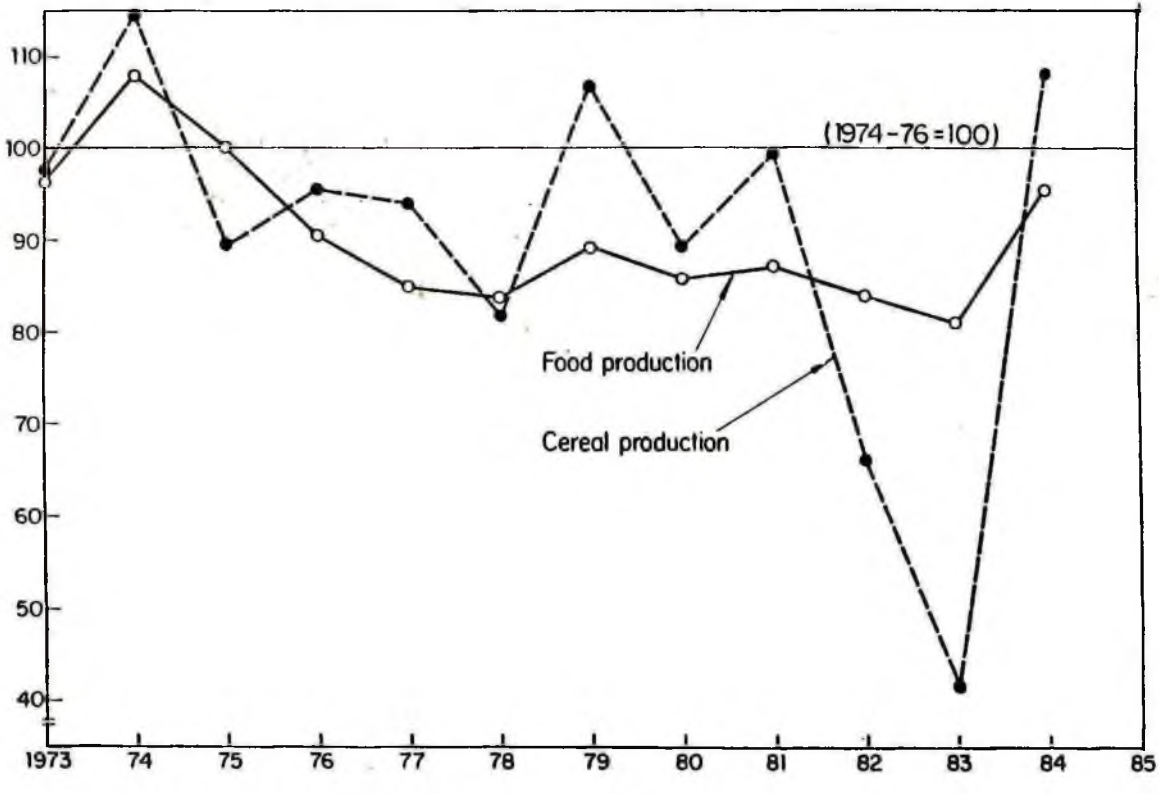
YEAR	YIELD (kg/ha)			
	Rice	Maize	Millet	Sorghum
1974-76	963	1095	633	744
1982-84	916	819	424	421

Source: FAO Production Yearbook, Vol. 38, 1984.

Table 7. Area harvested, yields and rice production among other cereals, Ghana, 1979-85.

YEAR	AREA HARVESTED 1000 ha		YIELDS kg/ha		PRODUCTION 1000 mt		% RICE PRODUCTION OF CEREALS
	Total Cereal	Rice	Total Cereal	Rice	Total Cereal	Rice	
1979-81	902	107	805	837	726	89	12
1982	822	61	662	590	544	36	7
1983	835	40	369	1000	308	40	13
1984	943	57	924	1158	871	66	8
1985	631	87	1015	738	640	64	10

Source: FAO Production Yearbooks 1984 and 1985 (Vols. 38 and 39).



Source: FAO production yearbook (Vol. 38), 1984.

Fig. 5. Food/cereal production indices (1974-76 = 100).

requirements of a growing population. Irrigation projects have, therefore, been planned in specific areas all over the country, and rice has been identified for expansion in the large areas of unexploited land particularly in the savannah and transitional zones which are suitable for rice cultivation. This is evidenced in Fig. 6 and Table 8 which show the irrigation projects in Ghana for the past two decades. The problem here, however, is the suitability of the "imported technologies" to the environment, considering the type of soils and the technical know how needed to make such operations economically viable.

It can be inferred from government programs on irrigation in which over 80 percent of all irrigated areas are cropped to rice that rice production is expected to play a very important role in supplying the food requirements of Ghana's growing population in the near future. This is further supported by the present government's objectives and strategy for the agricultural sector as outlined in the Ministry of Agriculture Document (April 1984)[14] among other things as follows:

(i) self-sufficiency in the production of cereals, starchy staples and animal protein to ensure adequate nutrition for every Ghanaian.

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[14] Ghana Agricultural Policy - Action Plan and Strategies (1984-86), prepared in support of the Economic Recovery Program, lays down the Government's agricultural development objectives, strategy and action plans.

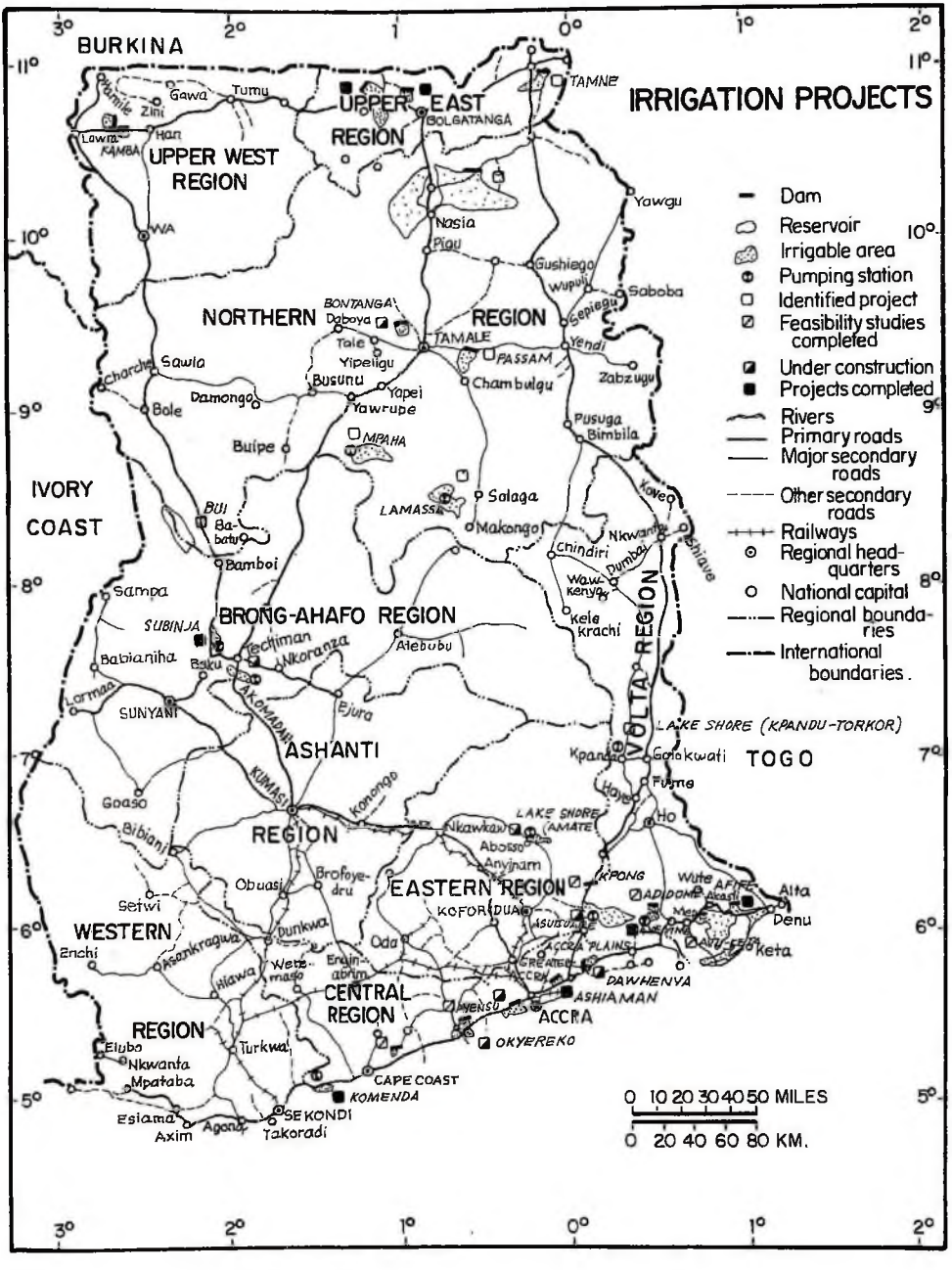

Fig. 6. Irrigation projects in Ghana.

Table 8 . Government irrigation projects since 1964,[a] Ghana.

LOCATION	AREA COVERED	YEAR OF PROJECT COMMENCE-MENT	PROPOSED YEAR OF PROJECT COMPLETION	CROPS
1. Ashiaman (G/Accra)[b]	200	1965/66	1977/78	Rice Vegetables
2. Vea (Northern Region)	1420	1965.66	1977/78	Rice Vegetables
3. Asutsuave (Eastern Region)	4050	1963/64	1978/79	Rice Sugarcane
4. Komenda (Central Region)[b]	1420	1965	1978/789	Sugarcane
5. Afife (Volta Region)[b]	1000	1964	1977/78	Rice
6. Adidome (Volta Region	200	1964	1977/78	Rice
7. Dawhenya (G/Accra)	480	1973/74	1977/78	Rice Vegetables
8. Okyereko (Central Region)	120	1973/74	1977/78	Rice Vegetables

Table 8. continued.

LOCATION	AREA COVERED	YEAR OF PROJECT COMMENCE-MENT	PROPOSED YEAR OF PROJECT COMPLETION	CROPS
9. Mankesim (Central Region)	320	1974/75	1978/79	Vegetables
10. Akomadan (Brong Ahafo)	1420	1973/74	1978/79	Tomatoes
11. Afram Plains (Eastern/Ashanti)	200	1973/74	1976/77	Cotton
12. Tono (Upper East)[b]	2450	1974/75	1978/79	Rice Other crops
13. Weija (G/Accra)	2260	1974/75	1979/80	Rice Vegetables
14. Aveyime (Volta Region)[b]	650	1975/76	1979/80	Rice
15. Ayensu (Central Region)	3500	1974/75	1981/82	Rice Vegetables
16. Bolgatanga (Upper East)	500	1974/75	1978/79	Various crops
17. Passam (Northern Region)	1250	1976/77	1980/81	Sugarcane

Table 8. continued.

LOCATION	AREA COVERED	YEAR OF PROJECT COMMENCE-MENT	PROPOSED YEAR OF PROJECT COMPLETION	CROPS
18. Keta-Avu (Volta Region)	40	1975/76	1977/78	Pilot Farm
19. Tamne (Upper East (Phase I)	500	1975/76	1979/80	Rice, onions, vegetables
20. Yapei/Mpaha (Northern Region)	5200	1976/77	1981/82	Cotton Vegetables
21. Lake Shore (Kpandu-Volta)	400	1976/77	1981/82	Cotton Ground nuts
22. Zongo/Macheri (Northern Region)	4000	1976/77	1979/80	Cotton
23. Demon (Northern Region)	400	1976/77	1979/80	Rice

[a]Other irrigation projects not included here but shown in Fig. 6 (Ghana-Irrigation Projects) are included in more recent development plans.

[b]These projects have since been completed. (Most of the rest are near completion).

Source: Irrigation Development Authority, Ghana.

(ii) maintenance of adequate levels of buffer stocks of grain, particularly maize and rice, to ensure: (a) availability of food during the lean season (March-July); (b) price stability; and (c) provision of maximum food security against unforeseen crop failure and other natural hazards....

Under this program, the total rice area was to increase from 67,210 ha in 1984 to 101,865 ha in 1986 with an average yield of 2.0/ha mainly through irrigation development projects.

4.4 Domestic Rice Production Versus Imports

On the average, the agricultural sector of Ghana's economy suffered a decline of 0.3 percent per annum for the period 1970-80 even though marked increases were realized in agricultural output in the early 1970s. This was further aggravated in the drought years of 1982 and 1983 by 6.7 percent and 1.5 percent decline respectively. However, this trend was reversed with good rains and a bumper harvest in 1984, and agricultural growth was estimated at an impressive 9.4 percent.[15] Available data from the Ministry of Finance and Economic Planning indicate that agriculture (including forestry)

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[15] Detailed discussion of the economy is provided in Ghana: Policies and Program for Adjustment (World Bank, Report No. 4702-GH, October 1983), and Ghana: Managing the Transition (World Bank, Report No. 5289-GH, November 1984).

accounted for about 53 percent of GDP in 1983. Cocoa (Ghana's major export crop) was estimated to cover about 50 percent of the total cultivated area; and of the non-cocoa cultivated land; maize (Ghana's most important cereal) covered 18 percent; sorghum and millet covered 11 percent and 13 percent respectively; and rice covered 5 percent.

Rice production in Ghana has increased substantially since 1960, more through area expansion rather than yield increases. In 1963, the total area under rice cultivation was estimated at 32,400 ha. This more than doubled by 1975 when land area cultivated under rice was estimated to be about 78,570 ha., with most of the increase occurring mainly in the Northern region. WARDA (1986) has estimated the annual rate of growth of rice land in Ghana to be 7.6 percent from 1960 to 1969; 1.0 percent from 1970 to 1979; and an overall annual growth rate of 4.2 percent for the period 1960-1984. Upland rice cultivation continued to predominate, covering about 85 percent of all rice land in 1983-84, while inland swamp rice and irrigated rice each covered 7 percent.[16]

Rice yields in Ghana have been rather low, and show declining trends over the years. This may be the result of a

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[16] WARDA Occasional Paper (July 1986). Riceland in West Africa: Distribution, Growth and Limiting Factors.

complex of problems of which adverse weather conditions, weeds, and bottlenecks in input delivery system may be the most important. There is a marked variation (which fluctuate yearly) in rice yields among regions, higher in the savannah and transitional zones than in the forest zones; but yields in irrigated rice cultures are generally high. Figure 7 shows rice production trends in Ghana.

On the average, food crop farm holdings[17] in Ghana (including rice farms) are small. The average farm size for cereals are lowest for rice and maize, about 0.9 to 1.0 ha per farm, and about 1.5 ha and 1.7 ha for sorghum and millet, respectively. On the other hand, if we consider food crops, large scale farms are significant for rice only in terms of output and total land area cultivated. Since 1974, over 50 percent of rice production in Ghana has come from large scale farms as shown by a marked shift from small scale to large scale farming between 1972 and 1974 in Table 9.

Available statistics on domestic rice production and imports show that Ghana produced only about 30 percent of the total rice

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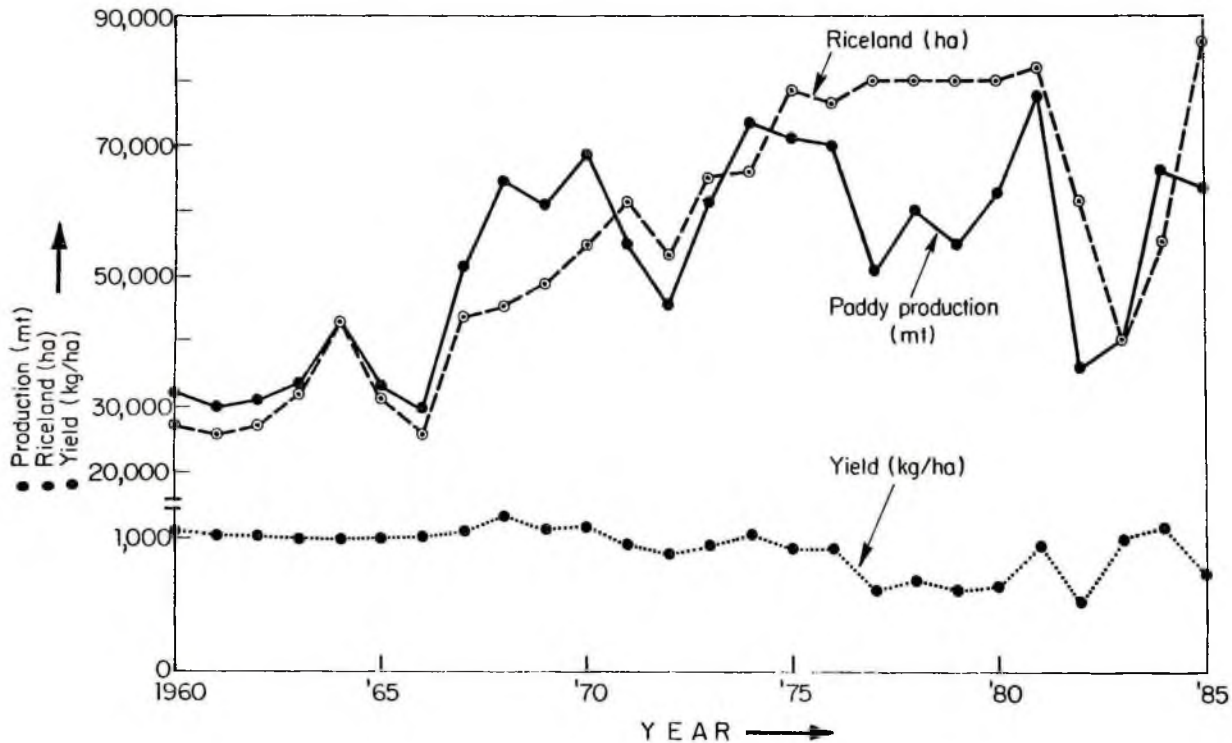
[17]According to the definition of the Ministry of Agriculture culture (MOA) for the Ghana Sample Census of Agriculture, 1970, a farm holding refers to all the land that is used by a farmer for the cultivation of a particular crop, say rice, in a given production season. A large-scale farm is also defined by MOA as the total farm holding of a specific crop per farmer that measures at least 10 hectares.



Source: FAO Production Year Book, 1985, Vol. 39 and various issues.

Fig. 7. Trends in paddy production, rice land, and yield in Ghana, 1960-85.

Table 9. Area cultivated and rice output of small-scale and large-scale farms, Ghana, 1972-74.

YEAR	AREA CULTIVATED ('000 ha)		OUTPUT ('000 mt)	
	Small- scale	Large-scale	Small-scale	Large-scale
1972	53.9 (77.0%)	16.1 (23.0%)	46.9 (66.4%)	23.7 (33.6%)
1974	42.8 (64.5%)	23.6 (35.5%)	36.7 (49.4%)	37.6 (50.6%)

Source: Agble, W.K. and Carson, A.G. (1977). Rice Production and Research in Ghana.

consumed before 1964. This means that rice imports constituted about 70 percent of total annual consumption. From 1965 to 1974, however, production increased, accounting for some 50 percent of the total consumption. Except for 1975 and 1976 when Ghana declared self-sufficiency in rice so that only minimal quantities were imported, this trend has continued to the present - production constituting about 50 percent and imports 50 percent of total consumption. Since there are noticeable discrepancies (especially between 1975 and 1980) in the rice production and imports figures obtained from different sources, they are all reproduced in Table 10 to facilitate better appreciation of the analysis that follow later.

4.5 Government Rice Policy

The evolution of rice policy in Ghana can be traced back to the pre-independence period when the colonial government established the first rice mill at Esiama (Western Region) in 1926. This followed a major policy statement by the administration in 1924 for a need to develop an organized rice industry in the then Gold Coast (now called Ghana after independence) when rice imports were increasing rapidly. For example, imports increased about 250 percent in 3 years from 3,220 tons in 1921 to 8,330 tons in 1924.[18] After World War II,

[18] F. A. Robb (1930). Results at Esiama Rice Mill, Department of Agriculture Year Book, 1930. Gold Coast Bulletin No. 23.

Table 10. Rice production and imports, Ghana, 1960-85.

YEAR	PRODUCTION (Paddy) 1000 mt				IMPORTS 1000 mt		
	MOA	WARDA	FAO	USDA	WARDA	FAO	USDA
1960	-	30.0	32.0	32.0	28.8	29.2	30.0
1961	-	31.0	30.0	34.0	46.3	30.5	47.0
1962	-	33.0	31.0	32.0	70.7	46.7	27.0
1963	-	43.0	33.0	42.0	26.4	17.4	39.0
1964	-	42.0	43.0	42.0	38.3	25.2	30.0
1965	-	32.0	33.0	32.0	29.6	30.1	49.0
1966	-	29.3	30.0	38.0	48.2	48.3	40.0
1967	-	42.0	52.0	52.0	39.4	40.1	31.0
1968	-	42.0	65.0	65.0	30.1	30.7	28.0
1969	-	60.0	61.0	67.0	28.1	28.1	53.0
1970	48.8	48.7	69.0	80.0	53.1	53.4	35.0
1971	54.9	54.9	55.0	67.0	35.1	34.9	24.0
1972	70.1	70.2	47.0	72.0	24.3	24.3	54.0
1973	62.0	62.1	62.0	75.0	53.6	53.6	39.0
1974	73.2	72.9	73.0	73.0	39.1	39.1	0.0
1975	71.1	70.5	71.0	70.0	0.4	0.4	0.0
1976	70.0	88.8	70.0	70.0	0.3	0.3	73.0
1977	109.0	65.4	51.0	58.0	43.0	43.0	95.0
1978	108.0	51.9	60.0	60.0	129.0	25.0	36.0
1979	93.0	55.0	55.0	93.0	28.0	36.0	30.0
1980	78.0	78.0	62.0	79.0	43.0	30.0	39.0

Table 10. continued.

YEAR	PRODUCTION (Paddy) 1000 mt				IMPORTS 1000 mt		
	MOA	WARDA	FAO	USDA	WARDA	FAO	USDA
1981	97.0	97.0	78.0	79.0	27.9	38.9	40.0
1982	36.0	36.0	36.0	54.0	52.7	26.1	34.0
1983	40.0	40.0	40.0	60.0	65.9	32.8	60.0
1984	66.0	66.0	66.0	99.0	50.4	50.4	40.0
1985	80.0	63.0	64.0	90.0	30.0	60.0	60.0

Sources; MOA - Ministry of Agriculture (figures in World Bank Reports).

WARDA - West African Rice Development Association Rice Statistics Yearbook, Nov. 1986 (6th Ed.)

FAO - Food and Agriculture Organization, Trade Yearbooks, various issues.

USDA - United States Department of Agriculture.

a Rice Extension Scheme was organized through the Department of Agriculture to assist rice farmers. In 1948, the British Government, desiring to see a well organized rice industry in Ghana, sent a Rice Mission to the Gold Coast made up of W. M. Clarke and F. Hutchison (Hutchison was well-experienced in irrigation and drainage for rice production). The purpose of the mission were two-fold: (a) to consult with the colonial government and advise on the existing rice schemes, and (b) to investigate and report on the possibilities of expanding rice production in new areas by mechanization, irrigation and drainage. Most of the areas identified by the mission have since been developed for rice production. Government rice policies in independent Ghana are discussed below under rice production policy, and pricing and input policy.

Rice production policy. When Ghana became independent in 1957, the new government headed by Kwame Nkrumah inherited a Ten Year Plan from the Colonial Administration in which expansion of rice production was emphasized. The second phase of this plan (Five-Year Development Plan, 1959-64) was later scrapped in favor of the new government's seven-year development plan (1963-70) which was also for Economic and Social Development. The goal of the Nkrumah government was to develop Ghana on a socialist model; and the two basic pillars for this model were industrialization and modern agriculture. In this development plan, rice received

a specific recognition as one of the cereals to be developed and production increased. This is evidenced from the production targets set for rice relative to the other cereals as shown in Table 11.

The 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. The overall increase in cereal production within the plan-period was expected to be 52 percent. Moreover, rice production from the public sector was to increase by 100 percent. In order to realize the goal of modernizing agriculture and increase food production (including rice), the government encouraged large scale farming (both by the state and individuals) and irrigated rice production, particularly in Northern Ghana where conditions are relatively favorable. As shown in Table 12, a large number of tractors and other agricultural machinery were imported between 1962 and 1964 by the Government through the United Ghana Farmers Council Cooperatives (UGFCC).[19] The government established the State Farms Corporation (SFC) in 1962 as part of the program to modernize agriculture. Three state farms were set up at Demon (Northern

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[19]The UGFCC was essentially a political organ set up by the government for the implementation of the agricultural modernization program. It took over most of the functions of the Ministry of Agriculture which was later reorganized.

Table 11. Cereal production targets, by sector. (National Development Plan), 1963-1970.

SECTOR	CROP YEAR	PRODUCTION (1000 tons)				% OF ALL CEREALS		
		Maize	Rice	Others	Total	Maize	Rice	Others
Private sector	1963-64	202	22	183	407	50	5	45
	1966-67	224	31	191	446	50	7	43
	1969-1970	297	48	215	560	53	9	38
Public sector	1963-64	10	3	2	15	66	20	13
	1966-67	41	14	9	64	64	22	14
	1969-70	43	24	15	82	52	29	18
Total product-ion	1963-64	212	25	185	422	50	6	44
	1966-67	265	45	200	510	52	9	39
	1969-70	340	72	230	642	53	11	36

Source: Ghana Seven-Year Development Plan, 1963/64, 1969/70.

Table 12. Agricultural machinery and equipment imported[a] by the UGFCC, Ghana, 1962-64.

I T E M	QUANTITY
Zetor 30 Tractors	200
Zetor 50 Tractors	500
BNT - 60 Bulldozers	120
TG-90 Crawlers	60
Rice combines	45
Rice mills	15
3-ton non-tipping trailers	80
Rice biner (model S-21)	30
Yanmar auto-feed rice thresher	20

[a]About 1000 wheel tractors had been ordered in 1961 for the government socialization program. The Workers Brigade (also a political organ) had already imported large quantities of agricultural machinery for its own program.

Source: Ministry of Agriculture.

Region), Adidome, and Afife (both in the Volta Region) for rice cultivation, in addition to other crops and animal husbandry. These farms performed farm services also to nearby private farmers. Table 13 summarizes rice production on these farms by 1970.

In anticipation of a rapid increase in rice production, the UGFCC imported and installed 15 modern rice mills in the potential rice growing areas. However, due to delays in construction, only a few of these mills could be operational before the UGFCC was dissolved in 1966 following a change in government.

It is noteworthy that the socialist approach adopted by Nkrumah's government for industrialization and mechanized agriculture had created supply bottlenecks and disequilibrium in the economy at the time of its overthrow. Prominent among the problems which caused such bottlenecks were an overvalued exchange rate, balance of payment problems, large external debts aggravated by deficit financing, high inflation, and falling real incomes. The government of the National Liberation Council (NLC) shelved Nkrumah's Seven-Year Development Plan and instead launched a Two-Year Development Plan (1968-70). The main thrust was on correcting the disequilibrium in the system through import liberalization, devaluation of the Cedi, and deflationary monetary and fiscal policies. They discouraged state involvement in industry and instead concentrated on harnessing the potentials

Table 13. Total farm area, rice area, and rice production on state farms, Ghana, 1970.

LOCATION	TOTAL FARM AREA (ha)	AREA UNDER RICE (ha)	AVERAGE YIELD (mt/ha)
Demon	10,000	1,600	1.1
Adidome	2,400	300	1.0
Afife	2,100	1,040	1.4

[a]Area under rice on these farms have been expanded since 1970.

Source: Factors of Agricultural Growth in West Africa. Edited by I.M. Ofori. April 1973.

of the private sector for economic development. The rice industry featured prominently under the agricultural sector of the plan. Seed multiplication programs were started for foodgrains (including rice), and the Agricultural Development Bank was established to provide credit for farmers. In 1969, a civilian government led by Dr. K.A. Busia was elected into power. They followed the agricultural policies[20] of the NLC government, and rice production was again given a booster. For example, in 1970 the government signed an agreement with the Federal Republic of Germany to supply 1,500 tons of fertilizer annually (free) for the development of agriculture in the Northern and Upper Regions, with a greater concentration on rice production. Government rice policy aimed at making rice available to consumers at moderate prices without discouraging the expansion of local production.

In January 1972, government changed hands again in Ghana, bringing in a new military government: the National Redemption Council (NRC). They launched the "Operation Feed Yourself" (OFY) program to increase food production, and initially supported small-scale farmers who produced the bulk of Ghana's food requirements. Rice, maize, and sorghum were the major food crops

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[20]Apparently, most of the new government officials had been instrumental in drawing up the programs of the NLC government.

which featured in the OFY program. However, government support later shifted to the large-scale mechanized farms which used intensive methods, apparently because they hoped that rice production increases could occur faster on large-scale farms. The NRC government also drew up a development program, a Five-Year Development Plan 1975/76-1979/80, in which rice production was targeted to increase by some 80 percent within the period as against 40 percent, 15 percent and 20 percent increases for maize, millet and sorghum, respectively.

The fundamental policy objectives and goals for the rice industry in Ghana for the present government continue to follow those of the past, except that currently, with the exception of fertilizers, no subsidies on farm inputs exist. The PNDC since assuming office in 1981 has undertaken many policy reforms aimed at arresting the steady deterioration of Ghana's economy since the last decade. An Economic Recovery Program (1984-86) was initiated under which a program for the agricultural sector: "Ghana Agricultural Policy - Action Plans and Strategies (1984-86)" was implemented. Highlights of the plan which included self-sufficiency in the production of cereals, --- maintenance of adequate levels of buffer stocks of grains, particulary maize and rice, to ensure (a) availability of food during the lean season (March-July); (b) price stability, and (c) provision of maximum food security against unforeseen crop

failure and other natural hazards have already been given in a previous section. The government's strategy was to emphasize maize, rice, and cassava during the three year period (1984-86) and increase output by increasing yields in selected high potential areas, including irrigated project areas, while encouraging production in other areas. The total rice area cultivated for the period was expected to increase from 67,210 ha in 1984 to 101,865 ha in 1986, an increase of some 52 percent. Rice yields were also targeted to increase to an average of 2.0 mt/ha.

It is evident from the foregoing discussion that government policies for rice production in Ghana over the years have varied in focus, but in general, emphasized area expansion through large-scale mechanized intensive farming rather than small-scale less-intensive farming and higher yields.

Input-output pricing and trade policies. Government specific policies for intervention in the rice industry since the 1960s include trade restrictions, floor and ceiling prices, input and credit subsidies, and investments in irrigation, research and extension.

Quantitative restrictions on rice imports started in Ghana with the introduction of an import licensing system for all imported commodities by the government in 1961. Since then rice imports have been subjected to various controls and regulations,

culminating in a total ban on rice imports in 1975 when Ghana declared "self-sufficiency" in rice, and again in 1986 under the present PNDC government. Generally, the government lacks the machinery to enforce price controls, and as a result the market price for local rice (usually of lower quality than the imported) exceeds that of imported rice.

In terms of rice pricing, the government has established and annually reviewed a minimum guaranteed price for paddy (i.e. floor price); and a controlled price is imposed on both local and imported rice (i.e. ceiling price). However, the government floor price has always been much lower than the prevailing market price for paddy because government subsidy on inputs like fertilizer, improved seeds, and machinery have been taken into account in fixing the floor price. Other reasons may be because of the shortfalls in rice supplies and high cost of production. But since 1983 when the government embarked on an economic recovery program, this trend is changing as subsidies on agricultural inputs are gradually being removed. The government control on rice has also not been effective because of its inability to control an effective share of the retail market. The Food Distribution Corporation (FDC), for example, is able to market only about 10 percent of the total output at government controlled prices. The Rice Mills Unit (RMU) also has to compete with private mills and traders who pay higher prices for paddy

than the government stipulated prices, and, therefore, operate far below capacity, usually only about 20 percent.

Until 1984, the rice industry enjoyed very substantial subsidies which benefited mainly the large scale farmers, farmers in irrigation project areas, and those who used purchased inputs. Subsidy on fertilizer ranged from 50 percent to over 86 percent between 1970 and 1980 (Tables 14 and 15). Improved seeds and farm operations by machinery were both subsidized. Bank credit for rice production was given at a subsidized rate of about 13% as against 18% lending rate for other sectors of the economy.

Successive governments in Ghana have given much prominence to irrigated and mechanized agriculture, particularly for rice production. The basic reason has been a quest for modernized agriculture so as to attain self-sufficiency in food production and ensure food security as evidenced from both past and present development programs. Large sums of money have been committed by governments over the last two decades for irrigation development and for the importation of agricultural machinery, and most of the modernization have gone into the rice industry. The policy of successive governments to expand rice production through irrigation development has caused significant budgetary constraints on the other sectors of the economy. For instance, under the Agricultural Policy (1984-86) for economic recovery, the government allocated US $9 million to the Irrigation Development Authority (IDA) alone to complete ongoing irrigation projects.

Table 14. Subsidy on compound fertilizer (NPK 15-15-15) (cedis/mt), Ghana, 1970-80.

ITEM	YEAR									
	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979/80[a]
Average FOB price (cedis/mt)	56.60	65.30	98.00	106.00	245.75	290.00	155.00	165.00	175.00	376.00
Freight, Insurance (cedis/mt)	15.00	17.00	24.00	30.00	47.00	55.00	66.00	80.00	95.00	140.00
CIF tema (cedis/mt)	72.60	82.30	122.00	136.00	301.75	345.00	215.00	245.00	270.00	516.00
Handling, port charges (cedis/mt)	2.55	2.65	2.85	3.75	5.65	7.90	9.00	12.00	18.00	32.00
Landed price, Tema (cedis/mt)	75.15	84.95	124.85	139.75	307.40	352.90	224.00	257.00	288.00	548.00
Transport to Tamale (cedis/mt)	25.80	27.70	28.90	32.25	34.50	43.05	60.90	81.00	102.00	170.00
Storage, other charges (cedis/mt)	9.65	9.65	10.15	11.25	11.75	12.60	12.60	51.00	65.00	100.00
Ex-depot price, Tamale (cedis/mt)	110.60	122.30	163.90	183.25	353.65	408.55	297.50	389.00	455.00	818.00
Subsidized sales price (cedis/mt)	56.00	56.00	56.00	56.00	56.00	56.00	56.00	130.00	200.00	200.00
Subsidy per ton (cedis/mt)	54.60	66.30	107.90	127.25	297.65	352.55	241.50	259.00	255.00	618.00
Subsidy as % of depot price	49.4	54.2	65.8	69.5	84.2	86.3	81.2	66.6	56.0	75.6

[a] Substantial change in figures due to cedi devaluation from ¢1.15 = US$1.00 to ¢2.75 = US$ 1.00.

Source: Osafo Kwaku (1983) "Rice Policy in Ghana". Unpublished Ph.D. Dissertation, Stanford University, USA.

Table 15. Subsidy on straight fertilizer (sulphate of ammonia) (cedis/mt), Ghana, 1070-80.

ITEM	YEAR									
	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979/80[a]
Average FOB price (cedis/mt)	28.40	29.00	44.00	78.00	194.20	157.00	85.00	94.00	100.00	201.00
Freight, insurance (cedis/mt)	15.00	17.00	24.00	30.00	47.00	55.00	60.00	80.00	95.00	140.00
CIF tema (cedis/mt)	43.40	46.00	68.00	108.00	241.20	212.00	145.00	174.00	195.00	341.90
Handling, port charges (cedis/mt)	2.55	2.65	2.85	3.75	5.65	7.90	9.00	12.00	18.00	32.00
Landed price, Tema (cedis/mt)	45.95	48.65	70.85	111.75	246.85	219.90	154.00	186.00	213.00	373.00
Transport to Tamale (cedis/mt)	25.80	27.70	28.90	32.25	34.50	43.05	60.90	81.00	102.00	170.00
Storage, other charges (cedis/mt)	9.65	10.15	10.95	11.25	11.75	12.60	12.60	49.00	65.00	100.00
Ex-depot price, Tamale (cedis/mt)	81.40	86.50	110.70	155.25	293.10	275.55	227.50	316.00	380.00	643.90
Subsidized sales price (cedis/mt)	40.00	40.00	40.00	40.00	40.00	40.00	40.00	100.00	160.00	160.00
Subsidy per ton (cedis/mt)	41.40	46.50	70.70	115.25	253.10	253.55	187.50	216.00	220.00	483.00
Subsidy as % of depot price	50.9	53.8	63.9	74.2	86.4	85.5	82.4	68.4	57.9	75.2

[a] Substantial changes in figures due to cedi devaluation from ¢1.15 = US$1.00 to ¢2.75 = US$1.00.

Source: Osafo Kwaku (1983). "Rice Policy in Ghana". Unpublished Ph.d. Dissertation, Stanford University, USA.

This was about 37 percent of the non-cocoa public investment program in agriculture. In 1984, the budget for irrigation schemes was ¢129 million (excluding recurrent expenditures of IDA amounting to some ¢52 million) which was about 22 percent of the capital budget of the Ministry of Agriculture. For the same period (1984-86), the government proposed in her agricultural policy document to mechanize 90 percent of the high potential area for rice and maize by 1986. This represented 70 percent of the total area under rice and 20 percent of the area under maize.[21]

Research and extension for the rice industry have been part of the overall research and extension programs for the whole agricultural sector. Government support for rice research and extension has been augmented (eventhough on a limited scale) by external donor agencies. The German Aid Agency (GTZ) for instance, has been financing the research programs at the Nyankpala Experimental Research Station on rice and other crops. The University of Ghana Agricultural Research Station at Kpong has also been conducting research on irrigated rice. The Seed Multiplication Unit (SMU) which sells improved seeds to farmers has been involved indirectly in extension work; while general extension to rice farmers is carried out by the Extension

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[21]The MOA Document, op. cit.

Division of the Ministry of Agricuture. However, research and extension activities in Ghana have not been without problems. Notable among them are inadequate research and technical staff, and lack of logistics to support crucial and extensive research work.

CHAPTER V

RESULTS AND DISCUSSION

The analysis of the impact of government policies and the estimation of the domestic resource cost of rice production in Ghana are presented in this chapter. Also presented here are the policy implications of the protection accorded the rice industry vis-a-vis the whole economy.

5.1 Policy Incentives

The extent of deviation of the domestic price of rice from its border price (c.i.f. Tema) has been explicitly demonstrated by the estimated Nominal Protection Rate (NPR) for the period 1970 to 1986. The NPR estimates have been made first for the protection offered by government pricing policy to the whole rice industry. This is presented in Table 16. Secondly, since the rice industry consists basically of two sub-sectors, namely: paddy production and paddy processing into rice, an attempt has been made to show the net protection conferred on farmers by these policies. This has been done by comparing the official domestic price for paddy in Ghana (the government sets a minimum

Table 16. Estimates of Nominal Protection Rate (NPR) for the rice industry, Ghana, 1970-86.

YEAR	BORDER PRICE[a] c.i.f. Tema (cedis/mt)	DOMESTIC PRICE[b] Wholesale (cedis/mt)	NPR %
1970	191.50	269.30	41
1971	171.20	277.95	62
1972	252.60	376.43	49
193	194.36	451.14	132
1974	466.69	496.22	6
1975	452.76	680.32	50
1976	349.58	1,394.70	299
1977	358.82	1,973.41	350
1978	421.96	2,680.54	535
1979	381.92	3,051.68	699
1980	1,128.00	9,330.00	727
1981	1,271.00	12,440.00	879
1982	748.70	13,330.00	1,680
1983	4,754.00	48,700.00	924
1984	9,266.15	50,000.00	440
1985	12,009.91	64,000.00	433
1986	19,998.00	64,000.00	220

[a]Based on Thai 25-35% broken (Thai Broken, Super A1) converted into cedis at official exchange rate. 1980-1983 figures are from Ghana Procurement Agency, Accra.

[b]Source: 1970-1979 from a Ministry of Agriculture, Accra
1980-1984 from WARDA Rice Statistics Yearbook (6th Ed). November 1986.

price for paddy every year) with an estimated border price[22] for paddy. Table 17 shows the estimates of the protection rice farmers enjoyed as a result of government rice policies.

It is evident from the NPR estimates that government policies generated enormous protection for the rice industry in Ghana. Except for 1974 when high world prices for rice almost eroded all the protection, (NPR was only 6 percent), the nominal protection resulting from government rice policies has increased steadily since 1970. The NPR reached a high 1,680 percent in 1982 before starting to decline. This means that since the mid-1970s, consumers in Ghana have paid between three times and about seventeen times more for every kilo of rice than they could have obtained it on the world market. That is to say, rice prices in Ghana have been set between 300 percent and almost 1700 percent higher than rice prices prevailing on the world market. On the other hand, the negative NPR for the early 1970s (Table 17) even though negligible (only -0.01 percent) suggests that rice farmers suffered a minimal penalty from government policies. That is, rice farmers were taxed rather than protected; and that the overall protection to the rice industry during the period did not benefit farmers but accrued to the rice processing sector (i.e., milling paddy into rice). However, since 1975 most of the

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[22]The estimated border price for paddy is based on the assumption that: (a) paddy is tradeable not just for seed, but for processing in the importing country; (b) paddy production in Thailand is efficient; and (c) Thai's paddy price represents a free trade price (i.e. protection free).

Table 17. Border price[a], domestic price[a] and estimates of Nominal Protection Rate (NPR) for paddy production, Ghana, 1970-1985.

YEAR	BORDER PRICE (US$/mt)[b]	DOMESTIC PRICE (US$/mt)[c]	NPR (%)
1970-74[d]	115.69	115.04	-0.01
1975-79[d]	106.51	584.42	449
1980	308.52	1,269.09	311
1981	343.30	1,970.90	474
1982	201.69	2,440.00	1,110
1983	171.59	731.67	326
1984	155.20	622.52	301
1985	133.82	418.50	213

[a]The figures presented here have been converted into U.S. dollars at the official exchange rates for Thailand and Ghana respectively.

[b]Based on Thai paddy price (assumed 25% broken) plus cost of insurance and freight. Average c.i.f. is US$ 50.2/mt except 1980-1982 when freight rates increased. Thai paddy price is from the Agricultural Statistics of Thailand, Crop Year 1985/86 and other issues.

[c]From WARDA Rice Statistics Yearbooks (5th Ed.) June 1983 and (6th Ed.) November 1986.

[d]These are averages.

protection conferred by government policy has equally benefitted rice farmers. Especially in 1981 and 1982, protection for paddy producers has been exceptionally high, more than 50 to 80 percent of the total protection enjoyed by the rice industry as a whole.

A comparison between the NPR estimates for the rice industry, on one hand, and that for paddy producers on the other, shows a definite trend. Whereas government policies penalized or offered no protection to paddy producers (on the average) in the early 1970s, the milling sector enjoyed substantial protection. And as protection afforded paddy producers increased from 1975 to the early 1980s, even though total protection for the rice industry increased, net protection to the rice processing sector decreased. One plausible explanation for this trend could be the extent of the overvaluation of the Ghanaian cedi. Balassa (1977), Lutz and Scandizzo (1980), have established that the over-valuation of a local currency guarantees protection to locally produced import substituting tradeables. This is because the NPR in such a case reflects both the effects of the overvaluation of the currency (implicit tariff) and of the direct intervention. It could be deduced that in the late 1960s and early 1970s when the Ghanaian cedi was stronger, government pricing policy offered a relatively lower protection for the rice industry and even minimally taxed the paddy farmers. But as the economy deteriorated rapidly from the mid 1970s (as already mentioned) and the Cedi became excessively overvalued at the official exchange rate, protection conferred on the rice industry

(especially paddy farmers) was amplified and shot astronomically high. This trend again started to reverse from 1983 when, subsequent to the economic recovery program embarked upon by the government, the cedi was devalued tremendously by some 3,200 percent between 1983 and 1986. The implication here is that consumers in Ghana have been greatly taxed (in terms of rice) over the years, not for government revenue (since quantitative restrictions through import licensing were used) but as a transfer from consumers to producers to finance an inefficient industry.

The results presented in Table 18 confirm that the rice industry continued to enjoy substantial protection from government policies in the mid 1980s. The NPR of 220 percent means that in the 1985/86 crop year the domestic price of rice was more than twice the world market price. This is further supported by the Implicit Tariff (IT) rate estimation which helps to quantify the impact of government policies on tradeable inputs - a positive IT means a disincentive to the use of the input, while a negative IT means incentive is provided to encourage the use of the input. The estimates were zero for the traditional system which means that traded inputs for this system have been purchased at their real prices; and -33 percent in each case for the improved and irrigated systems, suggesting that the use of traded inputs in these systems have been greatly encouraged by government policy. This reflects the real situation, especially for fertilizer which was about 40 percent subsidized (Table 19).

Table 18. Incentive indicators by production systems, Ghana, 1985/86.

PRODUCTION SYSTEM	PRICE OF OUTPUT		NOMINAL PROTECTION RATE (NPR)	VALUE OF TRADABLE INPUTS (cedis/ha)		IMPLICIT TARIFF RATE	VALUE ADDED (cedis/ha)		EFFECTIVE PROTECTION COEFFICIENT (EPC)
	Border	Wholesale	%	Financial	Economic	%	Financial	Economic	
Traditional (Less-intensive)	19,998.00	64,000.00	220	1,171.59	1,171.59	0	28,338.94	7,927.50	2.58
Improved (Partially-mechanized)	19,998.00	64,000.00	220	37,674.17	56,511.25	-33	28,885.83	-35,713.33	-1.81
Irrigated (Fully-mechanized)	19,998.00	64,000.00	220	69,689.10	104,533.70	-33	75,910.87	-59,038.25	-2.29

Table 19. Implicit Tariff (IT) Rates on fertilizers, Ghana, 1980-86.

YEAR	COMPOUND FERTILIZER[a] (cedis/50 kg.bag)			STRAIGHT FERTILIZER[b] (cedis/50 kg.bag)		
	Border	Wholesale	IT %	Border	Wholesale	IT %
1980	24.75	15.00	-39	19.80	12.00	-39
1981	43.50	30.00	-31	36.25	25.00	-31
1982	43.50	30.00	-31	36.25	25.00	-31
1983	84.10	58.00	-31	65.25	45.00	-31
1984	616.00	440.00	-29	413.00	295.00	-29
1985	616.00	440.00	-29	413.00	295.00	-29
1986	1,092.00	780.00	-29	705.60	504.00	-29

[a]Mostly NPK 15-15-15 or 20-20-0.

[b]Mostly sulphate of ammonia.

The EPC which is expressed as the ratio of the excess in domestic value added over free trade value added indicates the combined impact of price policies on output and tradeable inputs on producers' incentive, and, therefore, reflects the incentives afforded for investment in the rice industry (Corden, 1966). The EPC for the traditional (less-intensive) system was positive, 2.58 (or Effective Protection Rate, EPR, = 258%), which means that pricing policies offered strong incentives for rice production by this method. On the other hand, the EPC was negative for both the improved, partially mechanized and the irrigated, fully mechanized systems (-1.81 and -2.29 or EPR of -181% and -229% for the improved and irrigated systems, respectively). This implies that the returns to domestic primary factors (domestic value added) were lower by as much as 181% and 229% for the improved and irrigated systems, respectively, than what these factors could earn in a free trade situation. Thus, returns to factors of production were penalized by the protection system so that removal of the protection will allow these factors to be employed in more efficient productive activities than the rice industry. Moreover, the negative EPC values indicate that rice production by the improved and irrigated systems led to an absolute loss of foreign exchange to the economy. This could be attributed to the high cost of traded inputs used in these rice production systems. Since both systems use fertilizer and machinery which are traded, and whose prices have greatly increased as a result of the Cedi devaluation (a 65 hp tractor

cost ¢35,000.00 and a combine harvester cost ¢100,000.00 in 1979/80; and in 1985/86 their prices increased to ¢3.5 million and ¢6.9 million, respectively) the overall value added was negative in both cases. Again, this implies that government policy resulted in the diversion of factors of production from more efficient activities to a less efficient activity.

5.2 Comparative Advantage

That both past and present governments of Ghana have favored expanding domestic rice production has been demonstrated in the direction of their food polices over the years. The crucial question now is: would domestically produced import substitute rice benefit the economy, or in other words, will benefits accruing from import substitution in rice outweigh the cost to the economy? An attempt at answering this question has been made using the Domestic Resource Cost (DRC) measure.

Intuitively, the DRC criterion is an expression of the comparative cost principle in international trade. Ghana has comparative advantage in rice vis-a-vis the rest of the world if domestic cost per unit of rice is less than the shadow exchange rate. This analysis has employed the DRC as an "ex-post" measure of the cost of a restrictive trade system, using input-output analysis. It evaluates the opportunity cost incurred by the economy in sustaining its existing import substitution policy in rice. In order to ascertain the comparative advantage or disadvantage of rice in Ghana, the DRC estimate was compared with

the Shadow Exchange Rate (SER) as a way of eliminating the impact of distorted exchange rate, which in turn, distorts the rate of profit or loss due to the rice industry. A summary of the economic efficiency indicators is given in Table 20.

It is clear from the DRC/SER ratio (or Resource Cost Ratio, RCR) that Ghana has no comparative advantage in rice for all the three systems of rice production outlined in this study (see Appendix A). Even more important is the fact that both the improved and irrigated systems result in negative value added to the economy, inspite of the tremendous protection afforded by government pricing policies. The DRC/SER ratio of 2.86 for the traditional system, however, shows that among the three systems, this system performs better economically, apparently because of the minimal traded inputs used. Also, all the three systems showed negative economic profitability, indicating that rice production resulted in a loss to the economy. Even for financial (or private) profitability, all the systems showed negative profits at both the government farmgate (paddy) price and wholesale price (except the irrigated system which showed some profit at the government wholesale price). It was only at the open market price that all the three systems resulted in profits, highest for the irrigated system and least for the traditional system (Table 21). This may be attributed to the very low yields from the traditional system. The figures for economic value (EV) added, net economic profit (NEP), and net foreign exchange earnings (NFEE) were all negative for both the improved and

Table 20. Summary of economic indicators by production systems, Ghana, 1985/86.

ITEM	TRADITIONAL (Less Intensive)	IMPROVED, PARTIALLY-MECHANIZED (Semi-Intensive)	IRRIGATED, FULLY MECHANIZED (Intensive)
1. Yield: Paddy (mt/ha)	0.7	1.6	3.5
Milled Rice (mt/ha)	0.455	1.04	2.275
Value (US$/ha)	101.10	231.10	505.50
Value (¢/ha)	9,099.09	20,797.92	45,495.45
2. Production Cost (Economic)			
(a) Foreign: $/ha	1.92	577.48	967.86
¢/ha	172.13	51,973.30	87,107.70
(b) Domestic:¢/ha	26,274.67	72,343.85	65,362.85
3. Marketing & Distribution Cost (Economic)			
(a) Foreign: $/ha	11.11	50.42	193.62
¢/ha	999.46	4,537.95	17,426.00
(b) Domestic: ¢/ha	7,684.60	4,251.05	24,725.70
4. Total Economic Cost: $/ha	390.34	1,478.96	2,162.47
¢/ha	35,130.86	133,196.15	194,622.25

Table 20. continued.

ITEM	TRADITIONAL (Less Intensive)	IMPROVED, PARTIALLY-MECHANIZED (Semi-Intensive)	IRRIGATED, FULLY MECHANIZED (Intensive)
5. Total Financial Cost: ¢/ha	37,856.25	114,731.18	121,379.80
6. Economic Value Added: ¢/ha	7,927.50	-35,713.33	-59,038.25
7. Financial Value Added: ¢/ha	28,338.94	28,885.83	75,910.87
8. Net Economic Profit (¢/ha)	-26,031.77	-112,308.23	-149,126.80
9. Net Financial Profit (¢/ha) (Government Wholesale Price)	-8,736.00	-48,171.18	24,220.20
10. Net Foreign Exchange Earnings ($.ha)	88.07	-396.80	-655.98
11. Domestic Resource Cost (DRC)	386.6	-192	-137
12. Comparative Advantage: DRC/SER	2.86	-1.42	-1.02
13. Nominal Protection Rate (NPR)	220%	220%	220%
14. Implicit Tariff (IT) Rate	0	-33%	-33%
15. Effective Protection Coefficient (EPC)	2.58	-1.81	-2.29
16. Breakeven c.i.f. Rice Price: $/mt	572	948	634

Source: Based on Appendix Tables 1-8. The computations are shown in Appendix B.

Table 21. Economic and financial profitability by production systems, Ghana,1985/86.

I T E M	TRADITIONAL (Less Intensive)	IMPROVED, PARTIALLY-MECHANIZED (Semi-Intensive)	IRRIGATED, FULLY-MECHANIZED (Intensive)
1. Net Economic Profit ($/ha)	-289.24	-1,247.87	-1,656.96
(¢/ha)	-26,031.77	-112,308.23	-149,126.80
2. Net Financial Profit (¢/ha)			
(a) Farmgate	-13,382.25	-72,185.30	-9,403.70
(b) Wholesale (Government price)	-8,736.00	-48,171.18	24,220.20
(c) Wholesale (Open Market Price)	5,823.75	12,416.60	97,020.20

irrigated systems; but highest for the irrigated system (EV = -¢59,038; NEP = -¢149,127; and NFEE = -$656) indicating that the irrigated system has the highest economic or social cost and therefore higher loss of foreign exchange.

Alternatively, the relative comparative advantage can be determined by looking at the breakeven c.i.f. price of rice ($/ton) at which DRC equals the shadow exchange rate (SER). It could be seen from Table 20 that the traditional system had the lowest breakeven c.i.f. price of $572.00 while the improved system had the highest, $948.00. These c.i.f. prices thus ranged between 200 and over 400 percent above the c.i.f. price of $222.2 used for this analysis; indicating that the present world price of rice must rise between 200 and 400 percent to make all the rice production systems in Ghana economically efficient (i.e., have comparative advantage). Considering the downward trend of world commodity prices which have been at their lowest in recent years (the Thai f.o.b. price for 25-35% Broken or Thai Broken A-1 super rice fell by almost 50 percent from $ 252 in 1980 to $ 127 in 1986), such a sharp rise in price is most unlikely in the near future.

To further substantiate the deteriorating comparative advantage status of rice in Ghana, Table 22 which shows the Resource Cost Ratio (RCR) for rice production in some years within the last decade is provided. The important point here is that during the 1970s and early 1980s when the Ghanaian Cedi was highly overvalued, the comparative advantage of rice in Ghana had

Table 22. Changing comparative advantage[1] of rice production in Ghana, selected years.

PRODUCTION SYSTEM	CROP YEAR (RCR) 1977[a]	1979/80[b]	1985/86
Traditional (Less Intensive)	2.29	2.36	2.86
Improved, Partially Mechanized (Semi-intensive)	2.22	3.8	-1.42
Irrigated, Fully Mechanized (Intensive)	3.29	2.4	-1.04

[1]Official Exchange Rates:

Year	Cedis/US$1.00
1977	¢ 1.15
1979/80	¢ 2.75
1985/86	¢90.00

Source:

[a]Stryker, J.D. (1977). "Ghana Agriculture" West Africa Regional Project. World Bank, Washington, D.C.

[b]Osafo, Kwaku (1983). "Rice Policy in Ghana" Unpublished Ph.D. dissertation. Stanford University, U.S.A.

a better outlook (because of "artificially" cheap inputs) than the present when the Cedi has been massively devalued. As tradeable inputs became very expensive following the devaluation, rice production by mechanization and irrigation which intensively use traded inputs became more costly to the economy.

Sensitivity Analysis: In order to investigate the effect of relative changes in assumptions regarding the parameters used in the analyses with respect to the DRCs for the different systems, sensitivity analysis was done within an elasticities framework. The assumption here was that the DRCs are likely to be sensitive to the c.i.f. price of rice, yield, labor costs, irrigation/pumping costs, and capital services. The results of the sensitivity analysis are provided in Table 23. Only the parameters for the production systems were considered since post production activities may not be confined to only one method and, therefore, have little influence on elasticity values. In this respect, the elasticities are functions of the size of the domestic resource cost and the respective parameter, or the share of the particular factor in the initial total cost of production.

The elasticity values show the percentage change in the domestic resource cost that result from a one percent change in the respective parameter or factor of production. The DRC value for both the improved and irrigated systems of rice production are sensitive to rice yields and border price by the same margin in each case, with a higher sensitivity shown in the irrigated

Table 23. Elasticities of DRC with respect to yields, border prices, and economic/social cost of primary inputs, Ghana, 1985/86.

PRODUCTION SYSTEMS	BORDER PRICE (c.i.f.Tema)	YIELD	UNSKILLED LABOR	SKILLED LABOR	IRRI-GATION SERVICES	PUMP-PING COST	CAPITAL SERVICES	FERTI-LIZER AND AGRO-CHEMICALS
Traditional (Less-intensive)	-0.73	-0.73	2.49	-	-	-	0.02	-
Improved, Partially Mechanized (Semi-intensive)	-4.84	-4.84	3.48	3.97	-	3.96	3.97	3.93
Irrigation, Fully Mechanized (Intensive)	-9.11	-9.11	3.75	3.97	3.87	-	3.94	3.94

system. Thus, a one percent increase in yield leads to a 5 percent decrease in the DRC in the case of the improved system, and a 9 percent decrease in the case of the irrigated system. This implies that higher yield increases as well as increases in the world price of rice will considerably improve the comparative advantage position of rice in Ghana in terms of these two systems of production.

On the other hand, the DRC for the traditional system of rice production is not as sensitive to yield and border price increases - a one percent increase induces only a 0.7 percent reduction in domestic resource cost in each case. This may be attributed to the rather low yield for this system at present. A simultaneous increase in both the border price and yield are likely to result in a more significant domestic resource cost reduction with respect to this system. A 50 percent simultaneous increase in both the border price and yield leads to a more favorable resource cost ratio (the DRC/SER ratio has been computed to be 1.2). This suggests that internal programs that focus on yield increasing innovations and matched by favorable external prices for rice can shift the traditional system of production into a level of comparative advantage.

With respect to the economic cost of inputs, unskilled labor elasticity for the traditional system indicates that a one percent decrease in labor cost will result in almost 3 percent decrease in the domestic resource cost. This is not surprising since unskilled labor is the most important factor of production

in this system. The cost of capital services under this system has very little impact on domestic resource cost, implying that the use of more capital services to reduce labor cost is likely to improve its comparative advantage position.

For the improved and irrigated systems, the sensitivity analysis shows that the DRCs are elastic for all the inputs considered, almost by the same margin - a one percent decrease in the cost of any of the inputs leads to a 4 percent reduction in domestic resource cost. This means that the costs of all these inputs and their respective quantities/numbers employed in the production processes significantly affect the country's comparative advantage in rice by these systems.

The sensitivity analysis shows clearly that rice production in Ghana cannot be promoted indiscriminately. Great caution is needed by way of policy and policy implementation so as to direct scarce resources to areas where relative comparative advantage lies; or where prospects for comparative advantage in rice are most favorable since Ghana has no comparative advantage in rice at the present. Two issues come up here. First, a choice must be made whether to continue to promote large-scale rice farming and use scarce resources to import the necessary machinery and make further investments in irrigation development, or turn to the small-scale rice farmer and exploit the prospects of comparative advantage there by means of yield increasing innovations. Secondly, policies based on the choice made must be specific, pragmatic, and geared more towards efficiency in production.

Generalized policies which lack proper direction and target clientele will only compound issues and create complexities in attaining policy goals.

On the basis of the findings from this study, it will be more rational to discourage rice production in Ghana for reasons of economic inefficiency. However, if the government's decision takes into account other issues such as food security and income distribution, then it will be more economical and socially beneficial for the government to direct attention towards small-scale rice farmers where relative comparative advantage in rice lies. This will allow only large-scale farms which are relatively efficient to survive while marginal farms phase out gradually.

CHAPTER VI

ANALYSIS OF GOVERNMENT RICE POLICY

The highlights of government rice policy in Ghana which were outlined in Chapter IV are broadly discussed here. A brief historical analysis of both investment and pricing policies is given, and then capped with a comparison between the rice price policy in Ghana and those of other West African countries.

It should be understood from the very onset that governments in Ghana have never singled out rice for any specific or special program so far. All programs and policies for the rice industry have been made and implemented as part of an overall food policy or program. Since it is beyond the scope of this study to analyze such policies and programs in their entirety, only those sections which have direct bearing on rice have been selected and discussed here.

The history and evolution of agricultural policy in Ghana, together with the beginnings of the Department of Agriculture, dates back to the pre-independent colonial government. Early settlers along the coast, including missionaries (notably the Basel Mission) encouraged the development of indigenous agriculture. Perhaps the establishment of a Botanical Station at Aburi in 1890 set the pace for agricultural development in Ghana and the initial establishment of the Ministry of Agriculture (La

Anyane, 1963). Since its inception, the Ministry of Agriculture has generally been responsible for the implementation of government agricultural programs and policies, except in the early 1960s when it was reorganized and some of its functions taken over by the short-lived United Ghana Farmers Council (UGFC) and the State Farms Corporation (SFC). The other major state agency involved in implementing government food policies in Ghana is the Food Distribution Corporation (FDC).

Government food policies over the years have centered essentially on the production of cereals and starchy staples for self-sufficiency in food, and the maintenance of adequate buffer stocks of grains to provide food security against crop failure, and other natural hazards. As a general rule, investment, pricing, and trade restriction have been the major policy instruments directed towards achieving policy goals.

Investment policies

Over the years since 1950, farm size has featured prominently in Ghana's agricultural development policies as a factor for agricultural modernization and growth. As has been noted already, the modernization strategy of the Nkrumah era in the early 1960s marked a definite shift by government into large-scale farming. Prior to the early 1960s (i.e. 1950-1961), the Government development plan stressed that the progressive

improvement of the traditional system of production alone could not suffice the needs of an expanding economy. The colonial administration, therefore, established the Agricultural Development Corporation (ADC) (which continued after independence until 1961) to undertake special agricultural experimental schemes so as to ascertain the possibilities of large-scale farming in relation to local conditions of climate and soil. This was the first major attempt to introduce tractor mechanization into Ghanaian agriculture, and experimental and settlement farms were started in Northern Ghana of which, rice production featured prominently. But this experiment was a total failure because: (a) the heavy machinery and other equipments imported were unsuitable to the soil conditions, climate, and crops; (b) frequent breakdowns and inadequate supply of spare parts left most equipments idle; (c) skilled operators and technicians were scarce, and (d) there was an overall poor management and supervisory work (Dadson, 1971). Thus, the ADC's record in large-scale farming demonstrated some serious bottle-necks regarding state involvement in large-scale agriculture, and the lack of knowledge about the appropriate technology to introduce into traditional agriculture in Ghana.

It is against this background that Nkrumah's policy of full scale involvement by the state in plantation agriculture and large-scale mechanization was thought to be more politically than economically motivated. Nkrumah's idea of developing Ghana's

economy through industrialization and modern agriculture was noble. But the question is: what meaning was imputed to "modern agriculture"? It would seem from the establishment of many large-scale farms under the UGFC, SFC, and other political functionaries like the Young Farmers League (YFL); and the indiscriminate importation of tractors and other farm machinery that modern agriculture was tied to large-scale farms and tractor mechanization.

Binswanger and Pingali (1986) have observed that technology priorities for agricultural modernization in sub-Saharan Africa include: (a) yield-increasing innovations; (b) labor-saving technologies; (c) quality-enhancing innovations; and (d) technologies for land improvements. The poor performance of the many large-scale state farms established show that the wrong policy instrument was adopted for achieving the objective of modernized agriculture. Dadson (1971) notes that productivity on these farms were much lower than those of the unassisted traditional sector. For example, rice yields on these large-scale farms were only about 1/6 to 1/3 of those of the traditional sector. Thus, the "transferred technology model" of the Nkrumah era laid a poor foundation for large-scale agriculture in Ghana as a whole, and for rice production in particular.

It is to be noted that even though government support shifted to the small-scale farmer for rice and other crops in the

late 1960s and early 1970s, largescale rice production has been emphasized and encouraged by successive governments since the mid-1970s. The many irrigation and land development projects especially in the north and the coastal plains of Ghana and the huge investments made by governments up to the present attest to this. This shows that there has not been any fundamental shift in investment priorities for rice and other food crop production in the post-Nkrumah era. The only difference may be that instead of state-run large-scale farms, the private sector now handle such farms. Large investments continue to be made in machinery and irrigation for large-scale farming. For example, in the 7-year period between 1969 and 1975, about 166 combine harvesters, 2,219 wheeled tractors, 245 crawler tractors, and 217 irrigation equipments of various types were imported for rice and other crops (Prakah-Asante and Nyanteng, 1981). Irrigation projects continue to be prominent in government development programs until now. The PNDC's Agricultural Policy document (1984-86) proposed a medium-term and long-term targets for irrigation development as 23,500 ha (by 1988) and 180,400 ha (by 1993), involving millions of cedis.

Other investments have also been made both in research and extension (including bilateral and multilateral agencies), to provide improved rice varieties to farmers through the Seed Multiplication Unit of the MOA. Subsidized bank loans have been

made available to farmers (particularly large-scale farmers) until only recently when such subsidies have been removed. The Agricultural Development Bank, the National Investment Bank, and other commercial banks have sponsored large hectares of rice farms in the northern and upper regions.

The crucial question to be asked is: what impact have all these huge investments made on the rice economy in particular, and food production in general? The frequent food shortages experienced in recent years in Ghana, and the overall poor performance of the food sector as evidenced in declining yields over the years (adverse weather conditions notwithstanding) show that the overall impact of these investments have been very minimal if not negative. The trends in yield, area cultivated and paddy produced given in Chapter IV show clearly that government investment policy has focused on area expansion rather than yield increases as a means of boosting rice production. Available statistics show that large area expansion especially from the mid-1970s resulted in very low yields (see Fig. 7). In fact, the Grains Development Board in its two-year development plan in the mid-1970s showed great concern about the pace of expansion in the rice industry and suggested that a slower pace coupled with higher average yields was a better approach to increasing rice production in Ghana.

Killick (1978) observed that in Ghana, a rather consistent tendency for the govenrment to opt for project designs

emphasizing grandeur rather than economy reinforced the bias towards capital intensity. Government farms in the 1960s provide an example of a perverse mix of factors. In response to a plentiful supply of agricultural land and shortages of capital and foreign exchange, government farms were engaged in intensive cultivation of land with the use of imported tractors. This tendency seemed to have continued into the 1970s. Particularly from the mid-1970s, vested interests of certain govenrment officials and some military personnel in government might have caused the government to sacrifice economic efficiency for prestige in its area expansion drive in rice production.

Because developed land at irrigation project sites and farm lands in the north were virtually free, and inputs such as machinery, fertilizers, and other agro-chemicals (also credit) were heavily subsidized, many influential government personnel and their allies obtained large hectares of land for rice cultivation. This also resulted in the influx of "absentee farmers" and inefficient farms into the industry. A complex of technical, physical, and economic problems resulting from the area expansion drive might account for the dismal performance of the rice industry. Some of these problems are:

(a) poor clearing and land preparation techniques due to scarce skilled machine operators;

(b) weed infestation and subsequent shifting of farms to new areas (farmers report that it is usually cheaper to develop a new land than to control weeds);

(c) inadequate spare parts and poor servicing of machinery;

(d) inadequate and/or wrong timing of the supply of inputs; such as seeds and fertilizers;

(e) bush fires that consumed large rice fields;

(f) excessive soil erosion due to poor mechanization practices; and

(g) inefficient management of large-scale farms.

The problem of poor machine servicing needs some elaboration. Since the government does not have the necessary foreign exchange for direct and selective importation of farm machinery and equipments, these are usually obtained under bilateral aid and trade agreements which tie the country to its suppliers. Thus, the inherent mechanical inefficiencies and unsuitability of most machines to the Ghanaian condition came as a natural consequence.

Trade and Pricing Policies

It has already been mentioned that trade policies concerning rice has been part of an overall trade policy in Ghana. An import licensing system which put quantitative restrictions on rice imports has been the major policy instrument for controlling

Ghana's external trade in rice. With respect to internal trade, government employs a system of price controls to guarantee minimum price for paddy (floor price), and price ceiling to protect the urban consumer. Also, input subsidy policies notably for fertilizer, machinery and mechanization services, improved seed and irrigation services have been widely used. However, the effective implementation of these price polices has been the major bottleneck in making them have any significant impact on the domestic rice economy.

Historical evidence and the findings from this study show that pricing policies in Ghana have been biased towards the rice industry. This is not surprising since many government personnel, especially in the 1970s, have been involved in the elusive "rice miracle" which was anticipated with the establishment of many irrigation projects and mechanization schemes. The paddy/fertilizer price ratio ranged between 2 and 19, indicating that input pricing policy has been very favorable to the farmer to ensure private profitability in rice production (Table 24). Negative implicit tariff for traded inputs obtained from this study also show that pricing policies have greatly favored farmers and encouraged input use. Moreover, official figures from the Ministry of Agriculture show that rice prices have always been higher than the prices of other cereals in Ghana since 1970 (Table 25). The price policy bias towards rice,

Table 24. Support price of paddy and fertilizer selling price, Ghana, 1970-85.

YEAR	SALE PRICE		
	Paddy (Cedis/kg)	Fertilizer[a] (Cedis/kg)	Paddy/ Fertilizer Price Ratio
1970-74	0.14	0.06	2.3
1975-79	0.91	0.13	7.0
1980	3.49	0.30	11.6
1981	5.12	0.60	8.5
1982	6.71	0.60	11.2
1983	21.95	1.16	18.9
1984	22.00	8.80	2.5
1985	22.62	15.60	1.5

[a]Fertilizer refers to compound fertilziers, NPK 15-15-15 or 20-20-0. Straight fertilizer prices are between 20 and 40 percent less.

Source: Paddy price from WARDA Rice Statistics Yearbook, 5th Ed. 1983 and 6th Ed. 1986.

Fertilizer price from Ministry of Agriculture, Accra.

Table 25. Wholesale prices for major food crops, Ghana, 1970-83.

YEAR	PRICE IN CEDIS/TON					
	Rice	Maize	Sorghum	Millet	Yam	Plantain
1970	269.30	117.13	172.32	174.49	95.10	55.88
1971	277.95	119.64	181.62	187.46	113.78	83.79
1972	376.43	172.55	207.03	212.65	122.58	74.51
1973	451.14	184.67	290.59	274.16	149.91	110.78
1974	496.22	201.20	309.19	317.19	192.24	156.86
1975	680.32	249.90	315.78	312.76	262.76	145.10
1976	1394.70	570.14	793.30	779.46	380.21	295.10
1977	1973.14	1187.68	1767.14	1291.89	790.62	880.39
1978	2680.54	1213.83	1932.97	2007.68	1299.47	1464.71
1979	3051.68	1720.44	2334.59	2408.43	1611.84	1461.76
1980	8256.54	4141.38	6819.35	5337.30	2413.22	2145.10
1981	11913.62	7751.40	9557.84	9493.62	4257.27	3317.65
1982	22094.70	7991.08	13123.24	13539.03	5942.22	4603.92
1983	59796.99	36734.40	38115.73	34577.30	15433.66	15305.56

Source: Ministry of Agriculture, Accra.

therefore, cannot be overemphasized. But these "favors" from policies to the rice industry do not tell the whole story. The crucial question to address is whether such inputs have been available to the ordinary farmer! The stark reality is that most farmers generally have not had access to fertilizer and other inputs.

First, government resources were not enough to supply the total needs of the industry. WARDA (1977), in a study of large scale mechanized rice production in Northern Ghana, estimated that the total value of fertilizers that was required for rice in the north alone was about ¢6 million in 1976, and was to reach over ¢10 million in 1980. This figure was beyond the fertilizer needs for maize and other food crops in the region. Foreign exchange requirements to supply machinery, equipments and spares were also put at ¢6.5 million in 1976, and about ¢12 million in 1980. But the total budgetary[23] expenditure on agriculture for 1975-76 was estimated at ¢93 million and for 1976-77 was ¢111 million.

Secondly, the government did not have the machinery and resources to support a price stabilization policy. The Food Distribution Corporation (FDC) which was responsible for implementing floor and ceiling prices by the operation of a

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[23]Ministry of Finance and Economic Planning, Annual Estimates.

buffer stock system, controlled only about 10 percent of the rice trade because of the relatively low government support price. Government rice mills have generally operated at only about 20 to 30 percent capacity, and private millers and traders who buy paddy at higher prices control most of the rice trade. Imported rice has also been in short supply because of trade restrictions, so that even though official prices for imported rice are lower than those for the local rice, the open market price (private price) is the same for both (or sometimes higher for imported rice). Table 26 provides information about the rice price movements. The rsult of the significant differences between the prices for local and imported rice, and between the official and open market prices has been rationing of rice through cooperative buyers and government supermarkets. This has led sometimes to corrupt practices between some officials and traders whereby imported rice is obtained at the official price and sold for large profits on the open market.

Third, even though in terms of equity and income distribution the price incentives for rice might have shifted income to the north where most of Ghana's rice is produced, it is doubtful whether rural income really increased. This is because large-scale rice farms have been concentrated in the hands of a few influential people who bought most of the available inputs to the neglect of the poor farmer. In any case, fertilizer and seed

Table 26. Official retail price versus open market price for rice (cedis/kg),[a] Ghana, 1980-87.

YEAR	OFFICIAL PRICE		OPEN MARKET PRICE	
	Local	Imported	Local	Imported
1980	9.33	9.33	-	-
1981	12.57	4.00	29.90	29.90
1982	17.76	4.60	42.30	42.30
1983	48.70	11.40	115.98	115.98
1984	50.00	11.40	171.61	171.61
1985	64.00	36.00	96.00	96.00
1986	64.00	36.00	96.00	96.00
1987	96.00	50.00	100.00	100.00

[a] Some of these figures are not officially documented since open market prices sometimes differ from place to place and by quality of rice.

Sources: Ministry of Agriculture, Accra.
Food Distribution Corporation, Accra.

in particular arrived late most of the time, and if ever they were available large-scale farmers bought the bulk of them and resold some to small farmers at higher prices.

In sum, the foregoing analyses show that government rice policy has favored rice production in Ghana. However, poor implementation of these policies caused them not to significantly boost rice production. Also, highly subsidized inputs and high market prices for rice resulted in the establishment of many inefficient farms in the rice industry such that even at low production levels marginal farms were able to survive and make some profits. Thus, it could be deduced from the foregoing analyses that high price incentives were not matched by proper investment policies. The rapid area expansion which went too far ahead of the absorptive capacity of the economy and the existing managerial and technical skills eroded any gains that could accrue to the rice industry from the favorable pricing policies.

In relation to other West African countries, Ghana's rice policy as a whole has not significantly differed. Self-sufficiency in rice has been a central issue for all West African governments. Pearson et. al. (1981) noted in their study of rice in West Africa that trade and price policies, domestic tax/subsidy policies, and investment policies are those commonly employed by the Governments of Ivory Coast, Liberia, Senegal, Sierra Leone and Mali. Similar to the policy thrust in Ghana,

these policies have impact on the rice economy through their effects on output prices and on input and capital costs. Generally, pricing policies in these countries, except Mali, have been to transfer resources from consumers to producers or to government treasury. Needless to say, however, the mode of implementation and, therefore, their impact differ from country to country. For example, Table 27 provides information on paddy and rice prices in six West African countries. It can be seen that on the whole, prices for both paddy and milled rice have been highest in Ghana, about 4 times for paddy and 10 times for milled rice in the early 1980s. Also, with the exception of Mali, all four countries have taxed rice consumers in that wholesale prices for local rice have been higher than comparable c.i.f. import prices (Pearson, et. al. 1981). This is similar to the situation in Ghana, except that the difference between comparable domestic wholesale and c.i.f. prices is much greater in Ghana. The implication here is that in the entire West African sub-region, Ghana might have the highest rate of protection for the rice industry. Admittedly, among the other five countries considered, Mali and Sierra Leone have comparative advantage in rice production. However, like Ghana, Ivory Coast, Liberia and Senegal have no comparative advantage in rice production. Yet, among all these countries, WARDA estimated rice yields to be lowest for Ghana between 1980 and 1985 (an average

Table 27. Official wholesale prices for local rice in selected West African countries (US$/kg),[a] 1970-1985.

YEAR	GHANA		IVORY COAST		MALI		SIERRA LEONE		SENEGAL		LIBERIA	
	Paddy	Rice	Paddy	Rice	Paddy	Rice	Paddy	Rice	Paddy	Rice	Paddy	Rice
1970-74	0.12	-	0.13	-	0.06	-	0.11	-	0.11	-	0.12	-
1975-79	0.59	-	0.29	-	0.10	-	0.19	-	0.18	-	0.27	-
1980	1.27	3.39	0.31	0.47	0.15	0.47	0.26	0.46	0.20	0.46	0.26	0.51
1981	1.97	4.52	0.18	0.40	0.14	0.40	0.30	0.41	0.19	0.36	0.40	0.51
1982	2.45	4.85	0.18	0.36	0.18	0.42	0.38	0.43	0.17	0.31	0.40	0.51
1983	0.73	1.62	0.16	0.31	0.16	-	0.39	0.60	0.16	-	0.40	0.51
1984	0.62	1.43	0.16	0.34	0.15	-	0.30	0.60	0.15	-	0.40	0.49
1985	0.41	1.16	0.16	0.33	0.16	-	0.16	0.38	0.19	-	0.40	0.49

[a]Local currencies converted to US$ at the respective official exchange rates.

Source: Computed from WARDA Rice Statistics Yearbook, 5th Ed. 1983 and 6th Ed. 1986.

of 908 kg/ha compared to 1168 kg/ha for Ivory Coast and 1,027 kg/ha for Sierra Leone). This could also be an indication that in relative terms, Ghana's rice industry might be performing poorest in relation to the other countries.

It could be argued here that Ghana's continued poor performance in the rice sector is due to the over emphasis of successive governments on irrigation, mechanization, and large-scale farming. The other West African countries compared here, even though they also pursue irrigated and mechanized rice production, pay considerable attention to the small-scale farmer by way of more effective credit and input delivery systems. Indeed, their performance might not be a real success yet. Nevertheless, they have performed comparatively better than Ghana.

The "Green Revolution" that occurred in Asia during the 1960s involved a technological package very well suited to Asian factor endowments and institutional settings. Fundamentally, conditions in Asia differ from those in Africa, and, therefore, Asian technologies and those of the West for that matter cannot be transferred wholesale to Africa without substantial economic sacrifices. Thus, a successful development of rice production in West Africa and Ghana in particular, should be more oriented towards the indigenous small-scale farmer.

CHAPTER VII

SUMMARY AND CONCLUSION

Food production increases for self-sufficiency and food security, and more equitable income distribution for higher rural incomes have been important objectives for successive governments of independent Ghana. In pursuance of these objectives, governments, with the support of foreign assistance, have made substantial public investments to expand irrigation, import machinery and necessary equipments, and organize research and extension in agriculture. Rice, even though a minor food crop accounting for only about 10 percent of the total cereal production in Ghana, has been the focus of many investment projects in the food sector. The import substitution drive in terms of rice production has the objective of conserving scarce foreign exchange to promote other sectors of the economy.

Pearson et. al. (1981) have observed that there exists a complex relationship among a country's comparative advantage in producing rice, pressures on the allocation of scarce budgetary revenues, and a government's scope for implementing policies, more particularly trade and pricing policies. If a country has comparative advantage in rice production, scarce foreign exchange and limited domestic resources (labor, land, capital, etc.) can be used to produce rice efficiently and profitably when priced at their opportunity costs. A country with comparative advantage in

rice therefore has a great deal of flexibility in its choice of policies affecting rice. One option of the government could be no intervention in the rice sector, in which case the budget will not be affected and rice producers will be permitted to compete efficiently with potential imports. Another approach could be to tax rice producers by taxing exports of rice and lowering domestic rice price to consumers, thereby causing rice to positively contribute to government revenues. Comparative advantage in rice (or food) production, therefore, presents a government with a policy choice - to exploit the existing advantage to a maximum and export rice, or to maintain relatively low prices to consumers by taxing rice exports. The first alternative will stimulate the growth and industrialization process of the country, while the other will ensure cheap food to consumers.

On the other hand, a country has no comparative advantage in rice production if its costs of production exceed costs of comparable imports. In this respect, the government has little choice but subsidize rice production if it wants to promote local production. This could be done (even though it involves substantial economic and welfare costs) by transferring resources to producers through higher prices for domestic rice, thereby forcing consumers to pay the cost of inefficient local production. Or the government can directly subsidize (from government treasury) inputs (e.g. fertilizers), investments (such as irrigation), or output (by payments to farmers and millers). In

any case, both options could be simultaneously applied, but the enormous costs involved could cause the country to opt for continued rice importation.

The analysis made in this study focused on using the Domestic Resource Cost (DRC) criterion as a measure of Ghana's comparative advantage in rice production. For a more vivid picture of Ghana's rice economy, the Nominal Protection Rate (NPR), Implicit Tariff (IT), and Effective Protection Coefficient (EPC) were also estimated for rice.

The DRC was used as an "ex-post" measure to evaluate the opportunity cost incurred by the economy in sustaining its existing import substitution policy in rice. By comparing the DRC with the Shadow Exchange Rate (SER), the impact of distorted exchange rate was eliminated or accounted for. The NPR which is expressed as a percentage divergence between domestic and foreign prices of comparable product quality measured at the same level in the marketing chain, gives an indication of the magnitude of the incentives which the government output price policy confer on rice. The IT, like the NPR, helps to quantify the impact of government policy on tradeable inputs used in rice production. The EPC (also called EPR when expressed in percentage) indicates the combined impact of price policies on rice output and tradeable inputs. By expressing it as a ratio of the excess in domestic value added over free trade value added, the incentives to rice producers through the returns on domestic primary factors

could be obtained, and the direction of resource movements either towards or away from rice production could be ascertained.

The results from this study show clearly that Ghana has no comparative advantage in rice production for all the production systems identified in this study, namely: traditional (less intensive), improved, partially mechanized (semi-intensive), and irrigated, fully mechanized (intensive). However, in relative terms, the traditional system performs better economically (DRC/SER = 2.86) as compared to both the improved (DRC/SER = -1.42)) and the irrigated (DRC/SER = -1.04) systems. By considering also the EPC values which are positive only for the traditional system (EPC = -2.58), and negative for the improved (EPC = -1.81) and irrigated (EPC = -2.29) systems, we can conclude that these two systems (improved and irrigated) cause absolute loss of foreign exchange to the economy. Thus, if one looks at the Net Economic Profit (NEP) which is negative for all these systems but least for the traditional system (NEP = -¢26,032), and with a conservative estimate that each of the three systems resulted in a loss of ¢26,032 to the economy, we can conclude that for the 1985/86 crop season alone, the total loss to the economy through rice production (area harvested conservatively put at 60,000 ha) amounted to at least ¢1,562 million (or US$17 million). This is a fantastically huge loss to a developing economy like that of Ghana saddled with deficit financing, balance of payment problems and foreign exchange constraints.

Ironically, the NPR and IT estimates show that government pricing policies greatly favor the rice industry. For example, NPR ranged between 200 percent and 1700 percent from 1970 to 1986, while IT was -33 percent for both the improved and irrigated systems; implying that government input-output pricing policies have been biased towards the rice industry. This clearly reveals the rice industry in Ghana as an example of a grossly inefficient industry highly protected by government policies. Thus, over the years, the government has taxed rice consumers to finance an inefficient rice industry through its output pricing policy; and also caused a misallocation of resource use by diverting domestic primary resources from more efficient economic activities to rice production through its input pricing policy (input subsidy).

An analysis of government rice policy by means of a benchmark evaluation reveals that government policies, especially in the area of investment, have not been successful in achieving their objectives and goals. Policy effectiveness in achieving one or more government objectives at minimum cost in the face of resource constraints is a mark of success. For example, the ability of policy to make a positive contribution to the objective of increasing national income, equitable distribution of income, and improving the security of food supplies could easily be measured by changes in the appropriate indicators. Since this study has shown no significant positive contribution of policy to any of the above, including rice self-sufficiency,

(except that area cropped to rice has greatly increased), we could conclude that the rice policies followed by successive governments in Ghana have generally been ineffective. The rice industry of other West African countries like the Ivory Coast which followed similar policies like those of Ghana but paid more attention to the small-scale farmer have performed better.

In terms of input and output pricing, the present system whereby all subsidies on machinery and other farm inputs, except fertilizers, are removed should continue. However, greater improvements are needed in the input delivery system, and priority should be given to the small-scale farmer in fertilizer and improved seed distribution for yield increases on these farms. Floor price for paddy (support price) should be scrapped for the present since it has been ineffective, and only prevent the competitiveness of government rice mills and the Food Distribution Corporation (FDC) which are required to purchase paddy at the government floor price. In the same way, the ceiling price for rice should be abolished since the government lacks the necessary facilities and finance to implement an effective price stabilization program for rice at the moment, resulting in the present system benefitting only a "priviledged few". Rice price that is market-determined will help promote efficiency in rice production in Ghana.

The major conclusions and recommendations of this study can therefore, be summed up as follows:

(a) Ghana has no comparative advantage in rice production, especially production systems that depend more on traded inputs;

(b) highly mechanized and irrigated rice production is very costly to Ghana's economy, and results in absolute loss of foreign exchange;

(c) government rice policy must be redirected from area expansion by means of irrigation and mechanization to concentrate on yield increasing innovations for the small-scale farmer;

(d) floor price for paddy (support price) and ceiling price for rice should be scrapped for the present since they have been ineffective, and the government lacks the necessary facilities and finance to implement an effective price stabilization program for rice; and

(e) serious consideration of possible crop diversification that will direct domestic factors of production into economic activities that are more efficient in saving or generating foreign exchange must be given by the government.

Meanwhile, a gradual development of the domestic rice industry should be preferred as rice imports continue to supplement the domestic effort.

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APPENDICES

APPENDIX A.

A.1. FARM PRODUCTION COSTS

In discussing the economics of production, it is important to note that over the years different rice production systems have evolved in Ghana. Notable among them are traditional systems which use no mechanization and "modern" systems that use varying levels of mechanization and other inputs. These range from small hand or animal power operator machines to large machinery and equipments including combine harvesters. Small-scale farms average between 0.9 and 1.2 ha, and most large-scale farms average about 50 hectares with a few farms between 200 and 400 hectares. In between the extremes of no mechanization to full mechanization are farmers who contract their lands for clearing, ploughing and harrowing, or for ploughing and harrowing only; those who contract all farm operations including combine harvesting; and those who have their own equipments for all farm operations including combine harvesters (some, however, may contract only combine harvesting). Some farmers also use their own improved seeds, or buy from neighbors, while others obtain improved seeds from the Seed Multiplication Unit (of the Ministry of Agriculture) or other agencies. Also, there are farmers who do not use any fertilizers, and those who use only a minimal amount of fertilizers (i.e. not the recommended rate of application).

For this analysis, rice production systems in Ghana have been broadly categorized into three:

1. Traditional (less intensive);
2. Improved, partially mechanized (semi-intensive); and
3. Irrigated, fully mechanized (intensive).

These production systems represent a broad spectrum of all rice production activities in Ghana, and account for a greater bulk of all paddy produced. Even more important, both the improved and fully mechanized systems represent major alternatives to the traditional system.

Traditional (less intensive). This system embraces all rice production practices both in the forest and savannah zones which use neither mechanization nor modern inputs such as high yielding varieties and fertilizers. All farm operations are done manually, most of it by family labor (except in the northern and upper regions where a few farmers may use ox-drawn implements); and major tools are the cutlass and hoe. Rainfall is the main source of water, and flooded valley bottoms allow swamp rice to be cultivated (especially in the Western Region).

Under this system, rice may be cultivated as a sole crop or in a mixed cropping system. Yield is usually low, averaging only about 0.7 mt/ha.

Improved, partially mechanized (semi-intensive). This refers to the system of rice cultivation which is partially mechanized, and modern inputs are used. Land clearing and land preparation are mechanized; but sowing, weeding, fertilizer application, and harvesting are done by hand. Both family and hired labor are used extensively especially during harvesting.

This cultivation system is predominant in the transitional and savannah zones, and rainfall (which is the main source of water) is supplemented with pump irrigation from nearby rivers. Yields average about 1.6 mt/ha, but sometimes 2.5 mt/ha to 3.0 mt/ha are realized in some isolated cases.

Most farmers in this category rely on the Mechanical Services Unit of the Ministry of Agriculture for their farm operations, and a few farmers have their own tractors which they rent to other farmers. Also, farmers benefit from government extension services programs.

Irrigated, fully mechanized (intensive). This is the system under which all farm operations are mechanized except sowing and fertilizer application. Both herbicide application and hand weeding are practiced. The irrigated[24] area is still small,

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[24]The total irrigated area was only about 4,600 ha in 1985. This was estimated to be 0.2 percent of the estimated non-cocoa acreage in Ghana.

estimated to be about 3,900 ha in 1985. This is about 85 percent of the total irrigated area in Ghana (400 ha for maize and 300 ha for vegetables constitute the other 15 percent). Irrigated farms are found in the northern Savannah and coastal plains where government projects have focused on dam construction and land development.

Most dams in Ghana are under the control of the Irrigation Development Authority (IDA), and water supplied to irrigated fields are charged on a per hectare basis. Rice farms under this system usually have two crops per year (or five crops in two years in some cases), and yields are relatively high, averaging 3.5 mt/ha per season.

Modern inputs are intensively used, and the government provides some assistance through the Extension Services Unit of the Ministry of Agriculture. This system is highly capital intensive and, therefore, labor-saving. Hired labor is also mostly used.

Appendix Tables 1 to 4 give a summary of the technical and economic coefficients, as well as the private and economic/social costs of these rice production systems.

Appendix Table 1. Technical coefficient[a] for the rice production systems, Ghana.

INPUTS	TRADITIONAL (Less Intensive)		IMPROVED, PARTIALLY MECHANIZED (Semi-intensive,		IRRIGATED, FULLY MECHANIZED (Intensive)	
	Unskilled	Skilled	Unskilled	Skilled	Unskilled	Skilled
Labor (total mandays)	113	-	268	8	150	9
Land Preparation	25	-	10	4	-	2
Seeding	6	-	2	-	2	-
Weeding	30	-	35	-	20	-
Fertilizer aplication	-	-	-	2	-	2
Other chemicals	-	-	-	2	-	3
Irrigation	-	-	16	-	5	-
Pest control (Bird scarring)	25	-	120	-	120	-
Harvesting[b]	15	-	50	-	-	2
Threshing	10	-	30	-	-	-
Transport	2	-	5	-	3	-

Appendix Table 1. continued.

INPUTS	TRADITIONAL (Less Intensive)	IMPROVED, PARTIALLY MECHANIZED (Semi-intensive)	IRRIGATED, FULLY MECHANIZED (Intensive)
Seed	Local Variety (70 kg/ha)	High Yielding Variety (80 kg/ha)	High Yielding Variety (80 kg/ha)
Fertilizer			
NPK (15-15-15)	Nil	400 kg/ha	400 kg/ha
Sulphate of Ammonia	Nil	150 kg/ha	150 kg/ha
Agro-chemicals			
Herbicide (Stan F34T)	Nil	Nil	8 lit/ha
Insecticide (Furadan)	Nil	5 kg/ha	5 kg/ha
Land Development	Manual	Tractor Caterpillar	Tractor
Harvesting	Manual	Manual (usually by contract)	Combine Harvester

Appendix Table 1. continued.

INPUTS	TRADITIONAL (Less Intensive)	IMPROVED, PARTIALLY MECHANIZED (Semi-intensive)	IRRIGATED, FULLY MECHANIZED (Intensive)
Extension service	Nil	Yes	Yes
Source of Capital	Equity Tradi- tional lenders	Equity Banks	Banks
Source of Water	Rainfed	Rainfed Pump irrigation	Dam irrigation
Yield (paddy)	0.7 mt/ha	1.6 mt/ha	3.5 mt/ha

[a]These figures are averages from data obtained from the Ministry of Agriculture, Irrigation Development Authority (IDA), and Crop Services Department.

[b]Only skilled labor was entered for harvesting irrigated farms because it was assumed that harvesting on these farms are by combine harvesters.

Appendix Table 2. Cost of production, traditional (less intensive), Ghana, 1985/86. (cedis/ha).

INPUTS	FINANCIAL COST	ECONOMIC COST		
		Tradables (Foreign)	Non-tradables (Domestic)	Total
1. Seed	3,500.00	-	3,500.00	3,500.00
2. Fertilizer				
NPK 15-15-15	-	-	-	-
Sulphate of Ammonia	-	-	-	-
3. Other Agro-Chemicals	-	-	-	-
4. Simple Farm Tools	450.00	153.00	297.00	450.00
Total Material Input	3,950.00	153.00	3,797.00	3,950.00
5. Irrigation Services	-	-	-	-
6. Pumping Cost	-	-	-	-
7. Capital services	455.00	-	490.00	490.00
8. Hired labor cost	7,600.00	-	5,700.00	5,700.00

Appendix Table 2. continued.

INPUTS	FINANCIAL COST	ECONOMIC COST		
		Tradables	Non-tradables (Foreign)	Total (Domestic)
9. Family Labor cost	11,250.00	-	11,250.00	11,250.00
10. Skilled Labor Cost	-	-	-	-
11. Land Rent	-	-	-	-
12. Interest Charges	3,308.95	19.13	2,654.63	2,673.76
13. Other costs	2,652.30	-	2,383.04	2,383.04
Total Production Cost	29,216.25	172.13	26,274.67	26,446.80

Appendix Table 3. Cost of production: improved, partially mechanized (semi-intensive), Ghana, 1985/86.

INPUTS	PRIVATE COST cedis/mt	ECONOMIC COSTS (cedis/mt)		
		Tradables (Foreign)	Non-tradables (Domestic)	Total
1. Seed	4,000.00	-	4,000.00	4,000.00
2. Fertilizer				
NPK 15-15-15	6,200.00	11,912.40	2,268.00	14,180.40
Sulphate of Ammonia	1,512.00	2,324.70	850.50	3,175.20
3. Other Agro-Chemicals	7,490.40	9,301.50	2,605.50	11,907.00
4. Simple Farm Tools	450.00	153.00	297.00	450.00
Total Material Input	19,652.40	23,691.60	10,021.00	33,712.60
5. Irrigation Services	-	-	-	-
6. Pumping Cost	9,225.00	10,378.00	3,459.50	13,837.50
7. Capital services	5,100.20	7,929.00	2,379.20	10,308.20
8. Hired labor cost	40,000.00	-	30,000.00	30,000.00
9. Family Labor Cost	10,200.00	-	10,200.00	10,200.00
10. Skilled Labor Cost	2,400.00	-	2,400.00	2,400.00

Appendix Table 3. continued.

INPUTS	PRIVATE COST	ECONOMIC COST		
		Tradables	Non-tradables (Foreign)	Total (Domestic)
11. Land Rent	1,000.00	-	-	-
12. Interest Charges	10,947.20	5,249.85	7,307.45	12,557.30
13. Other costs	9,852.50	4,724.85	6,576.70	11,301.55
Total Production Cost	108,377.30	51,973.30	72,343.85	124,317.15

Appendix Table 4. Cost of production: irrigated, fully mechanized (intensive), Ghana, 1985/86.

INPUTS	FINANCIAL COST (cedis/ha)	ECONOMIC COST (cedis/ha)		
		Tradables (Foreign)	Non-tradables (Domestic)	Total
1. Seed	4,000.00	-	4,000.00	4,000.00
2. Fertilizer				
NPK 15-15-15	6,200.00	11,912.40	2,268.00	14,180.40
Sulphate of Ammonia	1,512.00	2,324.70	850.50	3,175.20
3. Other Agro-Chemicals	7,490.40	9,301.50	2,605.50	11,907.00
4. Simple Farm Tools	450.00	153.00	297.00	450.00
Total Material Cost	19,652.40	23,691.60	10,020.00	33,712.60
5. Irrigation Services	7,500.00	28,350.00	12,150.00	40,500.00
6. Pumping Cost	-	-	-	-
7. Capital services	12,248.70	18,349.25	5,446.30	23,795.55
8. Hired labor cost	28,000.00	-	21,000.00	21,000.00

Appendix Table 4. continued.

INPUTS	FINANCIAL COST (cedis/ha)	ECONOMIC COST (cedis/ha)		
		Tradables	Non-tradables (Foreign)	Total (Domestic)
9. Family Labor Cost	1,500.00	-	1,500.00	1,500.00
10. Skilled Labor Cost	2,700.00	-	2,700.00	2,700.00
11. Land Rent	-	-	-	-
12. Interest Charges	8,946.75	8,798.85	6,602.40	15,401.25
13. Other costs	8,052.85	7,919.00	5,942.15	13,861.15
Total Production Cost	88,573.70	87,107.90	65,362.85	152,470.55

NOTES ON COST OF PRODUCTION

1. Seed is considered a non-traded input, and purchased by the farmer at ¢50.00 per kg.

4. Simple farm tools include cutlasses and hoes which cost ¢250.00 and ¢200.00 each, respectively, and amortized over one year.

5. Irrigation service refers to the irrigation provided from dams constructed through government projects and operated by the Irrigation Development Authority (IDA). The IDA charges farmers on a per hectare basis. The World Bank has estimated the development costs per ha of large-scale dam schemes to be no lower than US $15,000.00, and an annual operation and maintenance cost of US $300.00/ha. These figures have been used for the economic cost of irrigation service.

6. Pumping cost includes cost and maintenance of pumping machine and irrigation equipments, as well as fuel and oil used.

7. Capital services include depreciation cost and maintenance of capital items: buildings, spraying machines, tractor, plough, harrow, and trailer (plus combine harvester in the case of irrigated, fully mechanized systems). The average prices of the following machinery and equipments for 1986-87 have been used:

(a) Purchase price of MF-375 2WD Tractor: ¢3,536,827.00

(b) Purchase price of MF-765 3-Furrow Disc Plow: ¢425,941.00

(c) Purchase price of MF-280 Tanden Disc Harrow: ¢517,927.00

(d) Purchase price of Combine Harvester (with complete head): ¢6,921,256.25

(e) Purchase price of knapsack sprayer: ¢6,000.00

(Source: Ministry of Agriculture and IDA).

8. Hired labor was valued at the prevailing market wage rate of ¢200.00/man-day (market wage rate of ¢150.00 plus food cost) and the shadow wage rate (economic cost) at ¢150.00/manday. Women and children labor (also family labor) have been converted to mandays at the ratio of 1:0.75 for women and 1:0.5 for children.

11. Land rent is zero for the traditional (less intensive) system because in the south family land is usually used for which no rent is paid; and in the north no rent is charged for land. For the irrigated system, no rent is also charged for land (it might have been included in the irrigation service charges); and land developed for irrigation agricuture at irrigation project sites is obtained (at no cost) by applying to the local IDA authorities. In the case of the improved system, there is still no official rent for

land, and its economic cost (or shadow price) is zero. However, most lands obtained outside family domains are done by paying some "kola" (a minimal fee) to the local chief (as long as no perennial crops like cocoa and coffee are cultivated), and this is assumed to be about ¢1,000.00 per ha.

13. Other costs include contingency costs and some overhead charges. It is assumed to be 10 percent of the total computed cost. It may also include expenses made on extension services (where applicable) for which no direct estimate has been made.

A.2. RICE MILLING COSTS

The conversion of paddy into rice in Ghana is accomplished through three milling processes, namely: handpounding, small scale motorized rubber roller hulling, and industrial milling. Parboiling is practiced both at the traditional handpounding level (especially in the northern parts of Ghana) and at some of the industrial mills. Parastatal organizations such as the Rice Mill Unit (RMU) of the Ministry of Agriculture, private organizations, and individuals are involved in rice milling. Appendix Table 5 gives a summary of rice milling operations in Ghana by the 1979/80 crop season.

For this analysis, it was assumed that the traditional (less intensive) system of rice production also used the handpounding method for rice milling. In the same way, the improved, partially mechanized (semi-intensive) and the irrigated, fully-mechanized (intensive) systems used the small-scale rubber roller and the large-scale (industrial) mills, respectively. This assumption, even though valid theoretically and for computational purposes, is not always true in practice. Most of the handpounding is done only among subsistence rural farmers because of the high labor requirement and the excessive strains involved. Rice found on the local markets are usually milled by the small-

Appendix Table 5. Rice milling in Ghana, 1979/80.

LOCATION	ANNUAL CAPACITY (mt/paddy)	MACHINE CAPACITY (tons/hr)	1979/80 OUTPUT	MILLING RATE	QUALITY (% broken)	OWNERSHIP
Industrial Mills						
Tamale Rice Mills	24,000	6.0	1,500-3,000	0.65	24-40	RMU
Mencillo	8,000	2.0	3,000	na	na	Private
Nasia	16,000	4.0	6,500	0.65	35-50	Private
Norgrains	4,000	1.0	1,500	na	na	Private
Bolgatanga	8,000	2.0	350	0.61	35-50	RMU
Yendi	8,000	2.0	200	0.61	35-50	RMU
Bawku	-	1.0	-	-	-	RMU
Wa	-	1.0	-	-	-	RMU
Oti	8,000	2.0	2,500	0.63	25-40	Private

Appendix Table 5. continued.

LOCATION	ANNUAL CAPACITY (mt/paddy)	MACHINE CAPACITY (tons/hr)	1979/80 OUTPUT	MILLING RATE	QUALITY (% broken)	OWNERSHIP
Kwame Danso	4,000	1.0	200	0.61	35-50	RMU
Asutsuare	8.000	2.0	500	0.67	35	RMU
Kpong	-	1.0	-	-	-	Private
Afife	8,000	2.0	na	0.65	40	Private
Dawhenya	8,000	2.0	na	0.65	40	RMU
Small Hullers						
100-150	35,000-50,000	na	22,000-30,000	0.65	25-40	Private
Handpounding	na	-	10,000-15,000	0.60	40-50	-

[a]The annual capacity figures are only theoretical. Calculations were based on a 250 days in a year operation at two 8-hour shifts a day (i.e. 16 hours). In practice, most of the mills cannot operate two 8-hour shifts because of their old equipments and unreliable electricity supply.

Source: Osafo, Kwaku (1983). "Rice Policy in Ghana" Unpublished Ph.D. dissertation, Stanford University, USA.

scale mills, while those shipped to the urban centers (especially in the South) are milled by the large-scale mills.

The rice milling costs for the three milling methods have been provided in Appendix Tables 6-8.

Appendix Table 6. Rice Milling Costs, (Handpounding), Ghana, 1985/86.

ITEMS	FINANCIAL COSTS (cedis/mt rice)	ECONOMIC COST (cedis/mt rice)		
		Foreign	Domestic	Total
Fixed Costs				
1. Depreciation				
Equipment	204.15	-	204.15	204.15
Building	120.00	-	120.00	120.00
Repair & maintenance	24.00	-	24.00	24.00
Insurance	-	-	-	-
Interest on capital	62.65	-	62.65	62.65
2. Variable cost				
Labor cost	7,500.00	-	7,500.00	7,500.00
Other costs	2,695.00	1,427.80	1,267.20	2,695.00
Total cost	10,605.80	1,427.80	9,178.00	10,605.80
Returns from Rice Bran/Husks	200.00		200.00	200.00
Milling cost	10,405.80	1,427.80	8,978.00	10,405.80
Distribution cost	2,000.00	-	2,000.00	2,000.00

Appendix Table 6. continued.

ITEMS	FINANCIAL COSTS (cedis/mt rice)	ECONOMIC COST (cedis/mt rice)		
		Foreign	Domestic	Total
Total per hectare Milling & Distribution Cost (Cost/ton x Yield)	8,640.00	999.46	7,684.60	8,684.06

NOTES: Equipments consist of motar, pestle, and winnowing trays amortized over two years.

Other costs include cost of sacks and labor cost for transporting the paddy from the field to the building/shed.

Distribution cost involves transporting the rice from the farm shed to the nearest market. Only labor for carrying the rice is assumed here, at ¢100.00 per 50 kg bag of rice.

Appendix Table 7. Rice milling costs (small-scale rubber roller mills), Ghana, 1985/86.

ITEM	FINANCIAL COSTS (cedis/mt rice)	ECONOMIC COST (cedis/mt rice)		
		Foreign	Domestic	Total
Fixed Costs				
1. Depreciation				
Engine and Mill	846.85	1,270.25	-	1,270.25
Building	702.55	210.80	843.00	1,053.80
Repair and maintenance	182.80	148.10	84.30	232.40
Insurance	-	-	-	-
Interest on capital	278.90	370.25	210.75	581.00
2. Variable Cost				
Salaries	744.00	-	744.00	744.00
Fuel	599.30	899.00	-	899.00
Lubricants	72.00	108.00	-	108.00
Storage	195.00	117.00	175.50	292.50
Other costs	720.00	240.00	480.00	720.00
Tax	217.10	-	-	-
Total Cost	4,559.50	3,363.40	2,537.55	5,900.95

Appendix Table 7. continued.

I T E M	FINANCIAL COSTS (cedis/mt rice)	ECONOMIC COST (cedis/mt rice)		
		Foreign	Domestic	Total
Returns from rice bran	450.00	-	450.00	450.00
Milling cost	4,109.50	3,363.40	2,087.55	5,450.95
Distribution Cost	2,000.00	1,000.00	2,000.00	3,000.00
Total per hectare Milling & Distribution Cost (Cost/ton x yield)	6,353.88	4,537.95	4,251.05	8,789.00

Appendix Table 8. Rice milling costs (large-scale government mills), Ghana, 1985/86.

I T E M	FINANCIAL COSTS (cedis/mt rice)	ECONOMIC COST (cedis/mt rice)		
		Foreign	Domestic	Total
Fixed Costs				
1. Depreciation				
Mill and Installation	662.40	993.60	-	993.60
Building	12,37.50	556.90	1,299.35	1,856.25
Electricity	580.50	296.00	574.75	870.75
Repair & Maintenance (includes fuel & lubricants)	327.60	294.85	196.55	491.40
Insurance, Others	376.35	-	564.55	564.55
Interest on capital	748.30	535.30	658.80	1,194.10
2. Variable Cost				
Salaries	4,494.60	-	4,494.60	4,494.60
Transportation	1,950.00	1,170.00	780.00	1,950.00
Sacks	1,200.00	720.00	480.00	1,200.00
Losses	136.00	-	202.50	202.50
Storage	207.00	93.15	217.35	310.50
Total Cost	11,920.25	4,659.80	9,468.45	14,128.25

Appendix Table 8 continued.

I T E M	FINANCIAL COSTS (cedis/mt rice)	ECONOMIC COSTS (cedis/mt rice)		
		Foreign	Domestic	Total
Returns from rice bran	600.00	-	600.00	600.00
Milling cost	11,320.25	4,659.80	8,868.45	13,528.25
Distribution cost	2,500.00	3,000.00	2,000.00	5,000.00
Total per hectare Milling & Distribution Cost (cost/ton x Yield)	32,806.10	17,426.00	24,725.70	42,151.70

NOTES ON RICE MILLING COSTS

Due to lack of a more recent data on rice milling costs, the data used in the computations are based on those for the 1979/80 crop season, adjusted for inflation and the effects of the devaluation of the cedi. The data base for this section is contained in Osafo (1983), "Rice Policy in Ghana", an unpublished Ph.D. dissertation, Stanford University, U.S.A.

It has been assumed that hand pounding requires 38 man-days per one ton milled rice (or 38 laborers to mill one ton of rice in a day) at the market wage rate of ¢200.00 per man-day. Also, handpounding is assumed to yield 2 bags of good rice bran (most of the bran is usually mixed with the husks and, therefore, discarded) sold at ¢100.00 per bag.

Small-scale rubber roller mills have an average output of 150 mt milled rice per year; and a rice bran output of 4.5 bags per ton of rice sold at ¢100.00 per bag (usually to poultry farmers). Peak milling period is usually the first 4 months after harvest when the mill employs three workers, one manager-operator and two assistants. For the next 5 months only one assistant is employed together with the manager-operator (the small mills usually operate a total average of about 9 months a year).

Most of the data used for the large-scale government mills was from the Tamale Rice Mill Unit. The computations were based on an assumed output of 2,000 tons milled rice in the 1985/86 crop year, and rice bran output of 6 bags per ton of milled rice. Tax is not included here since it is only a transfer to the government and not actual cost.

APPENDIX B

COMPUTATIONAL PROCEDURES

1. Value (US$/ha) = Yield x c.i.f. Tema

		Value/ha	Yield/ha
Traditional	: = 0.7 x .65 x 222.2 =	US$ 101.10	0.455 mt
Improved	: = 1.6 x .65 x 222.2 =	US$ 231.10	1.04 mt
Irrigated	: = 3.5 x .65 x 222.2 =	US$ 505.50	2.275 mt

2. Net Foreign Exchange Earnings (Economic Value Added)

	Value ($/ha)	Foreign (Economic) Cost of Production	- Foreign Cost of Marketi	
Traditional:	$ 101.10	- 1.92	- 11.11	= $ 88.08
Improved :	$ 231.10	- 577.48	- 50.42	= - $ 396.80
Irrigated :	$ 505.50	- 967.86	- 193.62	= - $ 655.98

3. Domestic Resource Cost (DRC) $= \dfrac{\text{Domestic Cost of Production + Domestic Cost of Marketing}}{\text{Net Foreign Exchange Earnings}}$

Traditional: $\dfrac{26,274.67 + 7,684.60}{88.07} = \dfrac{33,959.27}{88.07} = 385.60$

$\therefore \dfrac{DRC}{SER} = \dfrac{385.60}{135} = 2.86$

Improved : $\dfrac{72,343.85 + 4,251.05}{- 398.8} = \dfrac{76,594.9}{-398.8} = -192.06$

$\therefore \dfrac{DRC}{SER} = \dfrac{-192.06}{135} = -1.42$

$$\text{Irrigated}: \frac{65,362.85 + 24,725.7}{-655.98} \quad \frac{90,088.55}{-655.98} = -137.33$$

$$\therefore \frac{DRC}{SER} = \frac{-137.33}{135} = -1.02$$

4. Break-even c.i.f. price ($/mt):

$$= \frac{\left(\begin{matrix}\text{Domestic \& Foreign Cost of Production} + \\ \text{Domestic \& Foreign Cost of Marketing}\end{matrix}\right) \div \text{Yield}}{\text{Shadow Exchange Rate (SER)}}$$

$$\text{Traditional}: \frac{(26,446.80 + 8,684.06) \div 0.455}{135} = \frac{77,210.68}{135} = \$571.93$$

$$\text{Improved}: \frac{(124,317.15 + 8,789.00) \div 1.04}{135} = \frac{127,986.68}{135} = \$948.05$$

$$\text{Irrigated}: \frac{(152,470.55 + 42,151.70) \div 2.275}{135} = \frac{85,548.24}{135} = \$633.70$$

5. Net Economic Profit (Net Social Profitability-NSP)

	Gross Economic Returns		Total Economic Cost
Traditional :	222.2 x 90 = 19,998.00 x 0.455		- (26,446.80 + 8,684.06)
	= 9,099.09		- 35,130.86
	= -¢ 26,031.77		
Improved :	222.2 x 90 = 19,998.00 x 1.04		- (124,317.15 + 8,789.00)
	= 20,797.92		- 133,106.15
	= - ¢ 112,308.23		
Irrigated :	222.2 x 90 = 19,998.00 x 2.275		- (152,470.55 + 42,151.70)
	= 45,495.45		- 194,622.25
	= - ¢149,126.80		

6. Net Financial Profit

Domestic Price (Farmgate/Wholesale) x Yield (Paddy/Rice) - Total Production Cost (Financial)

(a) Farmgate

Traditional : ¢ 22,620 x 0.7 - 29,216.25 = - ¢ 13,382.25

Improved : ¢ 22,620 x 1.6 - 108,377.30 = - ¢ 72,185.30

Irrigated : ¢ 22,620 x 3.5 - 88,573.70 = - ¢ 9,403.70

(b) Wholesale (government price)

Traditional : ¢ 64,000 x 0.455 - (29,216.25 + 8,640) = - ¢8,736.00

Improved : ¢ 64,000 x 1.04 - (108,377.30 + 6,353.88) = - ¢48,171.18

Irrigated : ¢ 64,000 x 2.275 - (88,573.70 + 32,806.10) = ¢24,220.2

(c) Wholesale (open market price)

Traditional : ¢96,000 x 0.455 - (29,216.25 + 8,640.00) = ¢ 5,823.75

Improved : ¢96,000 x 1.6 - (108,377.30 + 6,353.88)= ¢12,416.60

Irrigated : ¢96,000 x 2.275 - (88,573.70 + 32,806.10)= ¢97,020.20

7. Economic Incentives

(a) Nominal Protection Rate (NPR) on output

$$= \frac{\text{Wholesale Price}}{\text{Border Price}} - 1 \times 100$$

$$= \frac{64,000}{19,998} - 1 \times 100 = 220\%$$

(b) Implicit Tariff (I.T.) rate on inputs

$$= \frac{\text{Financial Value of Traded Inputs}}{\text{Economic Value of Traded Inputs}} - 1 \times 100$$

(c) Effective Protection Coefficient

$$= \frac{\text{Financial Value Added}}{\text{Economic Value Added}} - 1$$

(NB: Marketing = Milling and Distribution Cost)

APPENDIX C

Ghana: Exchange Rate Movements

The exchange rate establishes the value/price of a country's currency relative to the currency of another country (or countries). Unlike industrialized countries where the price of foreign exchange is determined in international currency markets by the forces of supply and demand for a country's currency, many developing countries like Ghana (even though have similar fundamental economic forces) have their exchange rates typically set by governments (Timmer et al,. 1983). Thus Ghana's exchange rate for the Cedi reflects the rate at which Ghana must give up cedis to obtain a unit of foreign currency (say US dollar) to import goods and services; and it simultaneously determines the value in Cedis of goods and services that are exported.

Ghana's exchange rate for the cedi has been overvalued particularly in the 1970s and early 1980s. It implied that exportable agricultural commodities such as cocoa (Ghana's major export crop) and importable food crops like rice were undervalued. Thus, farmers received less for their crops than they would if the price of foreign exchange were market-determined. This means that an overvalued exchange rate acts as an implicit tax on agriculture; and at the same time guarantees protection for import-substitutes whose prices are set above the "artificially" low c.i.f. prices of comparable imports.

The exchange rate of the Cedi has been rather erratic since 1983 when the PNDC government set out in its Economic Recovery Program to correct the cedi overvaluation in order to permit the economy to regain its international competitiveness. Presented below are the exchange rate movements of the Cedi since independence in 1957.

Note:

(a) The old cedi was introduced as a new monetary unit on July 19, 1965 and replaced the Ghana Pound at a rate of 2.40 cedis per pound.

(b) On February 23, 1967, the new cedi equivalent to 1.2 old cedis was introduced.

YEAR	EXCHANGE RATE IN CEDI PER US $1.00
1957-66	0.71
1967-70	1.02
1971	1.82
1972	1.28
1973-77	1.15
1978-82	2.75
1983	30.00
1984	50.00
1985	59.88
1986	90.00
1987 (May)	149.25

Source: International Financial Statistics, Vol. XXXVI 1983 and Vol. XL No. 7, July 1987.