RICE INDUSTRY IN KWARA STATE OF NIGERIA: AN ECONOMIC ANALYSIS

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To the Giver of all wisdom and
knowledge

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ABSTRACT

The objective of the study is, broadly, to examine the structure and performance of rice production and processing enterprise in Kwara state with a view to identifying possible ways of transforming the industry. The study also aims at identifying and evaluating some of the factors determining the level of marketed surplus and consumption of rice. The analytical tools employed are mostly a combination of farm record analysis and statistical regression/production function techniques. Most of the survey data were collected during the 1977/78 crop season from 230 farming units, 20 rice mills, 50 rice parboilers and 183 rice consumers in Kwara state.

Chapter I deals with the general introduction, problem situation, objectives and methodology, followed by literature review in Chapter II. Chapter III is devoted to an analysis of resource situation in rice production while Chapter IV deals with resource productivity and resource-use efficiency in rice farming. The structure and economic performance of rice processing industry is analysed in Chapter V; the Chapter

also examines the least-cost milling facilities in Kwara state. Chapter VI is devoted to the analysis of the marketed surplus and home consumption of rice while in Chapter VII, the functional relationship between the quantity of rice consumed and selected variabl s are examined and some consumption elasticities are computed. The findings are summarised in Chapter VIII.

The analysis of resource situation showed,amcng other things, that capital is the most limiting factor in Kwara state peasant rice production. It was shown further that while non-institutional sources of credit play a dominant role in peasant rice production, the role of institutional sources is almost nil. The costs and returns analysis showed that, within the limits imposed by the quality of data, an average rice farmer was making a quite satisfactory performance. With an average paddy rice yield of 1,506.9 kg. per hectare, and an estimated cost of ₦205.8 per hectare, the net revenue accrueing to an average farmer was estimated at ₦251.6 per hectare.

In all the areas under study, the land variable alone accounted for over 70% of the variability in the aggregate production of rice, showing clearly that land is the most crucial determinant of rice production in Kwara state. On the whole, only few significant inefficiencies in resource use were observed, implying that a mere re-allocation of resources may not have any appreciable effect on aggregate rice output. The study also revealed constant returns to scale on both large and small rice farms, and rejected the hypothesis of inverse relationship between output and farm size in paddy rice farming.

The analysis of rice processing operation revealed that rice processing units were making satisfactory performance in spite of the rather high processing costs, the estimated net returns being ₦7,96 and ₦51.5 per ton for parboiling and milling units respectively. It was further shown that small rice mills are the least-cost milling facilities in Kwara State.

The emphasis on the marketed surplus study was both on the conceptual framework of the models and of the numerical results. The study showed that the allocation of rice output between market sales and home consumptions were both sensitive to price changes. Total price elasticity of marketed surplus ranged from 0.90 to 1.91 while that of home consumption elasticity fell in the range of -0.27 to -1.6. Output elasticity of marketed surplus ranged from 0.64 to 2.5. It was further shown that volume of production was more significant than family size and producer price in their influence on the marketed surplus of rice.

With regards to rice consumption by non-rice producing households, the result showed that while family size and income are positively and significantly correlated with the consumption of rice, education appears to be an insignificant variable. Household size elasticities ranged from 0.46 - 0.58 while income elasticities of rice consumption fell in the range of 0.01 to 0.38. The result also points to the conclusion that, at present, consumers' preference for imported rice is rather strong, owing largely to the relatively high cooking quality of this commodity vis-a-vis that of the locally produced rice.

Suggested policy measures include the development of irrigation facilities in the state, the expansion of farmers' credit base, selective mechanisation of rice farming operations, the use of modern rice mills in rice processing, a vigorous use of price instrument for the purpose of increasing the marketed surplus of rice in Kwara state and the removal of marketing bottlenecks, not only to facilitate efficient distribution of rice, but also to ensure that farmers are aware of the existing market conditions.

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CERTIFICATION

I certify that this work was carried out by Mr. J.P. Adeniyi in the Department of Agricultural Economics, University of Ibadan.

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CHAPTER I

GENERAL INTRODUCTION

1. Rice in Nigeria's Economy

(a) Production

Rice is regarded as the world's most important food crop, being the staple food of a large proportion of the world population, particularly of India, China and many other countries in Asia. It also ranks high among the staple foods in Nigeria.

Nigeria is one of the major rice producing countries in West Africa, ranking side by side with Sierra Leone and the Ivory Coast. The cultivation of the crop in the country goes back to early 16th century[53] with the introduction of *Oryza glaberrima*, a West African indigenous species of rice. The white grain species (*Oryza sativa*) was introduced into the country only about 100 years ago. Since then, production has gained momentum, especially in recent years under the national objective of attaining self-sufficiency in rice and some other food crops.

The major rice producing states in the country include Kwara, Sokoto, Niger, Benue, Ogun, Bendel, and parts of Imo and Anambra. Out of an estimated potential rice area of 0.61 million hectares, approximately 340,000 hectares was used for rice production in 1971 and about 580,000 metric tons of paddy rice was produced (Table 1.1).

Table 1.1

PRODUCTION OF PADDY RICE IN NIGERIA,1971 - 1974

Year	Production ('000 metric tons)	Hectares ('000)	Yield per hectare(Kg.)
1971	580	340	1,706
1972	500	304	1,706
1973	550	370	1,486
1974*	525	269	1,942

Source: Food and Agriculture Organisation, Annual Year Book, 1973, Vol.27, Page 46.

* 1974 figures are derived from National Agricultural Sample Census of Nigeria, 1974 - 1975, Federal Office of Statistics, Agriculture Census Division, Lagos, May, 1976.

This production fell to 525,000 metric tons in 1974 partly due to the small hectarage cultivated in that year. Table 1.1. shows that yield per hectare ranged between 1,486 kg. and 1,942 kg. over the four-year period. These national averages are low compared with what obtains in some other rice producing countries as shown in Table 1.2. For example, average yields obtained in Egypt and Japan more than doubled the oorresponding figure for Nigeria, while the estimate for China is almost equivalent to twice the maximum yield for the country.

Various factors have been suggested as being responsible fcr the relatively low yield. William and Alao[180] suggested poor cultural practices and inefficient farm management;

Table 1.2

PADDY RICE PRODUCTION IN SELECTED COUNTRIES, 1973

Country	Production ('000 metric tons)	Harvested Area ('000 hectares)	Yield per hectare (Kg.)
China	111,520	34,755	3,209
India	67,600	37,000	1,827
Indonesia	20,321	8,568	2,372
Japan	15,766	2,620	6,018
Thailand	14,650	7,392	1,982
Philippines	5,532	3,589	1,542
Egypt	2,274	450	5,053
Madagascar	1,750	920	1,902
Nigeria	550	370	1,486
Sierra Leone	479	351	1,365
Ivory Coast	400	290	1,379
Liberia	155	125	1,240
Africa	6,945	3,903	1,780
World	320,714	134,163	2,390

Source: Food and Agriculture Organisation, United Nations, Year Book, 1973, Volume 27, Page 46.

Perez[147] attributed the low yield to the problem connected with the available rice varieties, while the National Accelerated Food Production Programme (NAPP) report of 1975[45] indicated that rice diseases, among other things, account for the relatively poor average yield for the country. Other factors commonly suggested include inadequate fertilizer application and poor water control.

(b) Rice Varieties and Research

The rice varieties being distributed among farmers can be grouped under four broad categories: the swamp rice which grows mostly in naturally inundated land as well as in the fresh-water mangrove swamps; upland rice which grows in upland areas where rainfall is sufficient for the purpose, and the floating rice grown in the naturally flooded lands.

The most commonly grown varieties in the country include BG 79, MAS-2401 (swamp rice), Maliong (floating rice), OS 6 and Agbede (upland rice). Meanwhile, the extension service units of the Ministry of Agriculture and Natural Resources are promoting the use of more productive varieties such as IR 8 and SML - 140/10, both of which require a relatively shorter growing season.

More high-yielding varieties are being developed by the International Institute of Tropical Agriculture (IITA), Ibadan, whose research programme also includes field trials under varying local condition throughout the country, and working in collaboration with the International Rice Research Institute (IRRI) in the Philippines. The West Africa Rice Development Association (WARDA) with headquarters in Moronvia, Liberia, collects all available information on rice development throughout the West Africa sub-region and disseminates this information to interested parties; its research programme uses basic information and plant material from the IITA. The Federal Department of Agricultural Research at Moor plantation, Ibadan, and the Federal Rice Research Station, Badeggi are the major centres for national rice research programme in the country. These centres are concerned, among other things, with the selection of new varieties and fertilizer trials, with the Badeggi Research Station concentrating on applied research (including parboiling and milling studies), in collaboration with all the rice producing states in the federation.

(c) Rice processing and Marketing

While not a major constraint, rice processing and marketing are ill-developed and relatively inefficient in Nigeria. The crop is marketed primarily on small-scale basis by paddy producers who either sell directly to the consumer or (more often) to the middlemen. The paddy rice is milled usually at the local small-scale (mechanical) rice mills many of which are scattered all over rice producing areas in the country.

Although the margins between the farm gate, mill and final sales vary considerably, it is possible to make a rough estimate of the breakdown. Using retail market prices as the base (100), the percentage received at each marketing stage in Kwara State has been estimated (93) as shown in Table 1.3. Assuming negligible inter-state variation in rice marketing situation, these estimates may be taken to represent th

Table 1.3

ESTIMATED MARGINS AT DIFFERENT RICE MARKETING STAGES IN KWARA STATE (RETAIL PRICE OF RICE MILLED AT LOCAL RICE MILLS = 100)

Marketing Stages	Margins (%)
Farm gate (paddy rice)	26
Mill gate (paddy rice)	27
Ex-mill (milled rice)	64
Wholesale (milled rice)	67
Retail (rice loose/high broken)	100
Retail (rice packaged/low broken)	132

Source: Kwara State Ministry of Economic Development, Rice Growing and Milling Project - A feasibility Study. Interim Report, June, 1975, Page 32.

Table 1.4

RETAIL PRICES OF RICE (₦ PER LONG TON)

Year	Lagos		Ibadan		Benin		Kaduna		Ilorin	
	Price	Percentage change	Price	Percentage change	Price	Percentage change	Price	Percentage change	Price	Percentage change
1965	185	-	187	-	147	-	138	-	113	-
1966	224	+21.1	211	+12.8	274	+86.4	174	+26.1	135	+19.5
1967	217	- 3.1	219	- 3.6	265	- 3.2	157	-10.0	112	-17.0
1968	207	- 4.6	205	- 6.4	162	-38.9	140	-10.8	120	+ 7.1
1969	235	+13.5	223	+ 8.8	187	+15.4	187	+13.6	166	+38.3
1970	266*	+13.2	246	+10.3	231	+23.5	202	+ 8.0	224	+34.9
1971	373*	+ 2.6	351	+42.7	295	+27.7	n.a	-	206	- 8.0
Average/Year	244	+ 7.1	235	+11.9	223	+18.5	166	+ 9.4	154	+12.5

*Wholesale prices.

Source: Adapted from Federal Office of Statistics, Abstract of Statistics (various issues).

overall picture for the country. The table shows that 26% of the consumers' total outlay is received by paddy producers while the rest is absorbed by processors and middlemen.

Retail prices of rice have been on the increase all over the country in recent years. For instance between 1965 and 1971, average increases in prices ranged from about 7% per annum in Lagos to 19% in Benin as shown in Table 1.4. The average retail prices between the period ranged from ₦154 to ₦244 per long ton in Ilorin and Lagos respectively, the overall unweighted average being ₦205. These prices compare poorly with the average unit value of imported rice which ranged from ₦87.636 to ₦118.47 per long ton between 1962 and 1968 respectively, and falling to ₦94.670 per long ton in 1969 - a price drop which gathered momentum from the beginning of 1970 to 1973.

(d) <u>Rice Consumption</u>

Rice and its by-products can be put into various uses. For instance it is estimated that rice bran contains about 14 - 17% oil which is useful in the cosmetics and pharmaceutical industries[51]. The bran and other by-products can also be used in the manufacture of wine, sugar, alcohols, starch, glass, detergent, herbicide and fertilizer. It was estimated, for example, that as early as 1930, 5.2% of Japanese rice output was used in making wines, 4.9% in making cakes and 1.1% in the manufacture of sugar. And in the early 1960's, breweries in the United States were reportedly using about 25% of all rice consumed in that country[51].

There is as yet little or no industrial use for rice products in Nigeria, and only a negligible quantity is being used as livestock feed*. Rather, virtually all the rice produced in thecountry is used for human consumption.

Rice is a superior food which is being increasingly substituted for such staple food stuffs as yam and cassava in the diets of urban consumers in Nigeria. Consumption is growing more rapidly in urban than in rural areas, and more rapidly among high income group than low income group. A survey in Ibadan, for example, showed that an average family in the high income group spent about 33% of its staple food budget on rice compared with the expenditure of only 10% by an average family in the lower income group** One factor that accounts for this increase in consumption is

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* It is possible that with the recent trends in industrial expansion and the development of the livestock industry, these uses may become significant. The point must be made, however, that nutritional considerations favour the non-removal of rice bran, thus ruling out the use of bran for industrial purpose.

** Source: Ministry of Agriculture and Natural Resources, Ibadan.

prestige. For reasons that are little understood, rice is considered a "high prestige" food in Nigeria. In some cases rich families prefer it to other staples even in times when rice is more expensive than these substitutes. Another factor is the nutritional value of rice. Nutritional experts have expressed the view that because of the deficiencies in the calories and proteins intakes in Nigeria nutritional consideration should be advanced to discourage increases in the consumption of starchy foods and encourage increases in that of rice and other food stuffs with relatively high calories and protein contents.(116, 80, 41)

Given the rather high income elasticity of demand for rice*, the rising income, the decline in the preference for root crops, the possible improvement in the quality of milled rice and the possible drop in the relative price of rice resulting from production expansion, future consumption demand for rice is expected to rise at a rate faster than the rate of growth in population. This increase in demand will be accentuated by a high growth rate in urbanisation and a declining rate of growth in rural population centres.

In view of rising consumption, it has been found necessary, particularly in recent years, to supplement local production with increasing amount of rice import annually. As shown in

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* An income elasticity of 0.7 has been suggested by the FAO(42).

Table 1.5, the volume of rice import rose from 255 metric tons in 1971 to an unprecedented level of 225,224 metric tons in the first eight months of 1977, claiming over ₦94 million worth of foreign exchange. This indicates the need for a significant increase in the domestic production of this commodity in order to meet effective demand and to check foreign exchange drain. It therefore shows clearly the relevance of rice production study in the context of national development.

Table 1.5

NIGERIA'S RICE IMPORT: 1962 - 1977

Year	Quantity Imported (metric tons)	Value (₦)
1962	1,601	251,240
1963	1,300	193,576
1964	1,030	181,564
1965	1,400	245,026
1966	1,257	246,324
1967	1,500	283,986
1968	315	51,750
1969	651	50,382
1970	1,749	270,384
1971	255	50,708
1972	5,893	988,266
1973	1,069	266,153
1974	4,805	1,497,534
1975	6,652	2,376,879
1976	45,377	20,136,490
1977	225,224	94,054,464

Sources: FAO Trade Year Book, various issues
Figures for 1977 are for January - August.

2. Problem Situation

(a) Shortage of rice supply

As indicated in the preceding section, one of the major disturbing phenomena in Nigeria today (and in Africa, generally) is shortage in the domestic supply of rice with the attendant result of soaring prices and rising importation of this commodity. This shortage can be attributed to a number of factors, prominent among which is increase in population which is not matched by the rate of growth in food production. Commenting on the problem of shortage in the domestic supply of rice, the FAO observed:

> Rice production in Africa, largely an importing region, was about unchanged in 1976 over the previous year; import requirements in 1977 are expected to remain substantial, reflecting in particular sizable requirements in Madagascar, Mozambique and the Sahelian countries as well as continuing large purchases by Nigeria.(7)

Consequently, rice is one of the few crops the production of which is recommended for rapid expansion in Nigeria(40). Hardcastle observed: "of all the domestic food crops of Nigeria, rice appears to offer the most favourable opportunities for a substantial short term, nation-wide expansion in production"(53). Accordingly, government efforts are currently directed towards the production of this food crop in the country. For instance, in line with the Federal Government directives, the Kwara State Government recently launched an Operation-Grow-Rice scheme, the aim being to promote rice production and to encourage consumers to buy locally produced rice. This immediately raises two issues, one relating to production and the other concerning consumption.

As at present, not much is known about the economics of rice production to justify the validity of government policy on the production of this commodity. As a result of this lack of adequate economic information, planners are often forced to make micro-economic farm policies with little or no knowledge of possible effects, which explains why realised growth rate in agricultural production is often less than the planned target. Therefore, it becomes necessary to provide information on input and output in connection with the production of rice and other crops.

(b) Cost of Rice Production

A major problem facing rice industry in Nigeria today is high production costs. As the Consortium for the Study of Nigerian Rural Development rightly observed, "field research is urgently needed to identify means of reducing the cost of producing rice in order that Nigeria's surplus land and labour resources can be used to produce rice for the West African market".(40) One of the means of reducing per unit cost of production is farm size adjustment; it is generally believed that if rice farmers are to significantly reduce per unit cost of production, the size of their farms must be large enough to attain some of the economies of large-scale production.

However, the relation of cost economies to farm size has been a subject of speculation. Information is therefore needed on the nature of the cost economies associated with rice farms of different sizes and to indicate the scale of operation which allows maximum farming efficiency. Similar information is needed in connection with rice processing. Specifically, it is necessary to investigate means of reducing processing costs and to identify the least-cost facility in rice milling.

(c) Marketed Surplus of Rice

Increasing the production of rice is one thing, however; ensuring that adequate marketed surplus is generated to the non-rice producing sector is another, particularly in a situation where the farmer is both a producer and a consumer of his produce. It is therefore necessary to study the nature of marketed surplus response to changes in production and prices. This is important in connection with forcasting the supply of this commodity to the urban sector, estimating rice import requirements, and formulating appropriate agricultural price policy. To the best of the writer's knowledge, no attempt has been made to carry out any major empirical study on the marketed surplus of rice in Nigeria. This study is an attempt to fill this critical gap. An attempt is also made to provide some information on rice consumption in Kwara State.

In summary, the study is designed with a view to making some modest contributions to crucial problem areas by providing the missing links in the chain of knowledge about rice in-industry in Kwara State. Hopefully, the findings will go a long way in (a) reducing rice import and promoting rice export, thus making for improvement in our balance of payments situation, (b) increasing farmers' income and thereby increasing their purchasing power, (d) increasing the supply of paddy rice to some Nigeria's rice mills, most of which are now working below capacity due to inadequate supply of raw materials (141) and (e) bringing cheaper rice to consumers.

(d) Rice Consumption

In addition to the problems enumerated above, there is also the need for rice consumption study in Kwara State. The study on rice consumption would be of considerable interest from both the practical and the theoretical standpoints. From the pra -ctical standpoint, knowledge of the explicit relationship amongst quantity of rice and income is very essential for better planning of rice production, trade and distribution. For instance, estimates of consumption elasticities could form a basis for production, and for expansion and/or modernisation in rice industry. The estimates could also be used for assessing the feasibility of the development of rice production as an import-substitution project. From a theoretical viewpoint, an understanding of the underlying causes of variation in consumption would make contribution to the methodology for analysing consumer expenditure and assist in building up knowledge on stable economic relationships such as exists between the quantity of rice purchased and income.

3. The Objectives

The aim of this study is to examine the structure and pattern of rice production and processing operations with a view to identifying possible ways of transforming rice industry in Kwara State. The study also aims at providing some information on the marketed surplus of rice and on the pattern of rice consumption in the state. The specific objectives can be stated as follows:

1. To obtain information on resource situation in rice production and to examine the extent to which this imposes a limit to production and militate against the adoption of innovation.

2. To examine resource utilisation and compare resource productivity and resource-use efficiency in rice production among different farm sizes in the various rice producing areas of the state.

3. To identify means of increasing returns in rice processing and to determine the least-cost milling facility in Kwara State.

4. To study the nature of marketed surplus response to changes in production and price, and to estimate the elasticities of home consumption and marketed surplus of this commodity.

5. To evaluate some of the factors determining the level of rice consumption among non-rice producing units in the state.

6. To investigate some of the possible economic adjustments that could be profitably made and to make recommendations which might promote rice production in the country.

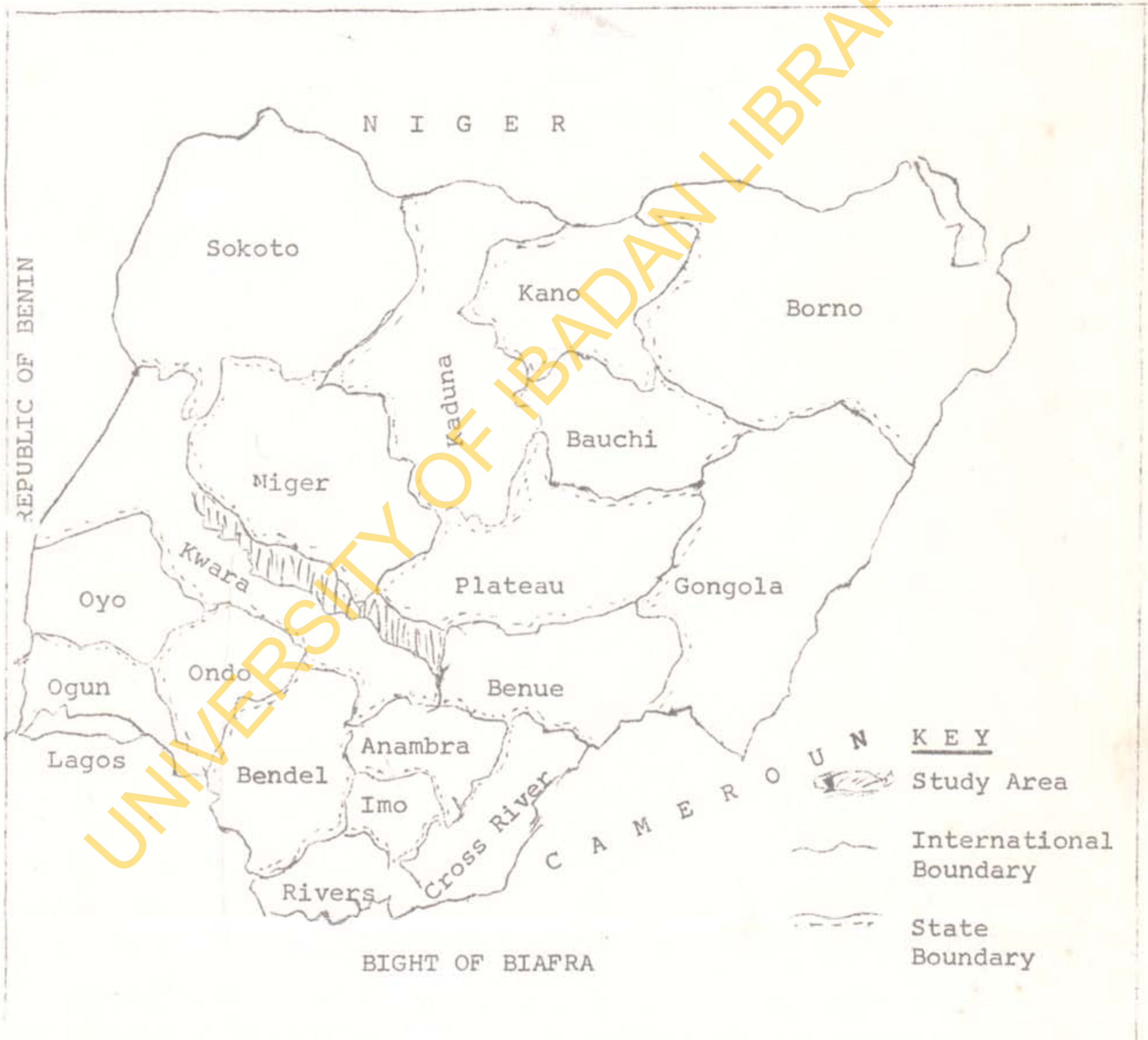
4. The Study Area*

Kwara State covers an area of 45,875.2 square kilometres and has a total population of 1,600,600 (1963 census), with a population density of 34.89 people per square kilometre. The climate is tropical, characterised by average annual rainfall ranging from 800 to 1,500mm. The raining season, which may be one or two peaks, generally runs from April through October. Variation in monthly rainfall can be very marked from one season to another, with consequent adverse effect on crops, particularly non-irrigated crops. The state is drained by some major perennial streams, with the Niger river flowing along most of its northern border and the Kainji Dam regulating the flow and opening wide areas of downstream flood plains for agricultural production. The vegetation consists largely of derived savannah woodland, with very high potential for livestock such as sheep, goats and poultry, and such arable crops like grains and tubers. Some tree crops like cocoa and cashew also thrive fairly well in some of the divisions of the state.

* See Maps 1 and 2, pages 18 and 19.

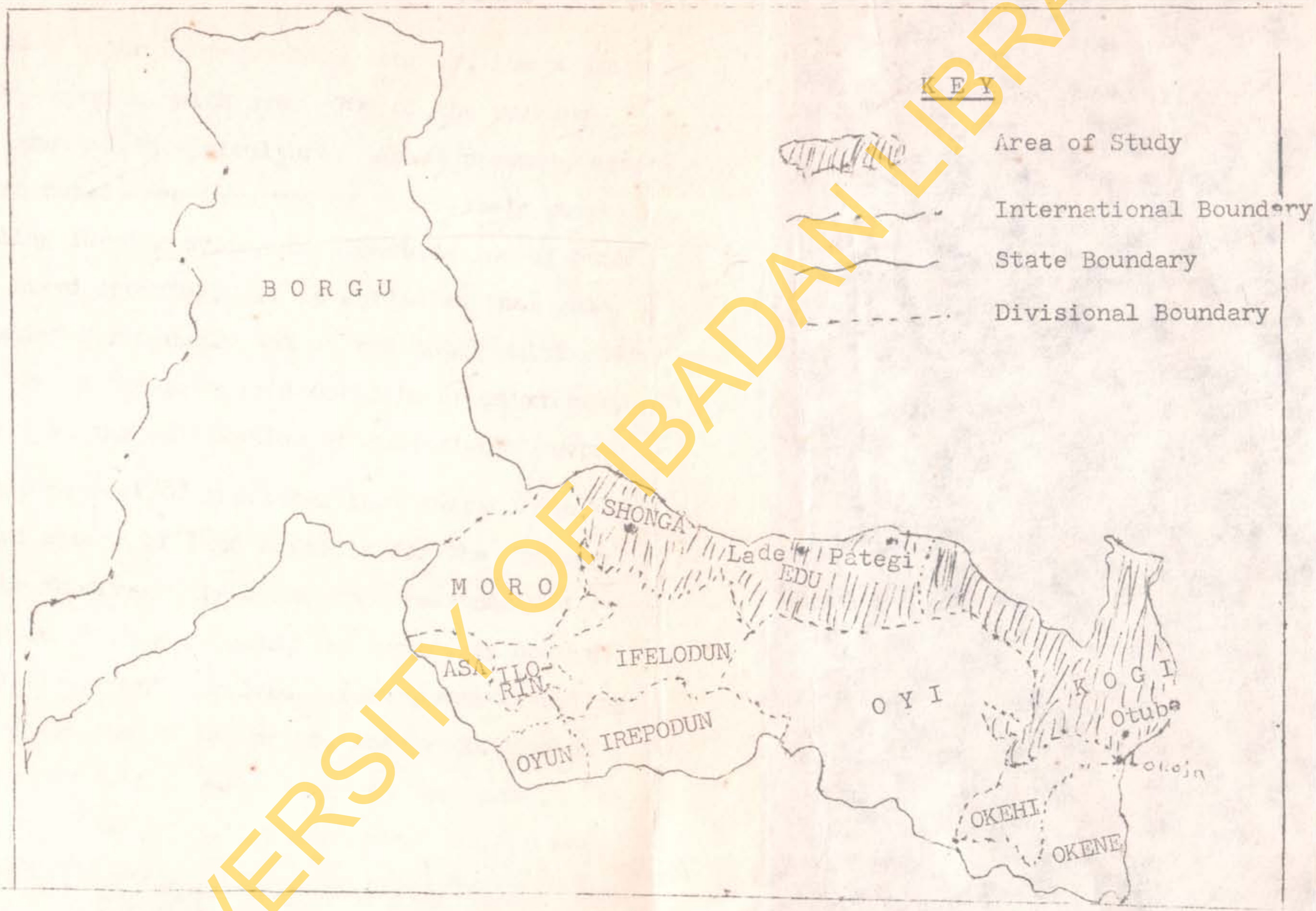
MAP. 1

NIGERIA: ADMINISTRATIVE DIVISIONS SHOWING THE STUDY AREA (SHADED)



MAP. 2

MAP OF KWARA STATE SHOWING THE STUDY AREA (SHADED)



Like many other states in the country, Kwara State is essentially agrarian, with over 70% of the working population engaged in agriculture. As at present, agriculture contributes more than 50% of the state's output. The prevailing farming system is a combination of bush fallow and mixed cropping. It is estimated that sole crops accounted for roughly 45% of the total cultivated area while 55% of the area is devoted to cropmixtures, with emphasis on the cultivation of subsistence crops.

A recent survey(93) indicates that Kwara State has a substantial amount of land suitable for the growing of rice. The topography is considered reasonably flat, particularly in the Niger basin, and generally does not require huge investment for land clearing and levelling. Rice is therefore one of the crops, the production of which is being currently intensified in the state. It is estimated that the state produces about 16,000 tons of the crop annually from an area of about 11,331.6 hectares. Rice is generally grown by small holders although a number of relatively large farms, both private and government sponsored, are in operation in all the rice growing areas. At present, these areas are mostly in Edu (former Lafiagi/Pategi) and Kogi divisions, with the former accounting for about 90% of total rice produced in the state. The two types of rice grown are swamp and upland rice, the former being grown on fadama (flood plains) and in few cases on irrigation schemes; the latter is rainfed. The present study is concerned mainly with swamp rice which accounts for over 90% of total rice produced in the state.

5. Methodology

(a) Sampling Procedure.

The first process in the sampling stage was to divide Kwara State into rice producing areas, using available records from the Ministry of Agriculture and Natural Resources. The records indicate that Edu, Dekina and Kogi divisions used to be the three major rice producing divisions in the state. With the recent excision of Dekina division from Kwara State,, however, Kogi division remains the only major rice area next to Edu, producing roughly 5% of total rice output in the state.

For the purpose of this study, the state was divided into three areas. Edu division was divided into two, namely Shonga-Tada area where the government rice scheme and the rice project of the state-owned Agricultural Development Corporation are currently situated, and Pategi-Lade-Kpada area where a Chinese Mission is currently working on a proposed 660 hectare integerated rice irrigation project. The third area is Otube - Abugi in Kogi division*.

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* See Map 2, page 19.

The next step involves a 2-stage sampling procedure. In the first stage, villages were chosen from among all the villages in the selected area of study. In the second stage a random sample of farmers was chosen from the household* units in each of the selected villages. No formal statistical method was employed in selecting the villages. Rather, the selection was purposive, made in consultation with the Ministry of Agriculture and Natural Resources. For this reason, the representativeness of these villages might be called into question. However, it is necessary to realise that the officials of the Ministry of Agriculture and Natural Resources possess a good knowledge for choosing the representative villages. Moreover, variations between villages are generally small relative to variation between households within villages in the study area. In general, the area is characterised by a uniform degree of capitalisation in farming, the dominance of labour input in agriculture , and a fairly uniform stage of uptake of agricultural innovations. All these characteristics preclude extensive variation in resource endowment and enterprise combination.

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* A household is defined as a group of persons living in the same dwelling and dependent on a common or pooled income for major living expenses.

For the purpose of this study, the sample size was determined largely on the basis of availabe funds and the method of data collection adopted. Accordingly, 230 households units were randomly selected for situational survey, 150 of which were selected for detailed micro-level study, with the sample size being distributed among the study areas roughly in proportion to the estimated total number of rice farmers in each area. In addition, 50 rice parboilers and 20 rice mills operating in the area were included in the sample. In the case of rice consumption, 183 consumers were randomly selected in Ilorin, representing urban area, and Omu-Aran, representing rual/semi-urban area.

The approval of the village heads having been obtained beforehand in the rice producing areas, little or no problem was encountered in the selection exercise. In Pategi and Otube, the village head himself was ostensibly included in the sample size, the purpose being to obtain the enthusiasm and cooperation of other sample units and to keep the village head informed at all stages of the information being sought. In choosing the sample,we expected that some of the original sample units might drop out before the end of the data collection process. The precaution taken was to include more units in the sample than we actually needed. Some of these additional units were later used to replace the drop-outs and those, who for one reason or the other did not furnish all necessary information.

(c) Data Collection.

(i) Training of Enumerators.

Five enumerators were employed for the data collection purpose, with one or two of them stationed in each area and assisted by the resident agricultural extension workers. These enumerators were trained at the permanent site of Kwara State College of Technology, Ilorin. The training included series of talk on the objectives of the study, problem of rural areas and the art of interviewing farmers. They were told to avoid promises which may not only lead to biased answers but may also create false expectations and build up tensions with farmers who were not included in the sample. Rather, the enumerators were to emphasise that the findings of the research will be made available to the government and other bodies connected with the granting of both financial andtechnical aids to farmers. They were then introduced to the pilot questionaires and later sent to the field to pretest these questionaires. The second stage in training consists of reviewing the enumerators' experiences during the pilot survey, using a reference manual[126] and the final draft of questionaires (See Appendix III).

(ii) Method of Data Collection:

Data collection took place during the 1977/78 crop season by means of highly structured questionaires, non-participant observation and informal discussion with the respondents. Some data like names of respondents, age, literacy level, resource availability, crops produced were obtained once or twice while others like the disposal of rice (e.g. the quantity consumed, marketed, etc) were obtained by repeated visits throughout the production period. Input - Output data were obtained using the cost-route technique whereby farmers are interviewed repeatedly once every week (or at least fortnightly). This technique was chosen primarily to overcome the problem of recall, since a majority of the respondents were illiterate, keep no records and therefore had to rely on the memories for the required information.

A combination of farm and residential visits was employed to obtain information from the farmers. Farm visits offer the enumerators opportunity to become conversant with the operations going on in the fields and enable them to identify the fields and establish good working relationships with the farmers. Residential visits became necessary as farmers complained that farm visits hindered their farming operations. Besides, it was not technically and economically feasible to make a weekly visit to each of the farms throughout the period.

In all cases, enumerators were closely supervised by the researcher himself, visiting the areas roughly once a month. The purpose of the visits was to verify the completed questionaires, to respond to problems encountered by the enumerators and help in maintaining their morale.

(d) Measurement of Input and Output.

(i) Land Input:

Measurement of input and output is recognised as a major problem in traditional agriculture. This is particularly true of land input, especially where the taking of aerial photographs is either not feasible or not within the financial reach of the researcher. In the present study, heavy reliance was placed on the agricultural extension workers' help in the measurement of this input. Initially, the measurement was in acres, which was later converted to hectares.

It is necessary to point out that irrigated rice farmers had no difficulty in determining their acreages because the irrigation schemes are normally divided into one-acre plots.

The problem is with regards to non-irrigated rice farms. Even in this case, relatively little difficulty was encountered since most of the non-irrigated rice farmers generally have affiliation of one type or the other with irrigated rice farmers; as such they have an idea of what an acre is. Besides, the tractor hiring unit of the Ministry of Agriculture and Natural Resources normally operates on per-acre basis and a majority of the farmers interviewed made use of the tractor hiring service. This notwithstanding, farmers' farms were visited to identify the plots and to determine the acreages.

(ii) Labour Input:

For the purpose of the study, labour was divided into three broad categories, namely family labour, communal labour and hired labour. Each category was recorded in hours by multiplying the number of workers by the number of hours spent on farming operations. Aggregation of labour input was done by adding the labour inputs of adult males to the man-hour equivalent of adult females and youths, holding one adult female as equivalent to $\frac{2}{3}$ man-hour, and one youth as equivalent to $\frac{1}{2}$ man-hour. For some of rice processing activities, labour was initially recorded in minutes and a weight of one was given to adult female. This is because women are considered as efficient as men in the types of work they perform in rice processing. The result was standardised into man-days and valued at the prevailing wage rate.

(iii) Output:

Rice is normally harvested in bulk and threshed, usually by men. The threshed rice is winnowed and measured by women immediately after threshing. In the measurement process, big standard measure (called ananias) are normally used throughout the study area. On the average, 25 of such ananias make a bag of paddy rice weighing 76.19 kg. The output was valued at ₦25 per bag which was the modal price of paddy during the harvesting period. The purpose of using the price prevailing during the harvesting period was to avoid the problem of determining the value added due to storage and related factors. The final product after processing is the milled rice. This was valued at the price prevailing at milling points.

(iv) Depreciation Charges:

Depreciation charge is an allowance made for that part of capital assets consumed by the production activities during the year. The value of this charge depends on the initial purchase price, the average useful life and expected salvage value of the capital assets. From the answers given by respondents and from the author's experience and discussions with some agricultural extension workers, the purchase price and average useful life of each fixed asset was determined. Depreciation charges were computed using the straight-line method. Where the serviceable life of the implements was less than one year, the amount expended on them is regarded as current expenses and the items were therefore not depreciated. In the case of farming implements and storages (rhumbus) the annual depreciation figure was further divided by the number of acres of all the farming enterprises for which the implement concerned was used. The farmers' rice acreages were used as a weight to determine the proportion of the depreciation figure to be charged to rice production. With respect to milling and parboiling implements, the depreciation figure was divided by the number of enterprises in which the equipments were used. In all cases, an appropriate interest charge was added as the opportunity cost of using capital in the production process.

(e) Limitations:

The study was confronted with a number of statistical and conceptual problems. One major problem was in the measurement of input. In the case of land for instance, farmers' acreages were used as a measurement of this input, thus ignoring variations in the quality of land input. The implication is that where there are wide variations in the quality of land on individual farms, non-standardisation of this variable may lead to over - estimation or under - estimation of its regression coefficient. However, it is generally recognised that there exists no acceptable criterion for standardising land variable. One suggestion is that the variable be corrected by some fertility index. The snag here is that the suggestion presupposes that such index can be corrected without involving a measure of productivity which is what we are supposed to explain. Similarly, the practice of adjusting land data in relation to different parameters such as irrigation and the rental value of land presupposes that relevant data exist. Besides, the shortcomings of this approach have made many researchers hesitant in adopting the method.* In this study it is assume that rice land was homogeneous in the study area since there were no facilities for carring out a soil survey in order to standardise the basic variations in land input. Similar problem was encountered in the measurement of labour input. For one thing, measurement of labour input in man-hour ignores variations in the quality and intensity of labour. Secondly information in the labour input was drawn from the memory of rice producers since it was impossible to make direct observations on the various production operations. Moreover, where labour is used for simultaneous operations as is often the case in rice farming, (for example the harvesting of cassava crop on rice

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*These shortcomings have been discussed in the literature. See for instance J.P. Singh (   )

farm is a form of land preparation for the rice crop following it), difficulties of measurement may arise.

It should be noted also that no effort was made in the study to determine the cost of management owing to its highly qualitative nature. Other socio-economic, technical and institutional factors were also omitted, which, though unquantifiable, are crucial in their effects on costs and returns. Furthermore, since the estimated production costs are depedent on the imputed value of unpaid inputs, and since these imputed values might diverge from the marginal productivities of the respective inputs, it is probable that the financial position of rice enterprise has been either overstated or understated.

The second problem is that of measuring output. Although standard measures are being used in the measurement of threshed paddy rice throughout the study area, there are a lot of variations in the methods of measurement. In some cases the measures are said to be full when the paddy rice just bulges out. In other cases, the left arm is extended round the measure to support extra paddy rice. Moreover, because each rice variety is not threshed separately but mixed up with other varieties, the measurement of yield data ignores quality differences in rice grains. And since the study analyses the yield data of only a single season, it ignores the effect of year-to-year weather variation. Where the seasons yield is outstandingly low or high, results and reccmmendations are of little value.

Thirdly, despite repeated assurance that information provided will be treated as confidential, some of the respondents were reluctant to disclose certain crucial information such as income and/or expenditure. In an attempt to minimise errors of this nature, doubtful returns were eliminated during the analysis.

Apart from statistical and conceptual problems, there are also various methodological problems which are often encountered in the collection and analysis of farm mangement data. Most of these problems have been extensively disussed in the literature[101].

As Osifo pointed out, "the major weakness of single enterprise studies is their lack of emphasis on the optimal levels and techniques of production".[141] This lack of emphasis is due largely to the fact that data are not usually available for enterprise combinations. Another weakness is that in a farm with more than one crop, costs and returns analysis for a single crop is not particularly useful as it does not indicate the income position of the whole farm. Given the assumption of profit-maximisation motive, a farmer will be interested in the overall financial position of his whole farm rather than that of a single enterprise.

However, although the quantitative estimates in this study may not have represented the true magnitudes and the general shortcomings of the study not withstanding, the result hopefully provides a rough and ready guideline so urgently needed for policy making.

(f) Method of Analysis:

The analytical techniques employed in the present study are farm record (or budgetary) and statistical regression techniques. Basically, farm record or budgetary analysis involves operations leading to the estimates of total cost and total revenue for the same production period. The difference between the two parameters is a measure of the net return (which might be negative or positive) for that period [182]. The use of statistical regression technique enables us to examine the functional relationship among selected variables. This relationship is examined in the study, using the singl-equation multiple regression approach with a set of cross-sectional and time series data. The parameters of the variables are derived by ordinary least squares method. This method is preferred to any other econometric estimation technique due to a number of reasons. Besides the simplicity of formulation and mathematical and computational convenience entailed in the technique, the parameter estimates obtained by the method have the optimal properties required for our purpose, namely unbiasedness, least variance and efficiency.

5. The Plan of the Study.

The rest of this study is arranged as follows. Chapter II is devoted to a review of analytical techniques and literature on relevant previous studies while Chapter III deals with an analysis of resource situation in Kwara State peasant rice production. Chapter IV is concerned with the resource productivity and resource-use efficiency in rice production. Estimates of costs and returns are also made for different rice producing areas and different farm sizes. The structure and economic performance of rice processing industry is analysed in Chapter V, the aim being to determine means of reducing costs and to identify the least-cost milling facilities. Chapter VI is devoted to the analysis of the marketed surplus and home consumption of rice while in Chapter VII, the functional relationship between the quantity of rice consumed and selected variables are examined and some consumption elasticities are computed. Chapter VIII provides the summary and policy implication of the study and suggests areas for further research.

CHAPTER II

LITERATURE REVIEW

Various analytical techniques have been employed in studying agricultural industry in both developed and developing economies. This chapter is devoted to a review of some of these techniques and relevant previous studies.

1. Farm Record Analysis

Farm record analysis has been a traditional tool, particularly in studying returns to size in agriculture. The usual method is to group farms into size classes on the basis of acreage, output or some other common denominators. Some measure of net returns (e.g. returns to labour and management) are computed for each size class and the result often shows positive correlation between net returns and farm size. Heady[55] Olson[135] and McAlexander[107] drew attention to some of the problems inherent in such analysis. As indicated by McAlexander[107], many of the conclusions and recommendations arising from such analysis are in direct opposition to known economic principles and technical relationships. Some of such findings may, for example, suggest that increasing returns exist where economic principles and technical fact indicate constant and diminishing returns, or that there is no limit to the level of output or to the degree of substitution among inputs. Usually, analysis of this type fails to bring about concrete recommendations with regard to what adjustment farmers should make and how.

One common source of problem in farm record analysis is the use of management return as a measure of resource allocation efficiency. In a situation where there is divergence between market prices and marginal productivities, erroneous conclusions are bound to arise. If, for instance, the prices of inputs are lower than their marginal products, return to management is overestimated, and conversely. Also, where yields are used as an efficiency indicator (as is usually the case in farm record analysis), this sometimes leads to the conclusion that the average yield (and hence the average net earnings) of larger farms are higher than for smaller ones, thereby suggesting that there may be no limit to return as long as yields are increasing. The problem here (common to most cross-sectional studies) relates to the use of inter-farm data to derive what is essentially an intra-farm estimate, for it is possible that points have been calculated on different production functions, As Heady pointed out, spurious functional relationship may be expected from non-homogeneous population data, although this type of potential error can be greatly reduced by the use of homogenous classification.

Admittedly not all the shortcomings mentioned above are peculiar to farm record analysis, nor are all the criticisms valid. What is necessary, as Epp(57 p.160) rightly indicated, is that analysis of this nature should be interpreted in the light of sound judgement.

2. Intra-firm Linear Programming analysis

With the popularity of linear programming technique in the 1950's, this tool has become increasingly useful in studying agricultural industry, particularly in determining optimum enterprise combination or in deriving agricultural supply functions. In most studies the idea has been to generate the profit maximising pattern of farm production for various price relationships, resource availability and technical coefficients.

The conventional simplex programming model can be formalised as follows:

$$\text{Max} \quad Z = C'X \qquad (2.1)$$

$$\text{Subject to } AX \leq B$$

$$\text{and} \quad X \geq 0$$

where

Z = the objective function to be maximised

C = n by 1 vector of prices

X = n by 1 vector of activity levels

A = m by n matrix of input output coefficients

B = m by 1 vector of available factors or other restrictions.

Parametric programming and other variants of this conventional simplex linear programming model have been used in past research studies in agriculture. For instance, Anderson and Heady,[6] Krenz et al,[87] and, more recently, Ogunfowora[122] have all used these models in estimating agricultural supply functions and have demonstrated evidence of their applicability.

Ogunfowora's formulation of the parametric programming model is formalised as follows:

$$\text{Max } Z_a = \sum_{j=1}^{n} c_j X_j \qquad (2.2)$$

subject to

$$\sum_{i=1}^{m} a_{ij} X_j \leq b_i \qquad (2.3)$$

$$\text{and} \qquad X_j \geq 0 \qquad (2.4)$$

where

$$Z = Z(X_1, X_2, \ldots, X_j, \ldots, X_n) \qquad (2.5)$$

$$C'_j \leq C_j \leq C''_j \qquad (2.6)$$

$$\frac{C''_j - C'_j}{\lambda} = k \quad \text{or} \quad C''_j - C'_j = \lambda k \qquad (2.7)$$

Z_a = the a^{th} objective function to be maximised for a given price level within the acceptable price range

bi = the level of the i^{th} resource available

C'_j and C''_j = the lower and upper limit of the price of the j^{th} activity

λ = constant increment in the price of the j^{th} activity

k = the number of optimum solutions within the price range.

Recursive programming is another more recent tool developed as an outgrowth of studies connected with linear programming. Both techniques are similar in that they can be employed to optimise a linear objective function subject to linear constraints. The difference between them is of a conceptual nature (62). While the former is capable of predicting the actual behaviour of farm firms, the latter is normally designed to estimate an optimal behaviour.

Admittedly, mathematical programming models have obvious advantages over some other analytical techniques. As indicated earlier, they can be used to generate optimum adjustment path in farming enterprise as economic and technical conditions change. According to Beneke and Winterboer, "the great advantage of linear programming is that it allows one to test a wide range of alternative adjustments and to analyse their consequences thoroughly with small input of managerial time"(21).

These advantages must, however, be weighed against the immense data requirements of any comprehensive linear programming model. Moreover, the problems of aggregation bias and specification errors have not been satisfactorily resolved. While the former have been studied in some depth in the context of static linear models (14), the latter remains somehow more elusive; and, as Ogunfowora et al (125) rightly noted, linear programming is not an appropriate technique for studying resource productivity.

The typical approach has been to obtain the marginal value products (MVP^s) of resources as by-product of the conventional linear programming solution. When such exercise is conducted for different farming systems, these MVP^s can be compared and used as the basis for resource adjustment and pricing policies. The short-comings of this approach have been discussed in the literature*.

3. Statistical Regression Approach

Perhaps the most popular traditional tool in studying agricultural industry is the statistical regression function technique. This tool has been widely applied for instance in production function estimates and in studying the responsiveness of peasant farmers to price changes. Some of these relevant studies will be reviewed here.

(a) Production function estimates

Over the years, various researchers have employed multiple statistical regression analysis in production function estimates, particularly in the study of resource productivity, returns to scale and resource-use efficiency

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* See, for instance (125) p.112.

in traditional agriculture. This technique not only provides a direct measurement of the parameters of resource productivity, but also overcomes some of the shortcomings of linear programming technique. Also, the technique differs from the traditional farm record analysis in that it first recognises the basic functional relationships which relate to decision making. The attempt is to place these functional relationships into an empirical system in which the basic economic principles can be applied. The method of analysis involves obtaining data from experiment, survey of farms or from a group of records in a given area. Production functions are then estimated, using regression analysis. Marginal products, elasticity of production and some other computations can be made from these production functions.

Several forms of production function - linear, square root, polynomial, Cobb-Douglas, Spillman - have been used in agricultural production function studies. However, although its popularity has waxed and waned over the years, the Cobb-Douglas production function has been perhaps the most widely used in agricultural economics, especially where interest revolves around quantitative estimates of returns to scale and resource productivities at the means of inputs. This popularity, according to Heady and Dillon, has been "partly because of the small number of degrees of freedom involved in the estimation of the parameters and partly because a multiplicative model seems logically appropriate" (59). Not only is the function simple to handle (being linear in logarithm form), it also yields diminishing returns to each factor of production separately. Other functional forms like quardratic and square root often lead to a loss of many degrees of freedom when fitted to farm samples, and usually results in too many regresion coefficients most of which are often not statistically significant.

In the two variable case, the Cobb-Douglas (power) function is of the form

$$Y = aX_1^{b_1}X_2^{b_2}U \quad \ldots \qquad (2.8)$$

where

Y = output

X_i = the variable inputs ($i = 1, 2$)

a = the constant

b_i = the transformation ratio when

X_i is at different magnitudes

U = error term

From equation (2.8), the marginal productivity (MPP) of resources can be computed. This magnitude provides a framework for policy decision on resource adjustment. A positive MPP implies that output could be increased by employing more of the given input; the converse is true for a negative MPP. Similarly, the relationships of marginal value productivities (MVP) to the market prices of the respective inputs give an indication of allocation efficiencies.

Under perfect competition, profit maximisation requires that the ratio of the MVP of inputs be equal to the ratio of their respective prices. To prove, assume the farm firm's profit equation is of the form

$$\Pi = P \cdot f(X_1 X_2) - r_1 X_1 - r_2 X_2 - b \qquad (2.9)$$

where P = the fixed unit price received by the producer,

r_1 and r_2 = the respective prices of X_1 and X_2

b = the cost of the fixed inputs

Equation (2.9) indicates that profit is a function of X_1 and X_2, and is maximised with respect to these variables. Taking the partial derivatives of (2.9) with respect to X_1 and X_2 and setting them equal to zero we have

$$\frac{\delta \Pi}{\delta X_1} = Pf_1 - r_1 = 0 \qquad (2.10)$$

$$\frac{\delta \Pi}{\delta X_2} = Pf_2 - r_2 = 0 \qquad (2.11)$$

Solving, we have

$$\frac{Pf_1}{Pf_2} = \frac{r_1}{r_2} \qquad (2.12)$$

or

$$Pf_1 = r_1; \quad Pf_2 = r_2 \qquad (2.13)$$

Thus, the first order condition requires that for profit to be maximised each input must be employed to the level at which its marginal value product, Pf_i, is equal to its price. The second order condition requires that the principal minors of the relevant bordered Hessian determinant alternate in sign, (61)

It is necessary to note that by employing Cobb-Douglas production function, we are making an implicit assumption about the nature of elasticity of subsitution. As originally set forth by Hicks (64), elasticity of substitution (Es) provides a measure of the rate of change in the marginal rate of substitution of resources in producing a given product. Theoretically, the value of Es can vary between zero and infinity. On the other hand, the value of Es implied by the Cobb-Douglas production function is unity. If this assumption is incorrect, specification error is committed, and doubt is cast on the appropriateness of fitting a Cobb-Douglas function. Hence the need to test the assumption of unitary Es among inputs by estimating on the farm data the parameters of the C E S production function (2. 14) developed by Arrow et al [9]

$$V = \gamma \left[\delta K^{-p} + (1-\delta) L^{-p} \right]^{-1/p} \qquad (2.14)$$

where V, K, and L denote output(valued added), capital and labour respectively,

and

γ = efficiency parameter

p = substitution parameter

δ = distribution parameter

An alternative is to use the Kmenta [85] approximation or any other method that has been recently developed as an outgrowth of research work connected with the CES production function. Incidentally, in most cases where such tests have been employed, the results of estimates have been found to be consistent with unitary elasticity of substitution, implying that there is no evidence against the use of Cobb-Douglas production function in agricultural industry(54, 13).

Relevant previous studies are in the areas of resource productivity and resource-use efficiency in traditional agriculture. With allocative efficiency defined in terms of profit maximisation, Schultz hypothesized that "there are comparatively few significant inefficiencies in the allocation of the factors of production in traditional agriculture" (163). This hypothesis has generated substantial interest in recent years, and many major empirical studies support the hypothesis, although evidences presented do not seem to be conclusive.

Chennareddy (28) fitted a Cobb-Douglas production function to farm survey data, and as a test of production efficiency, computed the ratio of marginal value products (MVP) to marginal-factor cost (MFC). Statistical test of significance was employed to examine the difference between the co-efficients required to make this ratio equal to unity, and those co-efficients obtained in the regression analysis. Concluding his findings, Chennareddy observed that "available empirical evidence does not lead to the rejection of the hypothesis of production efficiency in the traditional South Indian agriculture".

Other relevant studies in India include those of Saini [158] and Krishna [89]. Both concluded that farmers, on the aggregate, were quite rational in their allocation of resources.

Dittrich and Myers [36] obtained MVPs for land and labour from fitting data to a Cobb-Douglas production function and equalised these values by the method of iteration. These were then substituted in the original production function to obtain the maximum income obtainable, given maximum efficiency in resource allocation. The maximum obtainable was compared with peasant farmers' income, and the result showed that in spite of increasing market uncertainty, farmers were allocating their resources very efficiently in republican China.

In another recent studies, Salkin [160] and Huang [70] discovered some inefficiencies in resource use among peasant farmers. Employing generalised production function models in his study of South Vietnamese rice production, Salkin found that resources available to the existing rice farms could be reallocated such that increase in total output could be achieved. Huang's study was concerned with how allocation efficiencies may change with development stages in peasant economy. The result indicated that allocation inefficiencies existed mostly in the transition from a subsistence oriented economy, and that given enough time, these inefficiencies disappear. Similarly, Parthasarathy and Prasad (144) noticed that the inverse relationship between size and productivity found in management studies of "pre-technology" period has disappeared, implying that "with growing importance of non-traditional inputs, the small farmer has lost his traditional advantage".

In their study on transplanted paddy rice farming in India, Tambad and Baliga (170) indicated the existence of constant returns to scale, while a more recent study by Bardhan (13) showed that in India's paddy rice agriculture, there was some evidence of decreasing returns to scale.

Lawrence Lau and Pan Yotopoulos (94) applied the profit function concept to the analysis of returns to scale and allocative efficiency in India agriculture. By comparing the actual profit functions of small and large farms at given output and input prices and fixed quantities of land and capital, they found that smaller farms were economically more efficient than larger farms within the range of output studied. Their results also indicated constant returns to scale. On the other hand, the results obtained by Surjit Sidhu (166) ran counter to their findings in that he did not find any differences in the economic efficiency of small and large farms.

In Nigeria, resource allocation in traditional agriculture was examined by Welsch (179), Nwosu (119) and Ogunfowora et al (125) among others. Welsch fitted two functions (2.15) and (2.16) tp the data obtained by interviewing rice farmers:

$$Y = aX_1^{b1} X_2^{b2} X_3^{b3} X_4^{b4} \qquad (2.15)$$

$$Y = b_o + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 \qquad (2.16)$$

where

Y = Output per acre

X_1 = Labour per acre

X_2 = Seed per acre

X_3 = Rent (proxy for land quality) per acre

X_4 = Total acres.

For each variable, the MVP was computed and the ratio of MVP to MFC was calculated. The regression coefficients required to obtain a ratio of MVP/MFC = 1.0 was also calculated and compared with the observed regression co-efficients.

Four of the seven ratios were not significantly different from unity, indicating no evidence to reject the hypothesis of efficient resource use. The study also showed that while labour productivity was relatively low in rice production, the productivity of seed input was quite high. The analysis further revealed that given the observed efficiency in resource use, a reorganisation of existing resources could not bring about much increase in productivity. What was needed he maintained, was the supply of new factors, consisting of "particular material inputs and skill and other capacities required to use such inputs successfully" (179 p.146). He observed too that there was the need to develop small scale irrigation projects by communal labour, and recommended that the actual production should be in individual small holdings rather than communal holdings.

However, this study has a major weakness, namely, the data were collected during a single visit to the rice farmers, thus increasing the magnitude of memory errors. Given the environment under which Nigerian farmers operate, one is inclined to doubt Welsch's contention that "a number of the farmers kept simple records of inputs" (179). Unlike Welsch, Ogunfowora <u>et al</u> (125) and Nwosu (119) visited farmers twice weekly to collect data on input and output for the entire production season. Their analysis indicated that some resources were not being efficiently utilised in Kwara State agriculture, although in one of the studies, statistical tests of significance were not carried out to examine whether or not the MVP/MFC ratios were significantly different from unity.

In his study of rice production in the former Western State of Nigeria, Osifo [141] revealed that production cost per acre fell, and output per acre rose with increase in farm size. The study also noted the use of increasing volume of hired labour as farm size increased, and hired labour was found to be more effectively used than family labour. In another study Oboh [120] fitted a Cobb-Douglas production function to a survey data on rice production in the Mid-Western (now Bendel) State, and found that the sum of elasticities indicated increasing returns to scale. On the other hand, the result obtained by Adeniyi [4] ran counter to this in that the calculated sum of elasticities (0.7912) indicated decreasing returns to scale in rice production. In both studies, however, no statistical test of significance was carried out to examine whether or not this sum differed significantly from unity.

We can see from the foregoing that in most of the studies relating to allocative efficiency*, the typical approach has

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* Other relevant studies include those of Hooper [66] Masell [103] Sahota [157], and Yotopolous [183].

been to estimate a Cobb-Douglas type of production function and then, using point estimates of the production elasticities, to make some statistical test of equality between the estimated MVP's and MFC's. Dillon and Anderson (35) are of the opinion that this approach is not satisfactory. They declared:

> Such statements based on the mechanical use of traditional significance levels are devoid of economic content. In our view, significance test based on arbitrary probability levels are irrelevant to economic problems and provide no basis for the assessment of allocative efficiency. What is needed is a measure of profit maximising efficiency that has a direct economic interpretation, yet depends on the statistical quality of underlying production function estimate.

However, it is interesting to note that they too do not regard their alternative decision theory approach as error-free, neither did their analysis reject the profit maximisation hypothesis.

(b) Producers' response to price changes

The responsiveness of peasant farmers to price incentives has been a subject of hot debate in the literature. Mathur and Ezekiel(106) maintained , for instance, that various institutional and cultural restraints militate against farmers responsiveness to price changes in peasant economies. In a modified manner, Olson (136) and Krishna (88) endorsed this view. They argued that given the drive towards self-sufficiency in food production, peasant farmers always produce a certain amount of the subsistence crop irrespective of price changes and market expectations.

On the other hand, there are those who hold the view that peasant farmers respond positively (and quickly too) to price stimuli. While Schultz (163) asserted that in peasant economies institutional restraints are not impediments to farmers responsiveness to price changes, Mellor (108) went further to argue that peasant farmers supply responses may be greater than those of their counterparts in developed economies, owing to their (peasant farmers') relative flexibility with respect to the use of factor input. The view that peasant farmers respond positively to price changes has been supported by a number of studies in some developing countries. For example, Bauer and Yamey (18) Behrman (19) Bateman (17) and Dean (33) in their respective studies showed that peasant farmers in Nigeria respond very positively to price incentives, a finding which was confirmed by the works of Idachaba (74), Oni (137) Ogunfowora (122) and Olayemi (129) to mention a few.

Statistical regression technique was employed in many of these supply response studies. In its simplest form, statistical hectarage response equation can be conceptualised as follows:

$$H_t = a + bP_{t-1} + U_t \qquad (2.17)$$

where

H_t = crop hectarage in year t

P_{t-1} = lagged average annual price index of the crop

U_t = error term which is assumed to have zero mean and constant variance.

Variants of this model can be formulated depending on the objective of the study and data availability. Suppose, for instance, we want to estimate the influence of relative price changes on the substitution between enterprises or products, the equation can be conceptualised as:

$$\left(\frac{H_k}{\sum_{i=1}^{n} X_{i \neq k}} \right)_t = f \left(\frac{P_k}{\sum_{i=1}^{n} P_{i \neq k}} \right)_{t-1} + U_t \qquad (2.18)$$

where

$$\left(\frac{H_k}{\sum_{i=1}^{n} X_i \neq k} \right)_t = \text{the ratio of the crop hectarage to that of competing crops}$$

$$\left(\frac{P_k}{\sum_{i=1}^{n} P_i \neq k} \right)_{t-1} = \text{the lagged average annual price index of the crop relative to other competing crops.}$$

Equations (2.17) and (2.18) presuppose that relevant time series data exist. Where time series data are not available, producer panel* method has been a useful alternative analytical technique in studying acreage response. The usual procedure is to select a random sample from a given population of farmers, and to draw up questionnaires for the purpose of obtaining background information on factors which are most likely to influence farmers hectarage response. This technique was employed in Oni's[137] study

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* A producer panel is a group of farmers questioned and where necessary revisited periodically to evaluate, among other things, the price and nonprice factors influencing farmers' production behaviour.

of cocoa farmers' acreage response to price changes.[137] The respondents were asked to state how many acres of cocoa they would cultivate at suggested alternative producer prices. The mathematical model tested is as presented in equation (2.19).

$$A = ao + a1\ Pc + U_t \qquad (2.19)$$

where

A = acres of cocoa planting

Pc = producer price of cocoa

U_t = error term.

Regression equations were fitted to the cross-sectional data, using the least square method, and different functional relationships - linear, double-log and exponential - were tried. The result indicated positive acreage response to changes in producer prices. However, there are problems connected with the use of this model, most of which have been discussed in the literature[129, 137]

(c) <u>Marketed Surplus Response</u>

The literature on empirical estimates of the response coefficients of marketed surplus of food crops in developing countries is relatively few, owing largely to the non-availability of adequate data on sales of food crops in most of these countries. In view of the lack of time series data, there have been some attempts to estimate the price response of marketed surplus through an indirect approach (20, 11, 12, 174, 91).

For example in his study of rice in Thailand, Behrman [20] computed indirect estimates of the price response of marketed surplus as follows:

$$
\begin{aligned}
\frac{P_1}{M_1}\cdot\frac{dM_1}{dp_1} = {} & \frac{Q_1}{M_1}\left(\frac{P_1/P_2}{Q_1}\cdot\frac{\delta Q_1}{\delta P_1/P_2}\right) - \left(\frac{Q_1}{M_1} - 1\right) \\
& \left[\frac{P_1/P_3}{C_1}\;\frac{\delta C_1}{\delta (P_1/P_3)} + \left(\frac{I}{C_1}\cdot\frac{C_1}{I}\right)\frac{P_1 Q_1}{I}\right. \\
& \left.\left(1 + \frac{P_1/P_2}{Q1}\cdot\frac{Q_2}{P_1/P_2}\right)\right] \\
& - \left(\frac{Q1}{M1} - 1\right)\left(\frac{I}{C1}\cdot\frac{\delta C1}{\delta I}\cdot\frac{P_1/P_2}{Q_2}\cdot\frac{\delta Q_2}{\delta P_1/P_2}\right)\left(1 - \frac{P_1 Q_1}{I}\right)
\end{aligned}
\qquad \ldots.\ (2.20)
$$

where

P_1 = the absolute price of rice

P_2 = aggregate price for all income sources of a producer of Q_1, other than the production of Q_1,

P_3 = aggregate price of all commodities other than Q_1 which are consumed by a producer of Q_1,

M_1 = the marketable surplus of rice

Q_1 = the quantity of rice produced

C_1 = the quantity of rice consumed

I = total net income of the producer.

The result showed that marketed surplus of rice is responsive to changes in price, with the long run price elasticity of marketed surplus ranging between 0.40 and 0.83.

The major limitation of this study is with respect to the underlying assumption, namely that the income and price elasticities of rice producers' demand is zero. Under this crucial assumption, the longrun price elasticities of marketed surplus is obtained by multiplying the price elasticity of production by the inverse of the marketed proportion of production,

$$\left[\text{i.e. } \left(\frac{P_1/P_2}{Q1} \cdot \frac{\delta Q_1}{\delta P_1/P_2} \right) \frac{Q_1}{M_1} \text{ in equation } (2.21) \right].$$

This assumption, based on Behrman's own study on the domestic consumption of rice in Thailand is somewhat strange, and he himself pointed out the poor quality of the time series data used in the rice consumption study.

A more recent attempt to estimate the price elasticity of marketed surplus of food grain is that of Bardhan (11). His estimate was obtained as follows:

$$\frac{\delta S}{\delta Pf} \cdot \frac{Pf}{S} = \left[r \cdot \frac{Of}{S} - ef \cdot \frac{Cf}{S} \left(rf. \frac{Pf.Of}{O} - rc \frac{Pc.Oc}{O} \right) + \frac{Cf}{S} \left(Of - ef. \frac{Pf\ Of}{O} \right) \right] \quad \ldots\ldots \quad (2.22)$$

where S, Of, Cf, and Pf denote the sales, output, consumption and average price of food grains, respectively, Oc and Pc, the respective output and price of crops other than foodgrains; O, the farmers' income, and

$$r = \frac{\delta Of}{\delta (pf/Pc)} \cdot \frac{Pf/Pc}{Of}$$ = elasticity of production of foodgrain with respect to price ratio of grains to other crops,

$$rc = \frac{\delta Oc}{\delta (Pc/Pf)} \cdot \frac{Pc/Pf}{Oc}$$ = elasticity of production of other crops with respect to the price ratio of other crops to grains,

$$ef = \frac{\delta Cf}{\delta O} \cdot \frac{O}{Cf}$$ = cultivator's income elasticity of demand for foodgrains, and

$$\delta f = \frac{\delta Cf}{\delta Pf} \cdot \frac{Pf}{Cf}$$ = price elasticity of farmers demand for foodgrains.

Ordinary least squares method was employed to estimate the short run price elasticity which was found to be negative, implying a negative correlation between producer price and marketed surplus.

Bardhan's findings, in essence, lend support to the fixed-cash-requirement theory first expounded by Mathur and Ezekiel (106) . According to this theory, peasant farmers have a fixed demand for cash and therefore sell only that proportion of their total output that will satisfy this cash demand. Mathur and Ezekiel argued:

> An increase in the price of agricultural product makes it possible for the cultivator to satisfy his monetary requirements by selling a smaller quantity of foodgrain than before........and (retaining) the balance of his output for his own consumption. The residual is not the amount sold but the amount retained. If prices rise, the sale of a smaller amount of foodgrains provides the necessary cash and vice versa. Thus prices and marktable surplus tend to move in opposite directions.(106)

However, this theory has been criticised because of its unrealistic assumptions and also "because its conclusions do not agree with empirical facts" (117). And, although Bardhan's empirical study apparently confirms the view of Mathur and Ezekiel, Haessel(52), in a recent article has pointed out that the use of ordinary least squares method in Bardhan's study was inappropriate. Employing an alternative method - a two-stage least squares technique - and using Bardhan's set of data, Haessel computed price response coefficients which are positive and statistically significant, showing that marketed surplus responds positively to an increase in producer price.

In another recent study on marketed surplus, Ghatak (49) looked at the problem from the standpoint of the utility function of an individual farmer. To estimate the output and relative price elasticities of wheat, he employed an estimating equation of the form:

$$Y = a_o + a_1 P + a_2 Q + a_3 T_b + a_4 T_i + U \qquad (2.23)$$

where

Y = marketed surplus of wheat

P = price of wheat

Q = total output of wheat

Tb = barter terms of trade

Ti = income terms of trade

U = error term.

The result of the ordinary least squares estimation shows positive price elasticity. However, Saith,(159) in a critical comment on this study, threw light to the limitation of both the data set and the technique of estimation. A reestimation, carried out and with necessary correction for both the data set and the estimating procedure, yielded inconclusive results.

Several authors have examined the relationship between marketable surplus and total production. Some researchers (145, 22) studied this relationship by fitting linear function to the survey data, while Rao (150) observed that the semi-log model was a better fit. Raj Krishna (90) noticed that there existed both linear and non-linear relationship between marketed surplus and total production. The conclusion of most of these studies is that marketed surplus is determined mainly by total production, which conclusion was confirmed by Parthasarathy and Kamalakar (146). In their study, they found that the influence of family size on marketed surplus was almost negligible for paddy rice and that marketed surplus of paddy showed a direct relationship with farm size.

(d). Problems in the use of Statistical Regression Technique

The conventional regression approach of estimating production functions is fraught with a number of problems. First, there is the problem of accurate model specification. In the real world, production is determined by numerous forces, both technical and socio-economic , some of which are not quantifiable. For this and other reasons, it is impossible to incorporate all relevant explanatory variables in a typical model. Moreover, many factors affecting production are often correlated, giving rise to the problem of multicollinearity in statistical analysis. When multicollinearity is present, "the precision of estimation fails, so that it becomes very difficult if not impossible to disentangle the relative influences of the various (explanatory) variables" (59).

Secondly, there is the problem of serial correlation in the residuals of the fitted regression. When this occurs, doubt is cast on the appropriateness of the ordinary least squares estimation method. Specifically, the method does not yield the best ,ubiased estimates, and the estimated sampling variances of the regression coefficients may seriously under-estimate the true variance. Besides, all our statistical tests of the parameters are no longer applicable [29]. Hence, it is customary to use the Durbin-Watson [38] test and the Theil-Nagar [172] test for the presence of serial correlation.

Where time series are involved, they are generally short relative to the number of variables desirable to include. And, not only is the complex nature of production and the effects of changes in technology difficult to capture in quantitative terms, there is also the problem of uncertainty, particularly with respect to farmers expectation. However, various methods have been developed to take care of these problems. For instance, dummy variable and time trends could be used to capture technological and other non-quantifiable historical changes, while distributed lag models have been introduced to take care of farmers expectations.

Fourthly, the aggregation problem, It is often necessary in production function analysis to aggregate inputs into a relatively few categories. The problem here is that each input could be made up of heterogeneous items. If a high degree of aggregation is used, the implication of the resultant function may be of little relevance in decision making.

Apart from aggregation problem, there is also the problem of sampling. According to Reder (155) and Bronfenbrenner (51), the main criticism of production function estimation is the use of an inter-firm function to explain intra-firm relationship. Unless the farms selected for study are homogeneous with respect to soils, production methods, quality of resources and products produced, the estimated functions will merely represent crosses between several different functions. Production estimates are also affected by our present inability to quantify the management input. The consequence of this is far-reaching. For instance, since the sum of the elasticities of production with respect to each input provides an estimate of returns to scale, the omission of management from the analysis must bias the estimate of the co-efficients, and hence of the returns-to-scale estimator.

The use of production function estimates as a guide to efficient resource allocation is also fraught with problems. For a fitted function to serve as a perfectly accurate guide, some of the conditions to be fulfilled are:

(a) the inclusion of all relevant inputs, and

(b) accurate specification of production parameters (59).

Obviously, no estimated production function can adequately satisfy these restrictive conditions. Besides, production function estimates are essentially static, and their use as guides for resource allocation can refer only to the length of production period covered by the function. Moreover, where such estimates are derived from cross-sectional data, they will be affected largely by the climatic conditions prevailing during the survey period. If this period is a-typical, the usefulness of the fitted function is limited.

4. Conclusion

In this chapter, some analytical techniques and relevant previous studies have been discussed. One method of analysis that is common to some of the studies reviewed is that of the Cobb-Douglas function. The statistical problems that may exist have been pointed out, but in general, computational ease and the problems associated with alternative methods have made most researchers resort to this technique, using single equation least square method in the estimation. Given general assumption that may hold for a peasant economy, unbiased estimates are possible (104). However, the use of alternative techniques may be needed in some specific cases, if only to penetrate more forcefully into areas where available results are conflicting, particularly in studying resource-use efficiency, returns to scale, and marketed surplus response.

The conclusion is therefore inescapable that rather than advocating one analytical technique over the other, the results from all techniques should be regarded as complementary, and, taken together, should provide a more comprehensive understanding of the agricultural industry. In any case, it is necessary that all findings be qualified and used only as supporting, rather than conclusive evidences

The review presented above provides a background for the analyses that follow in the next chapters.

CHAPTER III

RESOURCE SITUATION IN RICE PRODUCTION

The present chapter examines some of the basic features of the peasant rice industry in Kwara State. In particular the resource situation in rice production will be analysed with a view to identifying the extent to which it limits the willingness and ability of farmers to expand rice production. Land, labour and capital resources will be discussed in that order.

1. Land Resource

(a) Land availability

The availability and use of farm land are necessarily affected by the existing land tenure system, the importance of which has been stressed in the literature [30, 31, 60, 2]. In general, a complicated tenure system leads to land fragmentation and militates against investment in the development of agricultural land. As Adegboye [2] pointed out, tenure arrangements can restrict progressive farmers to only poor land while fertile land is left idle elsewhere in the locality. By and large, the traditional view of land ownership in Nigeria is that of communal ownership, defined as "a situation in which a community exercises control over the occupation and use of landed property; the right of transfer and reversion is exercised only by the community as a whole"(1) . This view, however, ignores the varied land tenure systems among different communities, for, as Oluwasanmi observed, there are in Nigeria "as many tenure systems as there are ethnic groups" (140) .

To examine the tenure system in the study area, the rice farmers were asked how they obtained the land they were using for rice cultivation. The response is shown in Table 3.1.

To find out if there is any significant difference in what obtains in the three areas, an analysis of variance was carried out. The F ratio (1.2) is not statistically significant even at the 10% level, implying that there is no significant difference in the pattern of land ownership in the three areas. More than half of the respondents in Pategi and Shonga, and about 44% of those in Otube indicated that their plots were family lands.

Table 3.1

HOW LAND WAS OBTAINED FOR RICE CULTIVATION

How Land was obtained	Percentage of farmers responding			
	Shonga	Pategi	Otube	Total
Family land	76.2	61.1	43.5	60.3
Gift*	10.2	25.9	50.0	30.9
Rented	11.8	17.5	-	14.7
Borrowed	1.6	4.6	5.0	2.1

* A large proportion of the recorded "gift" land was actually family land. Most of the users in this category regarded their land as "gift" from the family.

The factors that account for this evolution of family (as against communal) ownership of land are rising population density, the increasing commercialisation of agriculture and the resultant rising value of <u>fadama</u> lands for the cultivation of rice, sugar cane, vegetables and other high-valued crops.

30.9% of the total farms were gifts, 14.7% rented and 2.1% borrowed. No land purchase case was reported during the study. The implication of this situation on agricultural land improvement has been extensively discussed in the literature*

The modal size of farm in rice cultivation was found to be roughly 1.2 hectares as shown in Table 3.2.

Table 3.2

DISTRIBUTION OF RICE FARMERS ACCORDING TO HECTARAGE GROWN IN 1977/78 SEASION

Farm size (hectares)	Percentage of farmers responding			
	Shonga	Pategi	Otube	Total
Less than 0.41	19.9	2.9	20.0	14.2
0.82 - 1.02	13.9	6.0	35.0	19.0
1.02 - 1.62	45.7	27.8	30.0	34.5
1.62 - 2.42	18.5	20.3	14.6	17.8
2.42 - 3.64	1.0	22.6	0.4	8.0
3.64 - 4.87	0.6	12.0	-	4.0
4.87 - 6.07	0.4	4.6	-	1.5
Above 6.07	-	1.8	-	0.6

* See for instance Adeniyi (3) and Adegboye (1).

Whereas about 40% of the respondents in Pategi area cultivated between 2.42 and 6.07 hectares of rice each, only 2% of the respondents in Shonga and 0.4% in Otube cultivated more than 2.42 hectares each. The largest holding cultivated by a single farmer was 9.5 hectares and the smallest, 0.21 hectares.

The farm size shown in Table 4.2 conceals much of the land fragmentation now taking place in the area. The rice farm owned by each of the respondents was in most cases on scattered plots, some of which were more than one kilometre apart. This hinders land tractorisation, and has long been recognised as a major problem in traditional agriculture (140).

When farmers were asked to indicate the factors that determine the amount of hectares they cultivated, four major factors were identified as stated below:

(i)	depends on family needs	(34.7%)
(ii)	as much as I can manage	(40.7%)
(iii)	whether labour is available	(18.6%)
(iv)	whether capital is available	(16.2%)

This suggests that managerial ability and family needs are major factors influencing rice farmers' investment decision, and that other factors such as availability of land and agricultural officials' recommendation (both of which accounted for 13.8%) do not have significant effect on farmers' scale of operation. Labour and capital availability appear to be more crucial than land availability.

In order to examine the extent to which land is available in the area, farmers were further asked to state whether or not they could obtain more land if they wanted to expand their rice production. 64% of all the respondents answered in the affirmative, suggesting that land was not a limiting factor in rice production. It is significant to note too that when asked to state all the major problems facing them in their rice production business, none of the respondents mentioned shortage of land as a major constraint.

(b) Land Use

(i) Diversified production

Analysis of production diversification not only reveals the extent of land use but also shows the major crops competing for farm labour. Moreover, as Okurume (127) pointed out, the proportion of farmers cultivating a particular crop indicates the relative importance of that crop in the economy. Although several measures of the degree of production diversification exists, the two best known measures are the percentage of farmers growing various crops and the proportion of income derived from the most important enterprise relative to other enterprises.

Apart from rice, guinea corn, maize and yam appeared to be the most popular crops among the farmers interviewed. Table 3.3 indicates that a large proportion of the respondents grew each of these crops. Next in importance were millet, melon and groundnut in that order. To test whether or not the relative ranks of the crops are independent of the area in which they are cultivated, Kendall's rank correlation analysis (E4) was applied. The coefficient of concordance, 0.30 is not significant even at the 20% level, indicating that there is no community of judgement among the three areas in the types of crop grown.

Table 3.3

OTHER CROPS BEING CULTIVATED BY RICE FARMERS

Crops	Percentage of farmers responding			
	Shonga	Pategi	Otube	All
Rice	100	100	100	100
Guinea Corn	30.5	78.7	1.0	36.4
Maize	54.2	63.8	85.0	67.67
Millet	37.2	36.1	0 .5	24.43
Melon	15.2	47.2	1.8	20.80
Groundnut	16.9	42.5	0.6	19.70
Yam	35.5	23.1	95.0	51.20
Others*	18.6	33.3	35.0	28.94

* Other crops recorded are potatoes, cassava, beans, bambaranuts, cowpeas, and vegetables.

When asked about the sources of their farm income, most of the respondents stated that about 70% of their farm income was normally derived from rice alone, indicating that while there were some diversification in terms of variety of crops grown, farmers depended highly on rice for cash income. This is an evidence that other crops are grown largely for subsistence.

Two forms of diversification were identified in the study area, namely (a) planting one crop per plot, with several crops on separate crops and (b) interplanting with other crops, except on those portions of the rice plot which are not very suitable for rice cultivation. In such cases (found mostly on rice irrigation schemes), the rationale for such interplanting has been to maximise returns to land resource particularly on irrigation schemes and to provide food for the family.

One major advantage of diversification is that it enables farmers to distribute farm labour in such a way as to keep it occupied at least for a large part of the season. Secondly, crop diversification reduces production uncertainty and makes for flexibility in income. However, against these advantages should be weighed the fact that most of the advantages of specialisation may be lost, resulting in rising average production cost and, in some cases, low yield due to competition among interplanted crops.

(ii) Influence of subsistence requirement

As indicated above, the desire for self-sufficiency in family food has been a major reason for crop diversification among rice farmers. About 90% of the respondents indicated that they had always combined at least one other food crop with their rice production business. Table 3.4 shows the percentage of farmers producing various proportion of their food requirements.

Table 3.4

DISTRIBUTION OF FARMERS PRODUCING VARIOUS PROPORTION OF THEIR FOOD REQUIREMENT

Proportion of food requirement produced	Percentage of farmers responding			
	Shonga	Pategi	Otube	All
75% and above	8.6	41.6	5.0	17.2
50 - 74%	47.4	37.9	44.4	46.2
35 - 49%	42.4	5.6	53.6	33.9
20 - 34%	1.6	4.6	-	2.3

An analysis of the frequency distribution of the farmers' response in the three areas yields an adjusted X^2 value of 147.6 (d.f. = 6), which is statistically significant at the 1% level. This shows that there is a significant difference in the degree of subsistence production in the three areas. The degree of subsistence is higher in Pategi where 79.5% of the respondents were producing above 49% of their food requirement. The percentage of farmers producing above 74% of their food requirement in Pategi was 41.6% as against 8.6 and 5.0% in Shonga and Otube respectively. On the whole, 63.4% of all the farmers interviewed were producing above 49% of their food requirement.

Various factors are responsible for this relatively high degree of subsistence in food production, prominent among which is poor marketing arrangement and unreliability of market supply of food in the area of study. This, to some extent, explains why some farmers tend to minimise their reliance on rural markets for food stuffs by striving for a high degree of self-sufficiency in food (114).

Given this drive towards self-sufficiency, one might call into question the general assumption that peasant farmers tend to allocate their resources in such a way as to maximise cash income. As Olayemi[128] rightly pointed out, such assumption is probably valid only to the extent that the drive towards income maximisation does not encroach on the minimum resources required for subsistence production. In the event of conflict between maintaining minimum level of subsistence production and maximising cash income, the former, in general, takes precedence over the latter. This is not necessarily irrational. In the drive towards efficiency in resource allocation, peasant farmers generally compare income maximisation on the one hand, with self-sufficiency in food production and the satisfaction derived from the minimisation of risks and uncertainty associated with heavy reliance on the local markets for food. Whatever is lost in terms of cash income provides a measure of the cost of self-sufficiency and the satisfaction derived from minimising risks and uncertainties. This factor necessarily affects farmers' responsiveness to price changes, since the degree of their responsiveness will depend, in the ultimate, on the degree of desired production diversification and the desired self-sufficiency in food production.

2. Labour resource

(a) Introduction

Labour is obviously one of the most important input in traditional agriculture. As Mellor observed: "the two prime inputs of traditional agriculture are land and labour. Capital is not only less important in quantity, but also it is largely a direct embodiment of labour in the form of land improvement, water system and simple tools"(108) .

Some few years back, the labour-surplus models of Lewis (97) and Ranis and Fei (153) were commonly applied to the analysis of the agricultural labour market of most less developed economies. The argument has been that the marginal productivity of labour was close to zero or even negative in these economies, so that the problem is essentially how to transfer the surplus labour in the agricultural sector to other sectors for useful employment.

Whilst these models might be relevant for some under-developed agricultural economies, particularly Asia, their application to traditional African agriculture has been questioned. With reference to Nigerian agricultural economy for example, Heilleiner has argued that although there exists pockets of labour-surplus areas in the economy, much of this economy can be described as being "labour-scarce" or "land-surplus" He maintained:

> In most of Nigerian agriculture, labour (even of the unskilled sort) was,and is, a scarce factor of production. It carries a price (the wage rate), which unlike that in labour surplus economies probably roughly approximates its marginal productivity. Labour for agriculture must there-fore be bid away from alternative occupation (60) .

This model is no doubt germane to an understanding of rice production in Kwara State.

Given the low level of technology in peasant economies, the quantity and quality of agricultural output produced in these economies depend to a large extent on the availability of labour, age, farming experience and literacy of farmers, and subsidiary occupations which compete for the available labour. Each of these will be discussed in turn.

(b) <u>Availability of labour</u>

The three major categories of farm labour available to farmers in the study area are family labour, exchange labour and hired labour. The amount of family labour available to an individual farmer depends, to a large extent, on the size and composition of his family. In order words, it depends largely on the potential labour foce, defined as all the family members living with the farmer, irrespective of their willingness and ability to work. The observed potential family labour force in the study area ranged between 1.0 and 14.0 standardised man-years per family, the modal size being 4.0 man-years.

When family labour is insufficient (as is often the case during peak seasons), farmers, in general, depend on either communal labour or hired labour. Alternatively, a number of households (usually of the same extended family) combine to pool their labour resources by farming as a group. The produce of the farm is controlled by the head of the farming group (usually the oldest member) also own individual "private" plots which they cultivate usually during their spare time, although such plots rarely exceed ½ hectare per farmer. When farmers were asked to state how they normally obtained labour for their farm work, 59.8% of the respondents mentioned family labour, 29.6% communal labour and 19.5% hired labour (Table 3.5).

Table 3.5

PROPORTION OF RICE FARMERS WHO DEPEND ON A PARTICULAR TYPE OF LABOUR

Type of labour	Percentage of farmers responding			
	Shonga	Pategi	Otube	All
Family labour	74.5	35.1	70.0	59.8
Communal labour	23.7	45.1	20.1	29.6
Hired Labour	1.6	15.1	40.6	19.5

The table reveals the dominant role being played by both family and communual labour in rice production.

To examine whether or not farmers' dependence on different type of labour varies from area to area, an analysis of variance was carried out. This gives an F value of 2.1, which is not statistically significant at any acceptable level of probability, implying that there is no significant difference in farmers' dependence on different type of labour in the three areas. About 60% depended on communal labour - particularly the exchange labour. Under this system, farmers of roughly the same age group form themselves into exchange labour group, the size of which varies between two and one hundred people. The group members work in turns on the farm of each member. Although payment for the group work is not obligatory, the host member (i.e. the current recipient of the group's service) is expected, by convention, to entertain the group with food and drinks. The amount expended on such entertainment depends on the size of the group and the amount of work done.

In order to determine the extent to which labour is available, farmers were asked whether or not they could obtain labour any time they needed it, While 77.9% of farmers in Shonga indicated that they could obtain labour always, only 42.6% and 30% of farmers in Pategi and Otube respectively gave similar answer. The rest indicated that they could obtain labour only occasionally, thus suggesting that labour is one of the limiting factors in their rice production enterprise.

(c) Age Distribution and Farming Experience

Age affects labour productivity and the adoption of innovation. Experience in many countries* shows that old farmers adhere strictly to traditional methods while younger farmers who are generally thought to be more adventurous are more willing to take risks and adopt new methods in order to enhance their economic position. Labour productivity is also affected by farming experience, especially where farmers have little or no formal training. And for a meaningful inter-farm comparison, it is necessary, among other things, to examine farmers' farming experience in order to identify causes of variation in farm incomes.

* See for instance the work of Hoffer(94) Rogers (153) and Brown (129).

Most of the farmers interviewed were between 30 and 45 years old as shown in Table 3.6, the observed modal age being 40 years. If we define old farmers to

Table 3.6

AGE DISTRIBUTION OF RICE FARMERS

Age (Years)	Percentage of farmers responding			
	Shonga	Pategi	Otube	All
Less than 20	1.0	3.7	-	1.6
20 - 24	3.6	5.6	5.0	4.7
25 - 30	19.9	36.1	20.0	25.3
31 - 35	24.3	23.1	15.0	20.8
36 - 40	16.6	12.9	15.0	14.8
41 - 45	26.0	10.2	25.0	20.4
46 - 50	8.6	6.5	10.0	8.4
Above 50	-	1.9	10.10	3.9

include all those who are above 35 years* about 50% of the farmers interviewed were old. The proportion of those above 35 years is 51.2% in Shonga, 31.5 in Pategi and 60.0% in Otube. On the whole only 1.6% of the farmers were below 20 years, indicating that young school leavers in the area were not taking to farming. All this may have adverse effects on structural transformation in agriculture and the adoption of innovations. An analysis of rice farmers' farming experience is presented in Table 3.7

Table 3.7

NUMBER OF YEARS SINCE FARMERS HAVE BEEN GROWING RICE

Years	Percentage of farmers responding			
	Shonga	Pategi	Otube	All
Less than 6	25.4	3.7	5.0	11.4
6 - 10	35.6	10.2	20.0	18.6
11- 15	6.8	20.4	30.0	19.1
16- 20	8.5	33.3	10.0	17.3
More than 20	23.7	32.4	35.0	30.4

* This definition seems justifiable, particularly in view of the fact that most Nigerian farmers generally tend to understate their age.

The table suggests that about 50% of all the farmers interviewed have been growing rice for 16 years and above. The proportion of farmers who have been growing rice at least for the past 11 years in Pategi (86.1%) is higher than those of Otube (75.0%) and Shonga (39.0%). The corresponding average figure for the three areas is 66.8%, thus indicating considerable farming experience among rice farmers. It is pertinent to stress that while this experience might promote efficiency in rice production, it could also generate conservatism and militate against the adoption of innovation in rice farming.

(d) Education and Literacy

Literacy helps in eradicating ignorance and in promoting the uptake of innovation. A recent study by Miller[109] shows that ignorance is one of the major factors limiting the adoption of improved techniques among some farmers in the former Western State of Nigeria.

Where farmers have some education and are able to read the job of disseminating new methods among them becomes relatively easy. Newspapers and pamphlets containing instructions written in English and/or local languages become useful media of information. Moreover, farmers' managerial competence in formulating and executing plans as well as their efficiency in record keeping depend largely on the type of education they have, and whether or not they are literate.

Only 4.6% of the farmers interviewed in Pategi and 1.7% in Shonga had primary education as revealed by Table 3.8.

Table 3.8

FORMAL EDUCATION AMONG RICE FARMERS IN KWARA STATE

Type of Education or School	Percentage of farmers responding			
	Shonga	Pategi	Otube	All
No School	15.3	46.3	10.0	23.9
Koranic School	83.0	47.2	20.0	50.1
Adult Education	-	1.9	90.0	30.6
Primary Education	1.7	4.6	-	2.1

While 90% of farmers in Otube area had attended adult education classes, none of these farmers had ever attended primary school. A large proportion of farmers interviewed in Shonga and Pategi attended Koranic School. On the whole 50.1% of all the respondents have attended Koranic School while over 70% have never attended either adult education or primary school.

This low level of farmers' education is reflected in their level of literacy as shown in Table 3.9

Table 3.9

LITERACY AMONG RICE FARMERS IN KWARA STATE

Level of literacy	Percentage of farmers responding			
	Shonga	Pategi	Otube	All
Can read and write vernacular	5.0	14.8	35.0	18.3
Can read and write Arabic	-	7.4	-	2.5
Can read and write English	3.4	0.9	5.0	3.1
Can neither read nor write any language	90.3	82.1	75.0	82.5

Less than 8% of all the respondents could either read or write any language. The implication is clear: in a situation where most of the farmers are illiterate, literatures on rice farming have little or no practical use. Rather much reliance would have to be placed on other form of extension education conducive to rapid progress in rice production.

(e) Subsidiary Occupations

It is necessary to examine the subsidiary occupations in which farmers are engaged in order to determine the extent to which these other occupations compete for farmers' labour. In general, farmers who engage in full-time farming are expected to be more efficient and more ready to explore new methods which offer increases in farm incomes than those who engage in farming as part-time business. On the other hand, subsidiary occupations generally make possible a fuller use of farmers' labour, especially during slack seasons.

As shown in Table 3.10, fishing appeared to be the most important subsidiary occupation among rice farmers with over 30% of the farmers in Pategi, Shonga and Otube engaging in this occupation. In Pategi, the next major occupation is weaving, followed by tailoring and "contract" business.

Table 3.10

SUBSIDIARY OCCUPATIONS AMONG RICE FARMERS IN KWARA STATE

Type of occupation	Percentage of farmers responding			
	Shonga	Pategi	Otube	All
Fishing	38.9	37.9	30.5	35.8
Weaving	-	13.9	-	4.6
Tailoring	6.8	4.6	-	3.8
Trading	6.8	3.7	5.0	5.3
Civil Service work	3.4	2.8	-	2.2
Bricklaying	3.4	4.6	-	2.6
Koranic Teaching	5.3	1.3	-	2.2
Animal rearing	-	1.8	-	0.6
"Contract" business	-	4.6	6.4	3.5
Others*	1.2	0.3	5.6	2.3

* Other occupations recorded include carpentry, drumming, mat making and blacksmithing.

Tailoring and trading rank next to fishing among farmers in Shonga while, in addition to fishing and trading, "contract" business is a major subsidiary occupation in Otube. On the whole, the proportion of farmers who engage in subsidiary occupations is smaller in Otube than in Shonga and Pategi.

In summary, then, the analysis on labour resource situation in rice farming reveals the dominant role played by communal labour, the ageing farming population, the low level of literacy among farmers and the relative importance of subsidiary occupations. As will be evident in some of the sections that follow, all these have significant effects on such issues as the adoption of innovation and the level of productivity in farming.

3. Capital Resource

(a) Availability and Use of Capital

For our purpose capital may be defined as the existing stock of wealth used in the production of goods and services.

Two categories of capital can be distinguished:

(i) fixed capital such as storages, tools and equipment, and

(ii) working capital such as cah set aside for production purpose, seeds, and fertilizers.

(i) <u>Fixed Capital</u>

Our survey revealed that the dominant impliments in rice production were hoes, cutlasses and sickles. An average farmer had roughly three hoes, one cutlass, two sickles and one or two <u>rhumbus</u> used for storage. The latter is a mud, thatched-roof hut with only one small opening. Because of its poor ventilation, the <u>rhumbu</u> is generally not used for storing the paddy rice which is reserved for seed.

The survey revealed that the use of tractor is becoming increasingly popular in the area. The percentage of farmers who made use of government tractor hiring service in Otube, Shonga and Pategi areas were 70%, 50% and 21.3% respectively, with an average of 47.1% for all the respondents. When asked why they did not use tractor, the non-tractor users responded as shown in Table 3.11.

Table 3.11

FARMERS REASONS FOR NOT USING TRACTOR

Reasons	Percentage of farmers responding			
	Shonga	Pategi	Otube	All
No money	42.1	4.4	1.3	15.5
Tractor not available	13.6	38.9	0.5	17.5
Tractor did not arrive on time	36.8	35.6	2.4	24.1
Tractor service too expensive	5.3	5.6	6.0	5.5
Others*	2.6	15.6	-	6.1

* Other reasons given include smallness of farm size and disagreement with tractor drivers.

While lack of money appeared to be the major limiting factor in Shonga area, most of the non-tractor users in Pategi area indicated that non-availability and late arrival of tractor accounted for their not using this impliment during the season. The use of tractor is becoming popular in the study area, and the demand for tractor service is on the increase. At the present subsidised rate of ₦27.18 per hectare for ploughing and harrowing, many farmers consider it cheaper to employ tractor rather than hired labour for land preparation.+

(ii) Fertiliser and Seeds

Discussion with the farmers revealed that fertiliser and improved seeds were readily available from government sales agents. About 97.8% of the respondents applied fertiliser during the season and different varieties of rice were grown.

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* It was discovered that there were some privately owned tractor hiring units in the study area. Despite the fact that these units charged more than double the government rate, the demand for their services was still on the increase.

Table 3.12 shows the percentage of farmers growing particular varieties of rice.

Table 3.12

PERCENTAGE OF RICE FARMERS GROWING PARTICULAR VARIETIES OF RICE

Rice varieties	Shonga	Pategi	Otube
B.G. 79	5.1	3.7	85.0
Mass - 2401	74.5	58.3	30.0
SML - 140/10	10.2	27.7	50.0
IR8	1.6	6.7	-
Siam - 79	5.1	7.1	15.0

The table reveals that whereas most of the respondents in Otube area grew BG.79, Mass - 2401 was most popular among the respondents in the other areas, with 74.5% of the respondents in Shonga and 58.3% in Pategi growing this variety.

It is significant that none of the respondents grew red rice (Oryza Glabberrima), a variety which constituted about 40% of the rice produced in the Northern States during the 1950's. It appears that this variety has been completely replaced by white rice (Oryza Sativa), evidently due to the low market value of the former.

(ii) Working Capital (Cash and Credit)

The importance of working capital in agricultural production lies in the fact that it is around this production factor that other factors exert their influence. Capital shortage, for instance, limits farmers ability to employ other factors of production; as a result it limits the adoption of innovation and scale expansion. Recent studies have shown that when increased capital base is combined with improved technology, greater opportunity exists for increased output and higher level of farm income (122, 124).

The two major sources of credit supply in Nigeria

are institutional and non-institutional sources*.
The former include development and finance corporations, commercial banks and cooperative societies; the latter include personal savings and loans from friends, relatives and money lenders. However, lending to peasant farmers has been limited almost entirely to the non-institutional sources.

In the present study, 78.7% of the respondents reported that they had obtained loan from their farming operation, 91.7% of which came from the non-insititutional sources alone. This is shown in Table 3.13.
None of the loans in Pategi and Otube and only 3.3% of those in Shonga were obtained from commercial banks.
On the whole 12.1% of the farmers got loans through the co-operative societies.

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* For detailed discussions on the organisation and co-operation of these sources, see Oshuntogun (143) Oluwasanmi and Alao (139) and Teriba (171).

Table 3.13

SOURCES OF CREDIT TO RICE FARMERS IN KWATA STATE

Credit Source	Percentage of farmers responding			
	Shonga	Pategi	Otube	All
Non-Institutional				
Friends, relatives and neighbours	58.0	71.6	60.0	63.2
Money lenders	38.0	26.5	21.5	28.5
Institutional				
Banks	3.3	-	-	1.2
Co-operative societies	13.3	3.0	20.0	12.1

When farmers were asked to indicate where they could get more credit if they wished to expand their rice production, the answers (presented in Table 3.14) lend further support to the view that non-institutional sources still dominate the farmers' credit opportunity. Whereas over 80% of the respondent looked to non-institutional sources for more credit, only 11.2% looked to

Table 3.14

POTENTIAL SOURCES OF CREDIT TO RICE FARMERS IN KWARA STATE

Sources	Percentage of farmers who were hopeful of getting loan from these sources
Neighbours (Wives, relatives and friends)	65.0
Money lender	24.2
Banks	7.6
Government(Co-operative Societies)	3.2

institutional sources. As is evident from Table 3.15 loans were, in some cases, obtained for more than one purpose by a single farmer.

Although various purposes of borrowing were reported among the rice farmers, the most common purposes were investment in farming (78.7%) and family living (37.9%).

Table 3.15

PURPOSE OF CASH BORROWING AMONG RICE FARMERS

Purpose	Percentage of farmers responding			
	Shonga	Pategi	Otube	All
Farming	92.3	53.8	90.0	78.7
Family living	65.3	33.3	15.0	37.9
Ceremonies	-	12.8	-	4.3
Others*	19.2	-	1.2	6.4

* Others include bride-price payment, trading, payment of school fees and pilgrimage to Mecca.

In addition to cash borrowing, some of the respondents reported rice borrowing. 65.2% of these rice borrowers state that the rice was used for planting while 54.3% reported family feeding as one of the major reasons for borrowing rice.

What stands out clearly in this analysis is the considerable credit experience among farmers and the negligible role of formal credit institutions in small holder rice production. According to Miller (110) the reluctance of credit institutions in extending credit to small farmers is due largely to high loan delinquency among these farmers, which in turn is partly a result of farmers ignorance of highly profitable uses for credit. Moreover, since all the commercial banks are operating for profit, most of their credit policies are often oriented towards aiding non-agricultural enterprises largely because the latter are, in general, able to meet banks' rigid repayment schedules and provide collateral security. Loans from non-institutional sources are generally small* and of a short duration. Although these sources have the advantage of being quick, more personal and informal, it should be noted that reliance on them is a disadvantage. Besides receiving high interest in some cases, this category of lenders also,

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* The amount of credit received from this source ranged between ₦6 and ₦400 as revealed by the present study, the average size being ₦55 per loan.

in many cases, enjoy obligatory patronage at uncompetitive prices when farmers sell their products.

The existing credit experience among farmers suggests that rice production could be significantly increased through an efficient credit programme. Farmers' demand for loans from credit institutions will evidently grow, and, given the present drive towards farm mechanisation and the increased use of new inputs, it is reasonable to expect that the non-institutional source of credit would become inadequate. Herein lies the rationale for over-hauling credit institutions in Kwara State with a view to making loans (particularly group loans), available to farmers, although great care should be taken to avoid problems of non-repayment and excessive costs of supervision. It is believed that when combined with programmes providing adequate extension education, timely and adequate supplies of inputs and profitable market outlets at the village level, such loans would play a vital role in the rice production industry.

4. Summary

The foregoing analysis examines the resource situation in rice production enterprise with a view to identifying the extent to which it militates against innovation, production expansion and structural transformation. It was shown that although land was not a major constraint in production, the existing land tenure system imposes some limitation on land development for production purpose. In general, land use was characterised by a relatively high degree of crop diversification and subsistence production. While labour might not be regarded as an extremely scarce factor, the observed ageing of the farming population as well as the widespread illiteracy among farmers are expected to have adverse effects on the level of productivity, the degree of mobility, the level of aversion to investment risks as well as the adoption of innovation in farming.

The analysis shows also the rudimentary nature of farmers' fixed capital asset, the increasing demand for government tractor hiring service and the increasing use of fertiliser and improved seeds. In general, capital appeared to be the most limiting factor in rice production. Given the considerable credit experience among rice farmers, it is reasonable to believe that rice production could be significantly increased through an efficient credit programme ; hence the need for a more comprehensive study of the pattern of credit utilisation in rice farming with a view to streamlining agricultural credit programme such as is conducive to rapid expansion in rice production. The next chapter examines the efficiency in the use of the existing resources.

CHAPTER IV

ANALYSIS OF RICE PRODUCTION ENTERPRISE

The analyses in the preceding chapters provide sufficient background for what follows in this chapter. One of the objectives here is to analyse the economic performance of rice farmers with a view to identifying measures for increasing rice output and farm incomes in rice production enterprise. The observed production practices will be discussed first as a background for the costs and returns analysis that follows. In addi- tion, production function approach will be employed to examine resource productivity and resource - use efficiency in rice farming.

1. Observed Production Practices

In the study area, farming operations on small holders' rice fields generally start with land preparation - clearing, burning, ploughing and harrowing. In many cases, these operations are performed by communal labour, and hand tools are commonly employed.

Perhaps due to the prevalence of tsetse flies, none of the respondents made use of bullock-drawn implements. As mentioned earlier, however, farmers demand for government tractor hiring service is on the increase. On rice irrigation schemes, tractorisation occurs only between March and June when there is little or no water on the rice fields; hence many farmers find it necessary to re-prepare the tractorised land before transplanting in July, August or September.

Nursery work normally starts between May and June, with the farmers using either seeds reserved from previous harvest or seeds bought locally at the rate of ₦1.00 per measure (ananias) of 3.17 kg. weight. Planting at stake (common on non-irrigated fields) and transplanting (mostly on irrigated fields) are performed largely by communal labour, and in some cases by hired labour. Contrary to expert recommendation, late planting/ transplanting is not uncommon, particularly on irrigated farms where farmers usually concentrate on upland farming for the first two or three months of the wet season. The first general weeding is with the small hoe, followed later by hand-pulling the weeds as they appear.

Apart from draining rice fields during fertilizer application and harvesting, very little effort is made by the irrigated rice farmers with regards to water control on their irrigated rice fields.

Damage by birds was found to be one of the major hazards on rice fields in the study area. This damage occurs during three stages of plant growth, namely, the germinating stage, the milking (or heading) stage and the late harvesting stage. The common bird-scaring method is to shout and fling stones at these birds. But the practice hardly scares them away; at best it merely keeps them away for few minutes or drives them from one rice field to the other.

Harvesting is performed when the rice seeds are ripe. The harvesting practice consists of grasping a handful of stems and cutting them with sickle about 7.6 centimetre above soil surface. The harvested plants are piled up in small heaps on the stubbles at various places on the field. After completing the whole field, the farmer prepares the treshing floor in the centre of which a semi-circular disc-like pit is dug. The harvested plants are later collected and piled up encircling the central pit with all the rice heads facing inwards. The plants remain in this position for about 7 to 14 days before threshing, depending on the size of the harvest and the time available. Threshing operation is performed by beating the rice pinacles into the central pit and the seeds are later collected and winnowed, usually by women. This latter operation is performed so as to separate the chaff and empty grains. The stalks of rice plant are later burned, or in some cases used as building materials. Since one harvest per year is generally obtained on rice fields throughout the study area, the fields are normally fallowed for the rest of the year; hence rice fields are generally not rotated.

Production practices described above are in constrast to what obtains on the government-owned rice plantation in Shonga area, under the management of the Kwara State Agricultural Development Corporation. Unlike what obtains on the small-holders' plots, most of the operations on the plantation - including land preparation, planting, harvesting and threshing - are mechanised. For this purpose, the corporation maintains five combined harvesters, two seed drills, nine disc ploughs and eleven tractors. Direct planting (planting at stake) is the common practice. The only major operations performed by manual labour are weeding, bird scaring and bagging. Even in the case of weeding, manual labour is needed only to supplement the use of herbicide, particularly to deal with stubborn grass.

Owing to the varying landscape on the plantation, three rice varieties - IR8, Maliong, and Mass - 2401 - are generally planted, each of which is harvested, threshed and bagged seperately for transmission to the corporation's rice mill at Pategi.

Bird scaring appears to be the most labour intesive operation, with about 150 out of the existing 200 casual and non-casual labourers engaged in this operation. It is reported that during the last growing season, about ₦6000 was paid as wages to the scarers who normally work from dawn to dusk on shift basis, shouting and flinging stones at the birds all over the 230.6 hectares of planted field. The management claimed that damage by birds reduced total yield to about half of the expected output last season, which partially explains why average yield dropped from 2017.0 kg. to 1120.6 kg. per hectare.*

Thus, unlike what obtains on government-owned rice plantation, most of the operations on the smallholders' plots are performed mannually. In general, production on these plots is characterised by, among other things, low level of technology, late planting/ transplanting, and the devotion of a substantial part of the available labour to the scaring of predatory birds.

2. Cost Analysis

(a) Physical Inputs in Production

Physical inputs per hectare are presented in Table 4.1.

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* These pieces of information were obtained from the Farm Manager and the rice project manager, Kwara State Agricultural Development Coroperation, Ilorin.

Table 4.1

PHYSICAL INPUTS PER HECTARE: KWARA STATE PEASANT RICE PRODUCTION

Area	Number of farmers	Average hectarage	Average Man-days	Average fertiliser input (kg)	Average Seed input (kg)
Shonga	80	0.99	92.6	120.7	8.2
		(0.41)*	(360.8)	(13.0)	(10.5
Pategi	50	1.55	124.4	119.4	28.1
		(1.1)	(481.3)	(30.6)	(24.5)
Otube	20	.98	234.4	141.0	21.3
		(0.84)	(862.6)	(35.0)	(12.7)
All	150	1.17	122.1	123.0	17,6
		(0.76)	(503.9)	(20.1)	(15.4)

* Figures in parentheses are the standard deviations of the estimates above them.

Labour input ranged from 92.6 man-days per hectare in Shonga to 234.4 in Otube, with an average of 122.1 for the whole area. A marked diversity in the use of labour among rice producers is evident from the high standard deviation of these estimates. This diversity could be due, among other things, to differences in labour requirement between irrigated and non-irrigated rice farms, observed variation in production practices as well as farmers dependence on different types of labour. It was observed, for instance, that farmers who depended heavily on hired labour used labour input more sparingly than those who depended mainly on family labour. Diversity also existed in the use of labour among different farm sizes. Table 4.2 shows that labour input per hectare decreases with increase in farm size. Whereas the labour input on large farms was, on the average, 98.0 man-days per hectare, the corresponding figure for small farms was 144.8.

Table 4.2

LABOUR INPUT PER HECTARE BY FARM SIZE

Farm Size	Average hectarage	Man-day per hectare
Large Farm	2.3	98.0
Small Farm	.64	144.8

This is in consonance with the common view that small farms, in general, use more labour per hectare than large farms. The reason might be that unlike the large farm which is more dependent on hired labour (to whom wage has to be paid at the market rate), the smaller farms depend largely on family labour who usually work on the farm at a less-than-market wage rate.*

* This point is discussed further on page 143.

On the whole labour input per hectare appears to be lower in the study area than in some other rice producing areas as shown in Table 4.4. It is possible, however, that some of these differences merely reflect differences in method of data collection, cultural practices, ecological condition as well as the period of investigation.

It is observed from Table 4.1 that fertiliser input per hectare was 120.7 kg. in Shonga, 119.4 kg. in Pategi and 141.0 kg. in Otube with an average of 123 kg. for the whole area, an average much less than the 228.6 kg. per hectare recommended for the area. On the other hand, the average seed input of 17.6 kg. per hectare was higher than the recommended quantity of about 15 kg. per hectare.

It is clear from this analysis that, in the area of study, physical inputs employed per hectare vary considerably between one farm and another within the same area, and between one area and another. These differences are naturally reflected in rice production costs and returns for different farms and areas.

(b) Structure of Costs

The profile of production costs per hectare is presented in Table 4.5. Estimated cost of production per hectare was ₦147.4 in

Table 4.4

LABOUR REQUIREMENT FOR PADDY PRODUCTION IN SELECTED AREA

Country	Kind of Rice situation	Year	Labour required per hectare (Man-days)
Comilla Tana(a) (Pakistan)	Irrigated IR-8	1967	170.5
Sierra Leone (b)	Upland	1966	551.0
Nigeria:			
Abakaliki (b)	Swamp(Transplant)	1962	202.6
Western Ishan (c)	Upland	1971	189.5
Bida (b)	Irrigated	1966	180.4
Bida (f)	Irrigated	1973	140.8
Kwara State: (g)			
Shonga	Swamp	1977	92.6
Pategi	Swamp/Irrigated	1977	119.5
Otube	Swamp/Irrigated	1977	234.4
			(122.1)*

Notes: (a) Derived from H. Anwaral (8)
(b) USDA/USAID (41)
(c) Oboh, D.O (120)
(d) Osifo D.E (141)
(e) Osifo D.E (142)
(f) Adeniyi J.P. (4)
(g) Present Survey

* Figure in parenthesis is the average for Kwara State.

Table 4.5

PRODUCTION COSTS IN KWARA STATE PEASANT RICE FARMING
(₦ PER HECTARE)

Area	Labour	Ferti-lizer	Seed	Cost of Tractor Hiring	Deprecia-tion	Total Cost
Shonga	88.4 (60.0)	19.3 (13.1)	2.6 (1.8)	31.2 (21.2)	5.9 (4.0)	147.4
Pategi	160.1 (71.1)	21.1 (9.3)	8.9 (3.9)	29.0 (12.9)	6.4 (2.8)	225.5
Otube	326.6 (82.4)	25.4 (6.4)	6.7 (1.7)	31.1 (7.8)	6.4 (1.6)	396.2
All Areas	143.7 (69.8)	20.4 (9.9)	5.6 (2.7)	30.0 (14.6)	6.1 (3.0)	205.8

Figures in parentheses are the percentages of total cost. The per-hectare cost of tractor hiring is higher than the amount indicated on p.98, due, perhaps, to the alleged "foul play" on the part of tractor operators.

Shonga, ₦225.5 in Pategi and ₦396.2 in Otube. The average for the whole area was ₦205.8 per hectare. As expected of traditional labour-intensive farming, labour was the dominant element in cost, accounting for about 70% of total cost of paddy production on the farms studied. The contribution of fertilizer and seed was 9.9 and 2.7% respectively.

Table 4.6 shows various categories of labour cost as a proportion of total labour cost. Family labour cost accunts for about 50% of total labour cost while communal and hired labour cost account for 28.8 and 23.5% respectively. In Shonga, the use of communal labour

Table 4.6

VARIOUS CATEGORIES OF LABOUR COST AS A PROPORTION OF TOTAL LABOUR COSTS

Area	Family Labour		Communal Labour		Hired Labour		Total labour Cost(₦ per hectare)
	₦ per hectare	% of Total labour cost	₦ per hectare	% of Total labour cost	₦ per hectare	% of total labour cost	
Shonga	91.2	48.3	64.0	33.8	34.05	17.9	189.25
Pategi	126.2	46.1	75.2	27.5	72.08	26.4	273.48
Otube	276.0	54.9	99.4	19.8	126.6	25.3	502.0
All	126.6	47.5	77.4	28.8	62.5	23.5	266.5

appeared to be more prominent and that of hired labour less significant than in Pategi and Otube. This may be explained in part by severe competition for hired labour from the Shonga ADC rice project.

3. Analysis of Returns

(a) Yields

Returns from paddy rice by area are presented in Table 4.7. Yields per man-day (a crude measure of labour productivity) were 31.7kg, 26.5kg, and 7.9kg, in Shonga, Pategi and Otube respectively. The average for the three areas was 22.1 kg. Yields per hectare (a measure of land productivity) ranged from 1262.5kg in Pategi to 1653.2kg in Shonga, with an average of 1506.9kg for the whole area. This, although higher than the estimated yield of 1463.5 kg per hectare in the 1950 sample census (44) is less than the recent national estimate of 1680.9kg. And when it is realised that yields of over 5600 kg. per hectare have been obtained on experimental plots for some swamp rice varieties in Nigeria, the low average yield observed in this study becomes disturbing. This low yield is due to various factors, prominent among which is inadequate fertiliser application, the mild drought which occurred in some parts of the area during the study period, damage by predatory birds and late planting.* The latter factor needs further comment. Whereas experiments in Badeggi Rice Research Station indicate that for each rice variety, the best yields were obtained with the August planting (beyond which yields

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* Other possible factors include low level of literacy among farmers and ageing farming population as pointed our in the last chapter.

Table 4.7

ANALYSIS OF RETURNS IN KWARA STATE PEASANT RICE PRODUCTION

Item	Shonga(N=80)		Pategi (N=50)		Otube (N=20)		All Areas(N=150)	
	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
Rice yield(kg)	1653.2	31.7	1262.5	26.5	1510.3	7.9	1506.9	22.1
	(35.5)*		(26.7)		(18.0)		(21.3)	
Gross Returns(₦)c	542.4	10.4	414.2	8.7	495.5	2.6	494.4	7.4
Total Cost (₦)	184.4	2.0	262.5	2.1	433.2	1.8	242.8	2.0
	(8.9)		(10.5)		(6.1)		(9.0)	
Net Returns(₦)	358.0	8.4	151.7	6.6	62.3	0.8	251.6	5.4

Notes: N = Number of respondents

(a) = Data on per hectare basis

(b) = Data on per man-day basis

(c) = Computed on the basis of ₦25 per bag (76.2kgs)

* = Numbers in parentheses are the standard deviations of the parameters above them.

were drastically reduced)[46], many farmers (particularly those on irrigation schemes) did not start rice cultivation until around September when they had finished a large part of their other farm activities. It was observed that some farmers continued transplanting up to late October, with the belief that irrigation water could be depended upon at anytime of the year. This was not always so. In fact during the survey period, irrigation water became extremely scarce by late November due to sudden cessation of rain some weeks earlier.

It is possible to employ yield per hectare as a simple measure of technical efficiency of crop production by comparing actual yield per hectare with the potential yield per hectare of the best rice variety*. The potential yields of recommended rice varieties are shown in Table 4.8, the highest average yields being 3967.2 kg. per hectare. This figure was used in this study to compute technical efficiency in Kwara State rice production.

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* Olayide _et al_ employed this measure to classify the crop production efficiency for various states in Nigeria. The method adopted was to compute actual yield as a percentage of potential yield, and to classify the production efficiency as follows: A = above 90%; B = 60-90% C = 20-59%, D = less than 20%, For detail see Olayide _et al_.[133]

Table 4.8

AVERAGE YIELDS (IN KG. PER HECTARE) OF THE RECOMMENDED RICE VARIETIES IN THE MULTIPLICATION PLOTS (STAGE I) AT FEDERAL RICE RESEARCH STATION BADEGGI - AVERAGE FOR FIVE YEARS, 1967 - 1971

Variety	1967	1968	1969	1970	1971	Total	Mean
Maliong	2848.5	2122.0	2350.3	2172.5	1617.6	11116.9	2222.9
I.C.B	2242	-	1895.6	2843.9	714.1	7695.7	1923.6
SIAM-79	3679.12	3107.4	3782.2	3782.3	2086.2	16437.2	3287.9
Kay 12	2394.5	2879.8	2139.9	2134.4	1915.8	11464.5	2292.4
BG. 79	2876.5	3762.1	3086.1	4463.8	3616.3	17803.7	3561.4
Tjina	3209.4	3295.6	1671.4	1671.4	1930.4	10878.1	2175.9
D-114	2210.6	3072.7	2212.9	2215.10	2113.0	11846.17	2369.8
SML-140/10	1924.8	-	5682.3	3860.7	4398.0	15860.6	3967.2
Mas-2401	2753.2	4931.3	1771.1	2716.2	4515.4	16687.2	3337.2
IR. 8	4272.1	-	3933.6	1507.7	3350.7	13064.1	3266.6
Mak-823	3771.01	976.4	2485.3	2485,3	21849.8	11899.4	2381.0
Sindaro	1894.4	2950.5	1511.1	3158.9	36170.5	13132.5	2626.5
OS. 6	2208.4	-	3876.4	-	1987.8	8068.9	2689.3
D - 99	4299.9	3345.1	1617.6	-	-	9242.6	3080.5

Source: Federal Rice Research Station, Badeggi.

In this respect, rice yield in the area of study was, on the average, only 38% of the potential yield, thereby indicating low technical efficiency.

(b) Returns

Average net revenue per man-day for all farms was ₦5.4 (Table 4.7) as against a recent estimate of ₦6.4 for the area (119). Net revenue per hectare was ₦358.0, ₦151.7 and ₦62.3 in Shonga, Pategi and Otube respectively. On the average, a rice farmer earned a net revenue of about ₦251.6 per hectare during the period. In relative terms, the farmers in Shonga area earned the highest net farm income per hectare and per man-day, while those in Otube earned the lowest. This diversity can be explained in terms of the differences in farming experience and in the level of resource use on different farms*. It is possible too that the Shonga A.D.C. rice project has some demonstration effects on the surrounding farmers.

4. Summary

Some estimates of costs and returns in peasant rice produc-

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*For instance, it is noted in Table 4.1 that the level of seed input used per hectare was lowest in Shonga than in Pategi and Otube. Also, the proportion of farmers who have been growing rice for less than 11 years ago is larger in Shonga than in any of the other areas (see Table 3.7).

tion are presented in this section. Within the limits imposed by the quality of data, our analysis indicates that average cost of production was ₦242.8 per hectare and average net revenue, ₦251.6 per hectare. This suggests a quite satisfactory performance despite the rather low rice yield. However, a great degree of heterogeneity in conditions among different farms is revealed by the relatively high standard deviations of the estimated costs and returns. These variations have been attributed to a number of factors prominent among which are differences in cultural practices (particularly in the use of seeds and fertilisers), laterplanting/transplanting, damages by birds, crop failures due to shortage of rain in some areas, nearness to government owned scheme and/or contact with agricultural extension workers.

In the section that follows, a more rigorous approach is employed to further examine resource productivity and resource-use efficiency in Kwara State peasant rice production.

5. Resource Productivity in Rice Production: Production Function Approach

(a) Model for Resource Productivity Estimates

In the following analysis, production function approach is employed to examine the relationship between input and output in peasant rice production, the magnitude of the selected explanatory variables on output, and the direction of this influence.

Some of the several mathematical models that could be used have already been discussed. Few of these models will be employed in this analysis to see the ones which best explain our observation, using as the basis for selection the magnitude of the adjusted* coefficient of multiple determination ($\bar{R}^2$), the statistical significance of the

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* The adjusted coefficient of multiple determination (adjusted for the degrees of freedom) is defined as:

$$\bar{R}^2 = R^2 - \frac{(k-1)}{n-k} (1-R^2)$$

where

k = number of variables

n = number of observations

R^2 = the coefficient of multiple determination and

$\bar{R}^2 \leq R^2$

The $\bar{R}^2$, which takes account of the number of independent variables in relation to the number of observations, aims at facilitating comparisons of "goodness of fit" of several regression equations that may vary with the number of independent variables and the number of observations.

over-all production function as judged by the F value, the significance of the t values and the appropriateness of the signs of the regression coefficients. The model employed is stated below in its implicit form:

$$Y = f(X_1, X_2, X_3, X_4, u) \qquad (4.1)$$

where

Y = the aggregate value of rice output

X_1 = land (in hectares)

X_2 = labour (in man-hours)

X_3 = operating expenses

X_4 = durable capital input

u = error term

Some of the functions tried are as shown in equations (4.2) - (4.5).

$$Y = a_o + a_1 X_1 + a_2 X_2 + a_3 X_3 + a_4 X_4 \qquad (4.2)$$

$$\text{Log } Y = \log a_o + a_1 \log X_1 + a_2 \log X_2 + a_3 \log X_3 + a_4 \log X_4 \qquad (4.3)$$

$$\text{Log } Y = a_o + a_1 X_1 + a_2 X_2 + a_3 X_3 + a_4 X_4 \qquad (4.4)$$

$$Y = \log a_o + a_1 \log X_1 + a_2 \log X_2 + a_3 \log X_3 + a_4 \log X_4 \qquad (4.5)$$

The land variable (X_1) was measured in hectares; this variable was not adjusted for the differences in soil fertility for reasons given in Chapter I. Labour variable (X_2) include family, communal and hired labour, all measured in man-hours. Operating expenses (X_3) consist of expenses on fertilizer and seed while durable capital input variable (X_4) measures the cost of tractor hiring plus the depreciation and interest charges on farm equipment. The problem connected with the measurement of these inputs have already been discussed in Chapter I.

(b) Empirical Results

In the fitted functions for each of the areas, the double-log function gave the "best fit". The estimated regression coefficients for the lead equations are presented in Table 4.9. It is significant to note that in all the lead equations, the coefficients for land are positive and statistically significant at 1% level. On the whole, this variable alone explained more than 70% of the variability in aggregate rice production, showing clearly that land is the most crucial determinant of the production of this commodity. Even when other variables were included, the increase in the value of $\bar{R}^2$ was very marginal. For Shonga, the inclusion of labour (X_2) and operating expenses (X_3) raised the $\bar{R}^2$ from 0.757 to 0.766 (equation 4.6) with

Page 131 : Table 4 . 9

ESTIMATED REGRESSION COEFFICIENTS AND RELATED STATISTICS FOR RICE PRODUCING AREAS IN KWARA STATE

Area	Equation Number	Constants	Regression Coefficients				Related Statistics		Sum of Elasticities
			X_1	X_2	X_3	X_4	$\bar{R}^2$	F	
Shonga (N=80)	4.6	2.4097	1.091*** (16.149)				0.757	260.8	
	4.7	1.378	1.0406*** (5.8491)	0.0361* (1.3520)	0.1312** (1.6201)		0.766	271.0	1.2079
	4.8	3.218	1.1398*** (12.928)	0.127 (0.1872)	-0891 (0.8179)	-0.0479 (-0.4620)	0.769	63.72	
Pategi (N=50)	4.9	4.501	1.4362*** (11.4095)				0.721	130.2	
	4.10	3.7812	1.0019*** (4.9304)	0.1351 (1.1721)	0.2091* (2.341)		0.738		1.3461
	4.11	5.028	1.4048*** (4.4990)	0.2721* (1.3548)	0.273 (0.1556)	-0.4228** (-2.2875)	0.742	34.14	
Otube (N=20)	4.12	1.6841	1.1954*** (7.0407)				0.722	49.57	
	4.13	3.2456	1,1605*** (6.6031)	0.1842* (1.4021)	-0.2130* (-1.3552)		0.726	9.64	1.1317
	4.14	2.377	1.2904*** (3.4192)	-0.5053 (-0.1002)	-0.1098 (-0.3551)	0.1861 (0.6471)	0.73	10.81	

*** Significant at 1% level
** Significant at 5% level
* Significant at 10% level

(Figures in parentheses are the t - ratios; this applies to similar tables in the rest of the study)

X_1 and X_2 being statistically significant at 10% and 5% level respectively. For this area, the inclusion of all the variables (equation 4.8) raised the $\bar{R}^2$ from 0.766 to 0.769, although only X_1 was then found to be statistically significant.

In Pategi, the inclusion of X_2 and X_3 raised $\bar{R}^2$ from 0.721 to 0.738, and both X_1 and X_3 were statistically significant (equation 4.10). With the addition of X_4 in equation 4.11, $\bar{R}^2$ was raised to 0.742 although X_3 was not statistically significant at any acceptable level of probability. For Otube area, $\bar{R}^2$ was raised from 0.722 to 0.726 with the inclusion of X_2 and X_3 (equation 4.13). The regression coefficient for X_3 was negative and statistically significant at 10% level in this equation. When all the variables were included, the $\bar{R}^2$ was raised to 0.731 but only land was found to be statistically significant (equation 4.14).

Judging from the significance of the t values and the appropriateness of the signs of the regression coefficients, it is clear that equations 4.7, 4.10 and 4 . 13 gave the "best fit" in Shonga, Pategi and Otube respec -

tively. The R^2 ranged from 0.726 in Otube to 0.766 in Shonga, implying that in these equations, the included explanatory variables accounted for over 70% of the variability in the output of rice crop. In addition, all the F values are statistically significant at the 1% level.

In the log function, the regression coefficients are the elasticities for the respective explanatory variables. The magnitude of these individual elasticities indicates the percentage change in output in response to a one percentage change in the input concerned, holding the other factors constant. Increasing, constant or decreasing returns to scale exist according as this sum is greater than, equal to or less than unity. The sum of elasticities are presented in Table 5.2. As shown in the table, the sum was 1.208 in Shonga, 1.346 in Pategi and 1.132 in Otube. Using a t - test* the returns to scale were

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* The t value is given as $t = \frac{1 - \sum bi}{\sqrt{Var(\sum bi)}}$

Where $\sum bi$, $\sqrt{var(\sum bi)}$, =(i=1,2...n) is the sum of the coefficients and the standard error of the coefficients respectively. To examine whether the returns to scale in the different areas are different from each other we calculate

$$t = \frac{\sum bi_1 - \sum bi_2}{\sqrt{var(\sum bi_1 + var(\sum bi_2)}}$$

Where $\sum bi_1$ = sum of the coefficients in area 1

$\sum bi_2$ = sum of the coefficients in area 2

For detail see Heady and Dillon (59).

Table 4.10

ELASTICITIES OF PRODUCTION FOR DIFFERENT RICE PRODUCING AREAS IN KWARA STATE

Area	Sum of elasticities
Shonga	1.208
Pategi	1.346
Otube	1.132

tested if they diverge significantly from unity in each area and whether or not they differ significantly from one area to the other. The result indicates constant returns to scale in all cases. In other words, a change in all the factors of production in the same proportion will, ceteris paribus, lead to a proportionate change in the total output.

6. Resource - use Efficiency

Given the state of technology, it is possible to increase rice output per unit of input by improving the efficiency with which the existing resources are allocated. It, therefore, becomes relevant to examine whether or not rice farmers allocate their resources efficiently, and if inefficiency exists, one would like to examine the necessary adjustment that could be made for achieving optimal allocation of resources.

To examine resource - use efficiency in rice production, the marginal value productivity (MVP)* of each factor was computed and compared with the acquisition price (i.e. the opportunity cost) of the respective factor. The acquisition price (or marginal factor cost - MFC) for all resources used (excluding land) is the average market price prevailing in the area. However, where resources are measured in value terms, efficiency in the use of such resources will be assessed by equating their MVP's to one naira plus, of course, some interest rate(59). For the purpose of this analysis, we decide to use an interest rate of 11%, being the average of the discount rates commonly used for similar studies in the country**. A given resource is efficiently allocated when there is no significant difference between the MVP of the resource and its MFC, while a significant difference bet-

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* The MVP of resources are estimated at the means of input(59).

** The discount rates commonly used in previous studies are 8%, 10% and 15%. For detail see Schmedtje(164) Olatunbosun(134) and Wells(177).

ween them is accepted as evidence of inefficient resource use. It is necessary to note in passing that in peasant agriculture, a major objective in production is to attain self-sufficiency and to ensure family survival - as borne out, for instance, by the production of crops in mixture (125) . Therefore, the gap between the actual and the potential resource allocation can be regarded as an approximate measure of the cost of ensuring self-sufficiency and family survival.

Table 4.11 shows the estimates of the MVP of resources.

Table 4.11

MVP OF RESOURCES IN KWARA STATE PEASANT RICE PRODUCTION

Area	Form of equation	X_1	X_2	X_3
Shonga	Double log	55.15	0.14	0.19
Pategi	Double log	39.14	0.25	0.47
Otube	Double log	63.8	0.42	-0.20

The MVP of land was positive in all areas; the value was 55.15 in Shonga, 39.14 in Pategi and 63.8 in Otube. The ratio between the MVP and MFC of land could be computed if the rental value of land were known - all things being equal, a ratio greater (or less) than unity indicates that the use of more (or less) land is economically advisable. Such a ratio is however difficult to compute where, as in the study area, land is generally not sold or rented. Nevertheless, the MVP's of land are useful guides in determining the potential rental value of land.

The MVP of labour is low in Shonga but relatively high in Pategi and Otube. In all cases, it is positive. The ratio between the MVP and MFC of this input is unity in Pategi; in Shonga as well as in the estimate for Otube, it is not significantly different from unity*. These ratios are presented in Table 4.12.

For operating expenses, the MVP was 0.19 in Shonga, 0.47 in Pategi and - 0.20 in Otube. Unlike what obtains in Shonga and Otube, the MVP/MFC ratio for this variable is significantly different from unity in Pategi which could well be a case of inefficient use of resources - seed

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* This is equivalent to saying that the MVP of labour is significantly different from the wage rate. The ratio is calculated using the formula:

$$t = \frac{(bi.\frac{Y}{X}) - \text{MFC of } Xi}{Y/Xi \sqrt{\text{Var (bi)}}}$$

Where Y and Xi are held at their geometric means.(59)

Table 4.12

RATIOS OF THE MVP OF RESOURCES TO THEIR ACQUISITION COST (MFC) IN RICE PRODUCING AREAS, KWARA STATE

Area	Ratios of MVP to MFC	
	Labour (X_2)	Operating expenses (X_3)
Shonga	0.76	0.17
Pategi	1.0	0.62*
Otube	0.95	0.14**

* Significant at 10%

** Significant at 5%

in this case, since the expenditure on fertiliser was found to be negligible in the area. In general, however the result indicates only few significant inefficiencies in Kwara State peasant rice production, thus implying that a mere re-allocation of resources would not have any appreciable impact on total rice output.

7. Farm Size and Resource Use

(a) Introduction

The analysis in the preceding sections were based on the entire sample farms, under the implicit assumptions that all the farms under study are similar with respect to such factors as resource endowments and farmers' managerial ability. This assumption may not necessarily hold for different farm sizes, since differences in production efficiency often arise due to differences in factor endowments and in farmers' managerial efficiency among other things. Consequently, the estimates presented in the preceding sections, though valid on the average, might tend to conceal some of these differences. It has been suggested,[13] for instance, that the MVP of labour can be lower than the wage rate on small farms where heavy reliance is placed on family labour and where farmers aim mainly at maximising returns per hectare rather than equating MVP of labour to an imputed wage rate. The situation is different with larger farms which depend largely on hired labour or purchased inputs. Similarly the productivity of other inputs might deffer with farm sizes.

Accordingly, farms were grouped into two sizes in the study. Those with 1.23 hectares or less were grouped as small farms while large farms are those greater than 1.23 hectares. Area dummy (D) was included as explanatory variables, with D taking the value of one for areas in Edu Division and zero otherwise.

(b) Empirical Results

Different equations - the linear, double log, semi-log and exponential - were fitted to the data for each farm size. The regression coefficients for the lead equations are presented in Table 4.13. The coefficient of multiple determination (R^2) was 0.40 and 0.36 for the large and small farms respectively. The coefficients for X_2 and X_3 were statistically significant in the lead equations. Whereas the coefficient for X_3 is positive on large farms, it is negative on small farms. The coefficient for area dummy variable (D) was statistically significant in the case of large farms. As shown in the table, the sum of elasticities for large and small farms was 1.263 and 0.72 respectively both of which were not significantly different from unity. This suggests that returns to scale are constant on both large and small farms.

Table 4.13

REGRESSION COEFFICIENTS AND RELATED PRODUCTION FUNCTION STATISTICS FOR DIFFERENT RICE FARM SIZES, KWARA STATE

Farm Sizes	Form of Equation	Cons-tant	Regression Co-efficients			Sum of ela-sti-citi-es	R^2	F
			X_2	X_3	D			
Large	Double-log	3.689	0.383* (1.9185)	0.5987+ (1.5021)	0.2813+ (1.710)	1.263	0.40	18.70
Small	Double-log	4.932	0.2602* (2.0684)	-0.3536* (-2.0122)	0.8146 (1.267)	0.72	0.36	10.50

* Significant at 5% level

\+ Significant at 10% level

The MVP of resources for different farm sizes are presented in Table 4.14. The MVP of labour was 0.56 on large farms which is higher than 0.17 obtained for small farms, reflecting the higher labour input per hectare on

Table 4.14

MVP OF RESOURCES FOR DIFFERENT FARM SIZES

Farm Size	MVP	
	X_2	X_3
Large Farms	0.56	1.07
Small Farms	0.17	- 0.14

the latter than on the former. It is significant to note too that while the MVP of operating expenses is positive on larger farms, this value is negative on small farms, which again reflects the excessive use of seeds as shown on page 118.

The ratios between the MVP of these resources and their marginal factor costs (MFC's) are presented in Table 4.15. Unlike what obtained on large farms, the ratio for operating expenses was negative on small farms. These ratios were, however, not significantly different from unity on both farms, implying efficiency in the use of this resource on different farm sizes. The ratio for labour on large farms (3.68) is significantly different from unity while that on small farms (0.93) is roughly equal to unity. In other words, the MVP of labour is higher than the wage rate on large farms unlike what obtains on small farms. One reason for this is that provided by

Sen(165) in terms of labour market imperfection in a dual agrarian economy which prevents labourers on small farms from bidding down the market wage rate on large farms to the opportunity cost of labour. The exact nature of the institutional impediments which preserve this labour-market imperfection has received some attention in the literature+.

Table 4.15

RATIOS OF THE MVP OF LABOUR AND OPERATING EXPENSES TO THEIR RESPECTIVE ACQUISITION COSTS BY FARM SIZES

Farm Size	MVP/MFC	
	Labour (X_2)	Operating Expenses (X_3)
Large Farms	3.68*	0.96
Small Farms	0.93	-0.13

* Statistically significant at 1% level.

8. Summary

Resource productivity in rice production was examined in the foregoing sections. Land was found to be the most crucial determinant of the production of rice, with this

+ For instance, See Bardhan(13).

variable alone explaining more than 70% of the variability in the aggregate production of the commodity. The MVP of land ranged from 39.4 to 63.8 in the study area, while that of labour and other resources were found to be relatively low.

The study shows also that Kwara State peasant rice production is characterised by constant returns to scale, and it rejects the hypothesis that there is an inverse relationship between output and farm size in traditional agriculture. On the whole, only few significant inefficiencies in resource use was observed in the study area; in other words, the findings do not reject the hypothesis of efficient resource allocation in Kwara State rice farming, thus implying that a mere reallocation of resources would not have any appreciable impact on total rice output. Thus, the result lends support to the findings in previous studies (123, 124, 135) and indicates the need for exploring other measures for increasing rice production in Kwara State.

The point must be made however, that, as pointed out in hapter I, increasing the quality rice production is only one part of the rice problem in Kwara State; reducing processing cost and improving the quality of milled rice is another. In the chapter that follows, the structure and economic performance of Kwara State rice processing industry will be examined with a view to identifying ways of reducing costs and/or increasing returns in rice processing.

CHAPTER V

RICE PROCESSING

In the preceding chapter, resource productivity in rice farming was examined and some measures were suggested for increasing the quantity of rice produced in Kwara State. As an extension to the analysis in that chapter, it is intended, in the present chapter, to examine the structure and performance of the rice processing industry with a view to determining ways of reducing processing costs and improving the quality of milled rice. To this end, the parboiling operation will be analysed first, if only as a prelude to a meaningful analysis of the milling operation.

1. Paboiling Operation

Parboiling process involves soaking the paddy rice in water for a given length of time, subjecting the soaked paddy to steaming or boiling, and then drying slowly and evenly before milling. Parboiled rice has some advantages over unparboiled rice. Not only can the former be stored more safely, it also has higher cooking quality and greater nutrient value than unparboiled rice (51, 168, 169). Moreover, parboiling process reduces breakages of rice grains during milling (46).

Rice parboiling is exclusively women's business in the study area, the source of paddy rice being partly the family farms, and partly neighbouring farms. In the latter case, the general practice is to purchase the paddy rice, parboil it and then take it to local mills for milling. The difference between the purchase price of the paddy and the market value of the milled rice constitutes the returns to labour, management, and all other factors in the parboiling process.

Table 5.1 shows the costs of parboiling a bag of paddy rice (76.20kg.) by a parboiling unit with a capacity of about 102.06 kg. of paddy per day. The cost was estimated at ₦1.75 per bag or ₦23.0 per ton of paddy as against an estimate of ₦11.9 per ton at Illushi, Bendel State (142), ₦7.3 in Bida division, Niger State (4). and ₦3.6 per ton suggested by a USAID Mission on rice in West Africa, 1968.

Labour and fuel (firewood) costs accounted for ₦54.3% and 37.1% respectively of total parboiling cost. It was estimated that if drying, handling and packing operations were excluded, labour cost (for parboiling operation alone) would not account for more than 21% of total parboiling cost, and fuel about 56%. Net returns in parboiling was estimated at ₦0.60 per bag (or ₦7.96 per ton) as shown in Table 5.2. This

Table 5.1

COST OF PARBOILING ONE BAG (76.20KG.) OF PADDY RICE IN KWARA STATE

Cost Item	Cost per bag (₦)	Percentage of Total Cost
Labour *	0.95	54.3
Fuel	0.65	37.1
Capital (Depreciation and Interest Charge)	0.15	8.6
Total	1.75	100.0

* Including drying, handling and packing.

shows that parboiling units were making some profit inspite of the relatively high parboiling cost.

It is evident from this brief analysis that a reduction in fuel (firewood) cost will significantly reduce total parboiling cost. By observation, it was discovered that the unutilised rice husks which at present pile up at milling points in the area could be used as a substitute for firewood in rice parboiling. It was observed too that the low milling quality of rice (e.g the foul ordour, dull colour and a high

Table 5.2

COSTS AND RETURNS IN RICE PARBOILING,KWARA STATE

Items	Costs/returns per bag (₦)
Initial purchase price of paddy rice	25.0
Transport Cost	1.05
Parboiling Cost	1.75
Milling Cost	1.32
Winnowing, handling and packing	0.28
Total Cost	29.4
Gross returns*	30.0
Net returns	0 .60

* Computed on the basis that the value of a bag of milled rice (79.38kg.) during harvesting period is ₦40 (the observed modal price), and that from one bag of paddy (76.20 kg.), we can get a miximum of 50.8 kg. milled rice. (Estimates were obtained from Federal Rice Research Station, Badeggi, and the Ministry of Agriculture and Natural Resources, Ilorin).

percentage of broken grains) was due, in part, to poor parboiling technique. Most of the parboiling units studied were ignorant of the recommended parboiling practices since the extension service of the Ministry of Agriculture and Natural Resources was apparently not geared towards the dissemination of research findings among parboilers.

2. Milling Operation

(a) Hand - Pounding and Mechanical Rice Milling units

Before the introduction of mechanical rice mills in Kwara State, rice was normally processed by hand-pounding technique which generally involves several processes. First, the paddy is dehusked and later winnowed to blow away the chaffs. The paddy is then repounded to remove more husks which again are later winnowed. The third pounding and winnowing is considered necessary to whiten the milled rice. These operations are manually performed by women, with an average woman milling between four and ten ananias (between 12.7 and 24.4 kg.) of paddy rice per day, working 8 hours a day. Generally, hand-pounding is performed by family members, if a small daily amount, and by communal or hired labour if a large amount for a special occasion or for the local market. Although this milling technique has virtually disappeared in Kwara State, the survey revealed that it is still being practised, particularly in remote areas where there are no mechanical rice mills.

In the past two decades, however, there has been some technological progress in the Kwara State rice milling industry. Whereas about 80% of paddy rice was handpounded both for subsistence consumption and for local markets in the 1950's, the proportion being handpounded today is perhaps between the 5 and 10% range, although there are no direct statistics on this. However, the number of small mechanical rice mills in the state is, to a large extent, indicative of what has happened technologically. As at 1972, the number of functioning small rice mills in the state was estimated to be roughly 53, with a majority of them located in Edu division of the state. The present number is evidently greater than this, and will no doubt increase significantly in the near future, judging from the number of loan applications being received by the state government from prospective rice millers*

Some background information was obtained during the survey, including the make and ownership of rice mills, capital resource situation in rice milling, literacy level and the subsidiary occupations of rice millers.

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* Correspondence with the Kwara State Ministry of Trade, Industry and Cooperatives revealed that between 1969 and 1977, 142 loan applications were received from prospective rice millers. Six of them were granted loan between 1973 and 1977 for the purchase of rice mills, with the remaining applications still under processing.

Most of the mills in the area have "Lister" diesel engine of 15 - 16 horse-power capacity, and combine hulling and polishing operations. In a majority of cases, the mills are owned by private single proprietors with between one and three workers to a mill. An average miller was a middle-aged owner/contractor operator with about 7 years experience in rice processing business, and charging roughly ₦1.30 per bag of paddy milled. The survey suggests that a large proportion (85%) of the capital invested in milling business came from non-institutional sources (personal savings and loans from neighbours/money lenders) while about 10% came from institutional sources (government and commercial banks). 69% of the millers interviewed were hopeful of getting additional capital for expansion purpose, mostly from non-institutional sources.

Although about 57% of the millers indicated that they had attended adult education class, a majority of them could neither read nor write. When asked to indicate other occupations they had apart from milling business, the millers responded as indicated below. 37.5% of the millers interviewed indicated that they had no other occupation beside rice milling. Of the remaining millers, 31.3% engaged in farming, 12.6% business trading, 12.5% koranic teaching while 6.3% combined fishing with rice milling business. This ~~is an~~

Table 5.3

SUBSIDIARY OCCUPATIONS AMONG RICE MILLERS

Occupation	Percentage of Millers Responding
None	37.5
Farming	31.3
Business/Trading	12.6
Koranic Teaching	12.5
Fishing	6.3

dispersal of entreprenueral effort over several business may represent an attempt to pool risk through diversification; or it may be due to limited market which prevents the expansion of any one of the business. Asked about the intended changes, 57% of the respondent indicated that they would have liked to buy mordern rice mills. For this purpose, most of these millers indicated that in addition they would have liked to build larger premises. Only 18.8% indicated that they would like to produce the raw materials themselves. In response to further questions, almost all the millers mentioned shortage of capital as the major barrier limiting the introduction of these changes, while 12.5% mentioned lack of man-power. Other major problems facing the millers, in order of priority, were servicing and maintenance, availability of spare parts, inadequate supply of paddy rice, lack of market and lack of technical information, with a majority of them indicating that they got technical information about milling only by discussing with other millers.

(b) Costs and Returns in Rice Milling

The structure of costs and returns in rice milling is influenced, among other things, by the level of capacity utilisation, the degree of competitiveness within the system and the state of technology. Each of these interacts with the other. For instance, the degree of competitiveness is determined, to a large extent, by the size of milling units and the structure of the milling industry, both of which are, in general, influenced by the existing milling technology. In a perfectly competitive market, returns in rice milling is determined largely by the existing technology through its effect on the milling cost, and on the quantity and quality of rice (and rice by-products) produced. The level of returns, of course, depend on the level of capacity utilisation in the rice milling system. In the section that follows, the level of capacity utilisation in rice milling will be discussed as a background to the costs and returns analysis.

(i) Level of Capacity Utilisation

To facilitate our understanding of the degree of capacity utilisation in rice milling industry, it is necessary to distinguish 2 types of capacity. The first is engineering capacity, defined as the maximum working hours for which the mill can be operated in a year purely on the basis of mechanical feasibility. Although this is difficult to determine precisely, discussion with factory managers, and agricultural officials revealed that the existing small rice mills can be run for 300 days per year at roughly 10 to 15 hours per day, reserving the remaining time for maintenance and repair. The second type of capacity is effective capacity, defined as the maximum working hours for which the mill can be operated in a year, taking into considerations technological, social and environmental constraints. On the average, the effective milling capacity was estimated at approximately 3 bags (228 kg.) of paddy per hour or 6720 bags (512.2 tons) per year of 280 working days, working 8 hours per day.

However, what the mill can effectively handle per year is one thing, what it normally handles in practice is another. From the information supplied by the rice millers, the average hours for which each mills normally operate per day during the peak and slack period were determined, and from these data, the average annual milling level of a mill was estimated, account being taken of possible contigencies during the year. On this basis, the average intake per year was estimated at 164.9 tons, which implies that only 32.2% of the milling capacity was being utilised per year.

The percentage of the capacity of rice mills utilised in each study area is presented in Table 5.4. The table shows that the effective capacity of rice mills was utilised more heavily in Pategi areas than in Shonga and Otube, the respective levels of capacity utilisation in these areas being 37.4, 27.2 and 28.0%. The factors that account for this underutilisation of milling capacity will be discussed in a later section.

(ii) Structure of costs and returns in rice milling

The costs of rice milling in the study area are presented in Table 5.5. Operating cost per year and per rice milling unit was estimated at ₦539.1, ₦630.5 and ₦619.1 in Shonga, Pategi and Otube areas respectively, with an average of ₦596.2 for all areas. The major element in this cost were

Table 5.4

PERCENTAGE OF THE CAPACITY OF RICE MILLS BEING UTILISED PER YEAR

Area	%
Shonga (including Bacita and Tsaragi area)	27.2
Pategi (including Lafiagi, Lade, Edogi Sapefu)	37.4
Otube (including Abugi)	28.0
All Areas	32.2

wages and fuel (including oil), all of which accounted for between 13 and 22% of total cost. Fixed cost per year was estimated at ₦580.1, ₦474.8 and ₦578.1 in Shonga, Pategi and Otube respectively, the average for all areas being ₦544.3. Salaries constituted the major component of fixed cost, accounting for 29.2% of total fixed cost in Shonga,

Table 5.5

COSTS OF RICE MILLING IN KWARA STATE
(₦ PER YEAR)

Items	Shonga	Pategi	Otube	All Areas
Operating Cost:				
Unskilled Labour (a)	220.3	240.7	160.0	207.0
	(19.7)*	(21.8)	(13.4)	(18.6)
Fuel and Oil	185.5	233.5	211.1	210.0
	(16.6)	(21.1)	(17.6)	(18.4)
Spare parts, repair and maintenance	133.3	156.3	248.0	179.2
	(11.9)	(14.1)	(20.7)	(15.7)
Total Operating Cost	539.1	630.5	619.1	596.2
	(48.2)	(57.0)	(51.7)	(52.3)
Fixed Cost				
Depreciation on Mill and Engine (b)	180.0	130.8	156.5	155.75
	(16.1)	(11.8)	(13.1)	(13.7)
Depreciation on building	16.9	19.8	20.0	18.90
	(1.5)	(1.8)	(1.7)	(1.7)
Salaries	326.5	275.0	347.3	316.26
	(29.2)	(24.9)	(29.0)	(27.7)
Others	14.5	14.1	10.7	13.10
	(1.3)	(1.3)	(0.8)	(1.6)
Interest (80%)	42.2	35.2	43.6	40.32
	(3.8)	(3.9)	(3.6)	(3.5)
Total fixed cost	580.1	474.8	578.1	544.33
	(51.8)	(43.0)	(48.3)	(47.7)
Total Cost	1119.2	1105.3	1197.2	1140.53

Notes: (a) Computed by multiplying the average daily wage rate at the mill by the average working days per year and by the number of unskilled labourers.

(b) Including transportation and installation costs.

Figures in parentheses are percentage of total cost.

24.9% in Pategi and 29.0% in Otube. Total milling cost per year was estimated at ₦1119.2, ₦1105.3 and ₦1197.2 in Shonga, Pategi and Otube respectively, giving an average of ₦1140.5 per year (₦11.8 per ton) for the study area. Table 5.6 compares this result with that of similar studies in selected rice producing areas.

The effect of the level of capacity utilisation on milling cost is evident from the foregoing analysis. Although operating cost was somewhat greater in Pategi (which has the highest level of capacity utilisation as indicated earlier) than in Shonga (which has the lowest level of capacity utilisation), the average fixed cost in Pategi (₦474.8) is considerably lower than what obtains in Shonga (₦580.1) and Otube (₦578.1). On the whole, total milling cost was lowest in Pategi, thus suggesting that the level of capacity utilisation has impact on total cost through its effect on fixed cost.

Returns in rice milling are presented in Table 5.7 . The observed average milling charge was ₦1.32 per bag (or ₦17.2 per ton) of paddy. Given the average milling cost of ₦11.8 per ton of paddy, it is evident that the milling units were making a net return of ₦5.51 per ton (or ₦526.23 per year) on the average. It is interesting to note that net returns ranged from ₦423.6 per year (₦4.6 per ton) in Otube area to ₦633.5 per year (₦5.74 per ton)

Table 5.6

COSTS OF MILLING A TON OF PADDY RICE IN KWARA STATE COMPARED WITH SOME OTHER RICE PRODUCING AREAS

Country	Year	Milling capacity (tons per hour)	Costs per ton of paddy (₦)
Pakistan [a]	1969	11.9	2.06
Philippines [b]	1966	0.63	1.57
Senegal [c]	1966	1.8	13.57-15.74
Nigeria:			
Former Western State [d]	1971	0.2	7.97
Ilushi [e]	1970	0.16	8.36
Bida [f]	1973	0.19	4.03
Kwara State [g]	1978	0.23	11.8

Notes:

(a) Derived from James E. Wimberley, "Cost Analysis of Rice Processing Related to Modern Rice Milling Industry in West Pakistan," The Planning Cell, Agricultural Department, Government of Pakistan, Lahore, 1969. (Mimeograph)

(b) Derived from FAO: Rice Milling in Developing Countries, , Commodity Bulletin Series, 1969.

(c) USAID/USDA, Rice in West Africa, Washington, 1968, p. 149.

(d) Derived from Osifo[141].

(e) Derived from Osifo and Tempelman[142].

(f) Derived from Adeniyi [4].

(g) Present survey.

Table 5.7

RETURNS IN RICE MILLING, KWARA STATE

Items	Shonga	Pategi	Otube	All Areas
1. Number of bags processed per day	5.5	7.0	5.8	6.10
2. Average working days per year	207	207	207	207
3. Number of bags processed per year	1138.5	1449.0	1200.6	1262.7
4. Milling charge per day(₦)	1.41	1.2	1.35	1.32
5. Gross returns (₦)				
(a) returns per year (Item 4 multiplied by item 3)	1605.3	1738.8	1620.8	1666.76
(b) returns per ton*	18.5	15.7	17.7	17.32
6. Total Cost (₦)				
(a) Cost per year	1119.2	1105.3	1197.2	1,140.53
(b) Cost per bag (Item 6(a) divided by item 3)	0.98	0.76	1.0	0.90
(c) Cost per ton *	12.8	9.96	13.1	11.8
7. Net returns (₦)				
(a) net returns per year	486.0	633.5	423.6	526.23
(b) net returns per bag	0.43	0.44	0.35	0.42
(c) net returns per ton	5.70	5.74	4.61	5.51
Returns on investment per year (%)	43.4	57.3	35.4	46.14

* Computed on the basis that 1 bag = 76.2 kg.

in Pategi area which is also the area with the highest level of capacity utilisation in rice milling.

(c) Policy Implication

The policy implication of the foregoing analysis is somehow clear; in order to reduce milling cost, there is need, among other things, for policies geared towards increasing the level of capacity utilisation in rice milling. As indicated earlier, only about 32% of the existing milling capacity is currently being utilised per year. Several factors account for this low level of capacity utilisation. First, the supply of paddy rice to the mills is inadequate to keep them busy throughout the year. Most of the milling activities are restricted to the harvesting and threshing period - late November to early March, while the mills virtually remain idle during most of the slack period.

The inadequate supply of paddy rice is partly due to heavy competition from the government-owned Pategi rice mill+ and the proliferation of small rice milling units. Because only

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+ A visit to the Pategi Rice Mill and discussion with the factory manager revealed that the supply of paddy rice to the mill was more than adequate. Apart from the supply from government-owned rice plantation in Shonga, the mill also purchased paddy from local farmers both within and outside the state.

elementary skill is required in the operation of the mills, prospective enterpreneurs do not find it difficult to enter the milling business. The result is unhealthy competition for the limited supply of paddy rice. If average fixed cost is to be significantly reduced, there is the need for an increase in the supply of paddy rice to feed rice mills. This might involve improved cultural practices, expansion of rice hectarage, intensive cultivation of present holdings, improvement of existing rice irrigation schemes and/or the establishment of new ones to ensure adequate supply of irrigation water, and the provision of incentives to rice farmers. Another means revolve around adequate maintenance of milling plants in order to reduce the rate of break-downs. This is in view of the fact that difficulty in obtaining spare parts often slow down the rate of repairs, and limits the effective milling capacity.

It was observed that of the total milling costs, wages and salaries accounted for 45.87%, fuel and oil 18.41%, spare parts, repair and maintenance 15.71%. Economy in the use of labour can be achieved by adequate supply of paddy to feed the mills; this will help in keeping operators productively engaged most of the time. This, of course, is a long-run solution. In the meantime, a change in the system of payment could be considered. The dominant system of payment in the area is the time-rate system (i.e. payment on monthly or daily basis). This could be replaced by the piece-rate system of payment whereby operators are paid commission on the number of paddy bags milled. Such a system of payment might not only reduce cost, but could also encourage operators to canvass for customers, thereby increasing the supply of paddy to the mills. In addition, millers can turn to buying paddy rice for milling and then selling the milled rice rather than merely servicing paddy owners as at present. Incidentally, part of the current loans being granted to prospective rice millers in the state is expected to be used for this purpose.

The magnitude of net returns in milling also depends on the price of the final product. As this price is influenced by the milling quality of the product, returns can be increased by improving the quality of milled rice. One way of doing this is by reducing the present high percentage of broken grains and unmilled rice contained in the final product. To achieve this, it is necessary to parboil and mill each rice variety separately so as to enable a proper setting of plants during milling. In addition, an improvement in the parboiling technique is necessary; this will not only reduce the percentage of broken grains but will also make possible the production of whiter milled rice which is free from foul ordour.

Unlike his Senegalese counterpart, an average consumer in Nigeria prefers rice containing little or no brokens; and not until rice production is significantly expanded can Nigeria expect to export broken milled rice to Senegal.

A long run solution is that of replacing existing obsolete machines with simple but modern ones with facilities for sorting extraneous matters from paddy rice and for separating husks from bran. The final product in this type of mill is milled rice which is well polished, and with relatively low percentage of broken grains. Simple mills with "rubber roll shellers" are available in Nigeria at reasonable costs, and hence within the reach of some individual millers or groups of prospective millers. Finally, the extension service division of the Ministry of Natural Resources will have to be reorganised such that due attention is given to processing activities. Hitherto, little or no effort has been made in this direction.

3. Choice of Technique in Rice Milling

(a) Preliminary Discussion

The whole exercise in the choice of technique is often directed at one goal: efficiency in resource allocation. In conventional economic theory, price mechanism is assigned the crucial role of ensuring efficient allocation of resources. The working of price mechanism, however, presupposes that perfect competition exists and that all prices are scarcity prices in the sense that they reflect opportunity costs. Given the imperfection in the market system and the flaws of the price mechanism, it is generally realised that efficiency in resource use cannot be taken for granted, particularly in developing countries. This is no less true of the use of resources in rice milling. In the rest of this chapter, both the existing and the "proposed" large rice mills in Kwara State will be discussed, after which an attempt will be made to determine the least-cost or most efficient milling facility of producing a given amount of rice output.

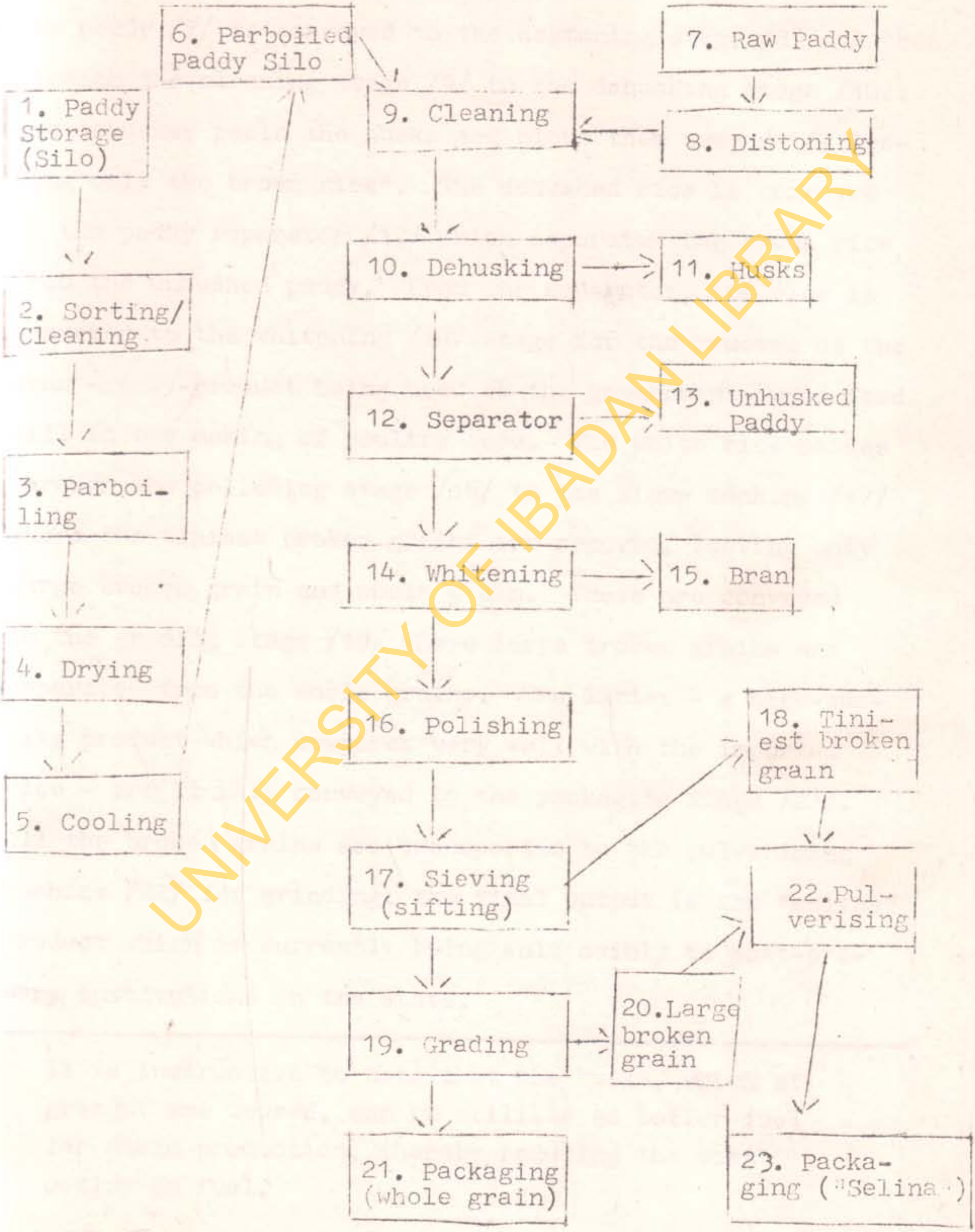
(b) Large Rice Mills in Kwara State

In 1974, the Kwara State Agricultural Development Corporation (former Kwara State Food Company) established a large rice mill in Pategi in an attempt to boost rice production and processing in the state. The multi-stage, self-contained Japanese milling unit at present offers employment to 27 people and has a capacity of 1.0 ton of paddy rice per hour, performing many different operations in the milling process. These operations are illustrated in the schematic flow chart shown in figure 5.1. The raw paddy awaiting processing is stored in the silo /1/ designed to prevent damage from insects or excessive humidity. From the silo, the paddy is conveyed to the sorting/cleaning stage /2/ where defective grains and infractions (dust, foreign matters etc) are removed. Thereafter, the cleaned paddy is conveyed into a tank for parboiling /3/, and from there into a rotating pressure vessel for drying /4/. When sufficiently dried (up to that level which allowed the paddy to retain sufficient moisture so as to reduce milling breakage to a minimum), the paddy is conveyed to the cooling tower /5/ to await milling.

As at the time of writing, arrangement was still in progress to acquire the parboiling plant described above. In the interim, the factory was concentrating mainly on processing unparboiled paddy rice.+

\+ However, the complaint of the consumers had been that the unparboiled rice breaks, melts or burns during cooking. As a result, the sale of unparboiled whole grain rice was discontinued in 1977. Instead, the factory started to produce "selina" product, the market for which is steadily expanding in Kwara State.

SCHEMATIC FLOW CHART OF RICE MILLING OPERATIONS:
PATEGI RICE MILL



Instead of passing through the parboiling stage, the raw paddy /7/ is conveyed to the destoning stage /8/ and then through the cleaning stage /9/ to the dehusking stage /10/. The dehusker peels the husks and blows them away /11/, leaving only the brown rice*. The dehusked rice is conveyed to the paddy separator /12/ which separates the brown rice from the unhusked paddy. From the separator, the rice is conveyed to the whitening /14/ stage for the removal of the bran - a by-product being used at the government-owned feed mill in the making of poultry feed. The white rice passes through the polishing stage /16/ to the sieve machine /17/ where the tiniest broken grains are removed, leaving only large broken grain and whole grain. These are conveyed to the grading stage /19/ where large broken grains are separated from the whole grains. The latter - a high-quality product which compares very well with the imported rice - are finally conveyed to the packaging stage /21/. All the broken grains are transported to the pulverising machine /22/ for grinding; the final output is the "selina" product which is currently being sold mainly to post-primary institutions in the state.

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* It is instructive to note that the husks, which at present are unused, can be utilised as boiler fuel for steam production, thereby reducing the cost outlay on fuel.

Another large rice mill - larger than the one described above - has been suggested for Kwara State, to be established near Abugi, some kilometres away from Pategi. It is expected that if established, the mill, with a rated capacity of between 2½ and 3 tonnes per hour, will provide employment for 103 people, 28 of whom will be in the management and skilled labour cadre. Unlike the existing mill at Pategi, the suggested mill will operate on a continuous basis in three 8 - hour shifts at full operation. The total input capacity of the mill at full development is expected to be roughly 13,500 tonnes of paddy, with a total output of 9,450 tones of edible rice (70% average recovery) and about 650 tonnes of bran (93). The estimated total milling cost per year is presented in Table 5.8.

The dominant element in operating cost is expected to be the paddy rice (raw material), accounting for about 76% of the estimated total cost. This is followed by packaging materials, wages and salaries, and maintenance and repairs in that order. Building and the main plant are expected to be the largest item in fixed cost, accounting for 40.7 and 38% of the estimated total cost respectively. It is necessary to note that these estimated costs assume adequate supply of paddy to enable full capacity utilisation in rice milling. To this end, a large plantation of irrigated rice has been suggested for the area. There are, in addition

Table 5.8

THE "PROPOSED" MODERN RICE MILL IN KWARA STATE: ESTIMATED TOTAL MILLING COST PER YEAR AT FULL DEVELOPMENT

Cost Item	Cost	% of Total Cost
Operating Cost:		
Wages and Salaries	110,600	4.2
Paddy Purchasing	2,025,000	76.3
Packaging materials	386,100	14.6
Power	17,200	0.6
Maintenance and repairs	74,100	2.8
General charges	39,200	1.5
	2,652,200	100.0
Plus contingencies	2,784,800	
Capital Cost:		
Final design	163,300	8.9
Buildings	748,750	40.7
Machinery & Equipment	228,200	12.4
Main plant		
- Mill	279,200	15.2
- Parboiling plant	419,200	22.8
	1,838,650	100.0
Plus contingencies	2,206,350	

Source: Kwara State Ministry of Economic Development(93).

provisions for buying paddy rice from other sources to supplement supply from the irrigation scheme.

It is clear from this brief discussion that the Kwara State government is currently making some effort not only to ensure increased rice output, but also to improve the quality of milled rice in the state. What is not clear, however, is whether or not the present move towards the establishment of larger rice mills is economically justifiable. The specific question relates to whether or not large rice mills are the least-cost milling facilities in the state. In the sections that follow, an attempt shall be made to provide an answer to this question, using four different milling techniques - namely, hand-pounding, small rice mills, the existing large rice mill and the proposed large rice mill - as the basis of analysis.

(b) Theoretical Considerations

Consider a firm with a given size, producing under a given technology and using two resources, X_1 and X_2. The problem is that of using these resources in such a way that cost is minimised in producing a given output. Alternatively, it is the problem of using that combination of X_1 and X_2 that will produce maximum output for a given cost outlay.

Let the production function be represented as:*

$$Y = f(X_1, X_2) \quad .... \qquad (5.1)$$

where

Y = output and

X_1, X_2 = inputs

This relationship can be expressed in graphical form as in Fig. 5.2, which assumes that only capital (K) and Labour (L) are needed in production. With the different processes (processes I, II and III), different input combination is required to produce the varying output of y_1, y_2 and y_3. For instance, while OT_1 of L and Oq_3 of K are needed to produce output y_3 under process I, OT_2 of L and Oq_2 of K are needed to produce the same output under process II. The corresponding input combination under process III is OT_3 of L and Oq_1 of K. Thus process I is more capital intensive than processes II and III.

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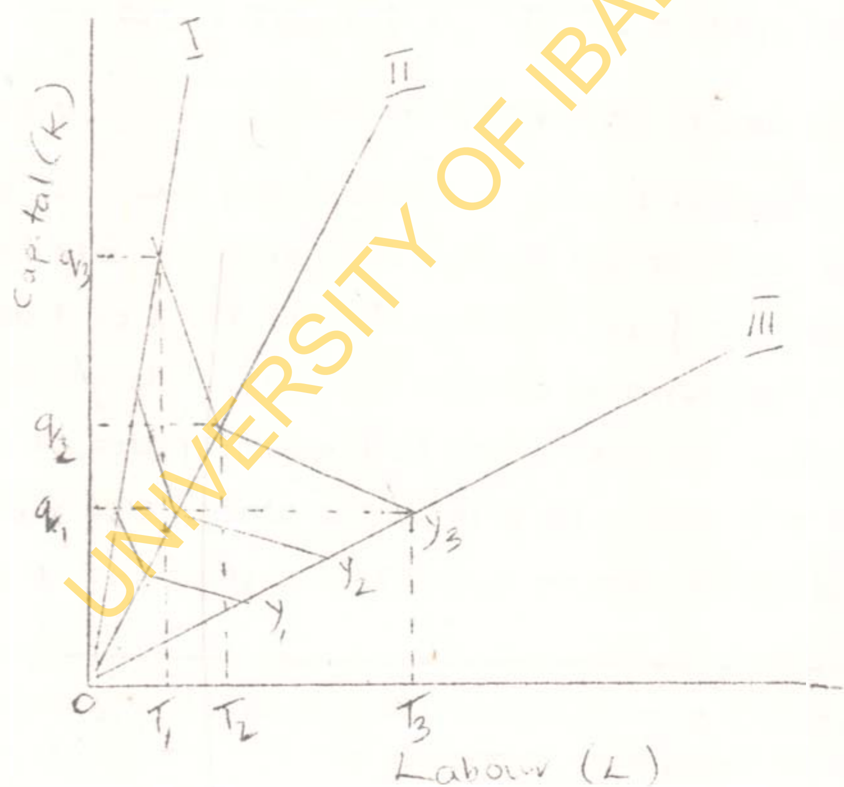
* It is assumed that the production function is well behaved.

Fig. 5.2: Process of Substitution Betw en Factors of Production in the Production of a Given Unit of Output



Each of the iso-quants* in Fig.5.2 is convex to the origin reflecting the fact that while X_1 and X_2 may be technical substitutes for each other, they are not perfect substitutes. The iso-quant function is given as

$$Y_o = f(X_1, X_2) \quad \ldots\ldots \quad (5.2)$$

where Y_o is a parameter.

To minimise the cost of producing the specified output level, Y_o, form the function.

$$G = p_1X_1 + p_2X_2 + b + \lambda \left[Y_o - f(X_1, X_2) \right] \ldots\ldots (5.3)$$

where p_1 and p_2 are the respective prices of X_1 and X_2, b is the fixed cost, and λ, an undetermined langrange multiplier. Setting the partial derivatives of G with respect to X_1, X_2 and λ equal to zero and re-arranging, it can be shown that for cost to be minimised, the contribution to output of the last naira expended on X_1 must be equal to that of X_2. This is the same as saying that the marginal rate of technical substitution between X_1 and X_2 (i.e. the

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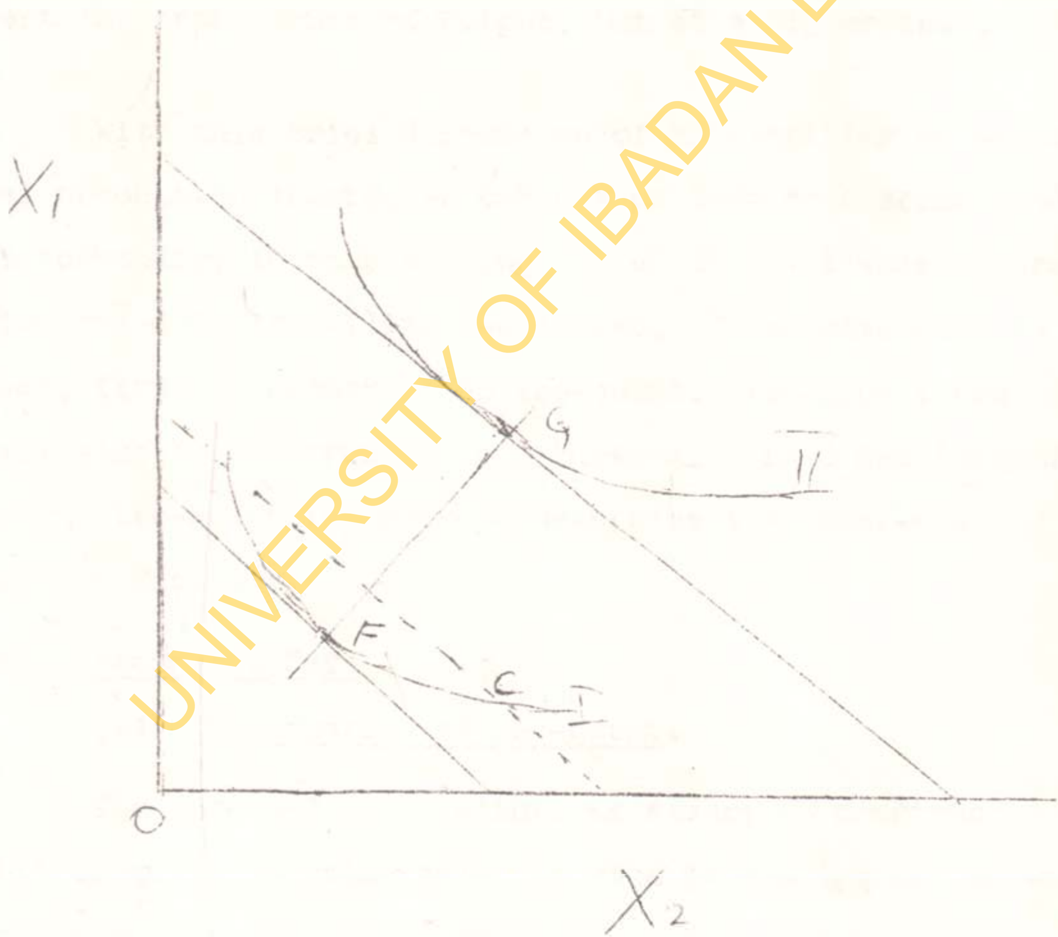
* Figure 5.2 shows kinked iso-quants since only 3 processes are involved. If the number of processes are sufficiently increased, we could obtain a smooth curve for each output level.

Fig. 5.3: Optimum Combination of Inputs



slope of the iso-quant) must be equated with the ratio of their respective prices (i.e. with the slope of the iso-cost line). In graphical terms cost is minimised, at the point of tangency of the iso-quant to an iso-cost line. As shown in Fig.5.3, the least-cost or most efficient combination of X_1 and X_2 is at points F and G where the iso-cost lines are tangent to iso-quants I and II respectively. Any other point on an iso-quant (e.g. point H) would represent the same amount of output, but at a higher cost.

With this brief discussion of the familiar neo-classical production theory, we can now proceed to discuss choice of technology in rice milling, given the available information and data on milling facilities. These data will be used, first to construct an iso-quant. Iso-cost lines will also be constructed, and these will be drawn tangent to the iso-quant in order to determine the least-cost milling facility.

(c) Technical Data

(i) Construction of iso-quant.

The data and calculations necessary to construct a unit isoquant in value added by rice processing are shown in Tables 5.9 to 5.12 . Table 5.9 rows 1 - 3, shows milling capacity, costs, and number of unskilled

Table 5.9

CONSTRUCTION OF A UNIT ISOQUANT IN VALUE ADDED BY RICE PROCESSING - DATA PER UNIT

Item	Hand Pounding Alternative 'A'	Hand Pounding Alternative 'B'	Small Rice Mill	Existing Large Rice Mill	"Proposed" Large Rice Mill
1. Milling Capacity (tons per year)	7.3	64.0	512.2	5,000.0	14,400.0
2. Investment Cost (₦)	2.00	3.6	2,506	446,894	1,838,650
3. Operative Labourers (Number per Shift)	1.0	1.0	2.5	16.0	25.0

labourers required per shift for each facility.
The milling capacity is measured in tons of paddy per year, assuming that the unit can operate for 280 days in a year, working 8 hours a day. Two estimates of milling capacity were made for the hand-pounding unit. In the first estimate (Alternative "A"), it is assumed that a worker can handpound a maximum of 8 ananias (24.4 kg) of paddy rice per day. Our survey reveals that this is about the maximum amount that an average woman can hand-pound per day. The second estimate (Alternative "B") assumes that a worker can hand-pound as much as 228.6 kg. of paddy per day. This assumption is made partly to facilitate graphing and partly to examine whether or not this technique can ensure optimality even with the very high productivity assumed. With regards to the small rice milling unit, the present survey reveals that this unit can process 24 bags (1828.5 kg.) of paddy rice per day, which amounts to 512.2 metric tons per year. For the large rice mills, figures on milling capacity and processing costs are derived from a recent feasibility study report on rice growing and milling in Kwara State (93) and from the information obtained from the factory manager of the Pategi Rice Mill. Processing costs in hand-pounding and small rice milling units are on the basis of the observed factor costs prevailing during the study period. The prevailing wage rate falls between ₦1.40 and ₦2 per day; for the purpose of the analysis, a wage rate of ₦1.70 (the modal wage rate) was used.

The last row in Table 5.9 shows the number of unskilled workers employed in each unit.

The data in Table 5.9 are standardised in terms of 1,000 tons of rice per year with each of the facilities being scaled up or down to a comparable 1,000 ton capacity. The results are shown in Table 5.10. In row 3, the 1,000 tons of paddy rice per facility is converted into milled output on the basis of the extraction rate in each facility (i.e. the amount of milled rice each facility produces per ton of paddy rice). The present survey revealed that the extraction rate in hand-pounding facility was roughly 60%, small rice mill 63%, existing large mills 69%, and "proposed" large rice mill 70%*. In addition, each facility is presumed to produce an output with varying consumer value. Thus, the ex-mill price of large rice mill's output was estimated (row 4, Table 5.10) at ₦470 per ton, small mill's output, ₦329 per ton, and hand-pounded output,

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* Source: Ministry of Agriculture and Natural Resources, Ilorin, Federal Rice Research Station Badeggi, and discussion with rice millers in the study area.

Table 5.10: DERIVATION OF A UNIT ISOQUANT IN VALUE ADDED FROM RICE PROCESSING - DATA PER 1,000 TONS OF RICE INPUT PER YEAR

Item	Hand-Pounding Alternative 'A'	Alter-native 'B'	Small Rice Mill	Existing Large Rice Mill	"Proposed" Large Rice Mill
1. Investment Cost (₦)	274.0	56.3	4892.6	89,378.0	127,684.0
2. Operative Labourers (Number)	137.0	15.6	4.9	3.2	2.7
3. Milled Output (Tons)	600	600	630	690	700
4. Market Price(₦ per ton)	305.5	305.5	329	470	470
5. Value of Output(₦)	183,300	183,300	207,270	324,300	329,000
6. Cost of Paddy(₦)	150,000	150,000	150,000	150,000	150,000
7. Value Added	33,300	33,300	57,270	174,300	179,000

₦305.5 per ton**. The value of milled rice produced by each unit (row 5, Table 5.10) is obtained by multiplying the ex-mill price by the milled output. The cost of paddy (row 6, table 5.10), is substracted from the value of output to obtain value added from 1,000 tons of paddy rice input (row 7, Table 5.10). At this stage of the analysis, large rice mills seem to hold substantial competitive edge since they are producing about 200% more value added than hand-pounding unit, and 27% than small rice mills.

The construction of a unit isoquant requires that we calculate the investment cost and number of labourers needed to produce a given amount of value added, say ₦150,000. These calculations are presented in Table 5.11.

** A recent feasibility study on integrated rice project in Kwara State estimated the ex-mill price of large mill's output at ₦470 per ton (93). It is assumed that the output of hand-pounding and small mill units respectively cannot sell for more than 65% and 70% of the large mill's output, following C.P. Timmer's suggestion (173).

Table 5.11

CONSTRUCTION OF A UNIT ISOQUANT IN VALUE ADDED BY RICE PROCESSING - DATA PER ₦150,000 IN VALUE ADDED PER YEAR

Item	Hand-Pounding Alternative 'A'	Hand-Pounding Alternative 'B'	Small Rice Mill	Existing Large Rice Mill	"Proposed" Large Rice Mill
1. Investment Cost(₦)	1,234.2	253.6	12,814.6	76,917.4	106,997.8
2. Operative Labourers (Number)	617.1	70 3	12.8	2.7	2.3

For small rice mill, the investment cost associated with ₦57,270 in value added is ₦4,892.6. Therefore, for a value added of ₦150,000, the investment cost is

$$\frac{₦\,150{,}000}{57{,}270} \times 4{,}892.6 = ₦12{,}814.6$$

and the number of labourers, $\frac{150{,}000}{57{,}270} \times 4.9 = 12.8$

The calculations for other facilities are similar. The data in table 5.11 are used to construct the desired isoquant (Fig. 5.4) with the number of operative labourers on the X axis and investment cost on the Y axis. For the hand-poun-pounding technique, alternative 'B' data are employed in the construction of isoquant.

(ii) Construction of Iso-cost lines

The next stage is to construct isocost lines which will be drawn tangent to the isoquant in order to determine the least-cost milling facility. Since the vertical axis in figure 5.4 is in total investment cost rather than in annualised capital charges, it is necessary to convert annual labourers' wages into a lifetime "wage fund".[173] This is done by discounting a labourer's annual wage payment for an assumed lifetime by appropriate discount rates in order to calculate the present value of the cost of a labourer. In this analysis, the wage rate of ₦1.70 per day was used, being the observed modal wage rate in the study area. It is estimated that at this wage rate, a labourer would earn ₦476 per year, working 280 days in the year. This earning is discounted for 25 years. Three other wage rates (₦1.40, ₦2.0 and ₦3) were also used for sensitivity tests, and discounted for 25, 35 and 50 years*.

One of the major problems often encountered in studies of this nature is that of determining the appropriate social discount rate. For the purpose of this analysis, something close to the social opportunity cost of capital is considered adequate. Although there is no completely satisfactory solution to the measurement of this variable in an operational setting, the most usual procedure is to select an interest rate based on the observed rates ruling at the time of investigation. While Eckstein** suggested the use of a

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* It is pertinent to note that at the discount rates used, what happens after the 15^{th} or 20^{th} year makes virtually no difference to the final outcome.

** See Eckstein, O, Water-Resource Development: The Economics of Project Evaluation, IBRD., Washington, 1962, p.176.

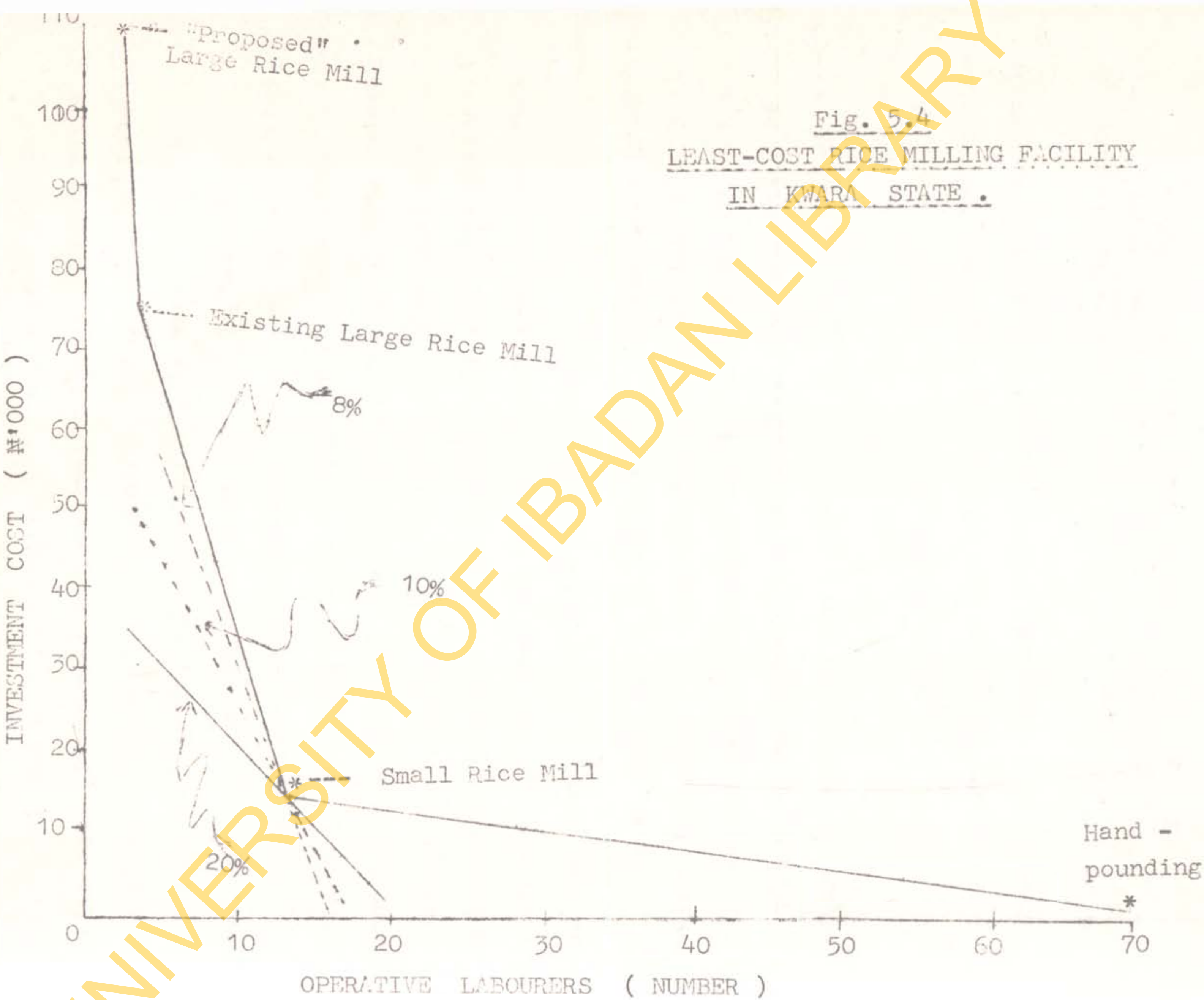

Fig. 5.4
LEAST-COST RICE MILLING FACILITY IN KWARA STATE.

government rate (which measures the opportunity cost of additional taxation), Schmedtje (164) maintained that the prime rate of interest in investments involving least risks should be combined with a free market rate. Applying this approach to Nigeria, Schmedtje's estimate was around 9 or 10%. Stolper*, on the other hand, used 6% in his work on Nigeria's 1962/68 Development Plan and in many other studies, this 6% is often employed as the rate which corresponds to the conditions under which the Federal Government obtains outside funds. Other workers (177, 134, 175, 71) have used some multiple discount rates ranging from 6 to 20%. The present study employs 8%, 10%, 15% and 20% as representing the range of most likely opportunity cost of capital.

At the rate of 8%, a wage of ₦476 per year has a present value of ₦5,507. The slope of the 8% isocost line (Fig.5.4) will be the same as that of a line connecting ₦5,507 on the Y axis with one labourer on the X axis. The derivation of other iso-cost lines are similar.

(d) Discussion of Result

Figure 5.4 shows that all the isocost lines have corner tangencies at the small rice mill, thus suggesting that small

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* See Stolper, W.F., Planning Without Facts: Lessons in Resource Allocation from Nigeria's Development, Cambridge, Mass., Havard University Press, 1966.

rice mills are the least-cost facilities for producing value added in rice processing at the wage livel of ₦476 per year, while the other rice milling units do not appear to be the optimal technique. The hand-pounding technique is certainly not the least-cost technique at the suggested wage level and discount rates - the more so, seeing that alternative "B" data (which are used in the calculation) are heavily biased in favour of this technique. Thus, the decline of hand-pounding technique as well as the predominance of small rice mills in the study area are both corroborated by economic analysis.

This conclusion remains valid even when three other wage levels (₦1.40, ₦2 and ₦3) are used to allow for sensitivity test. The estimated present value of the annual wage level corresponding to these wage rates are presented in table 5.12. When these figures are ploted on a graph following the procedure described earlier, all but two isocost lines* are tangent to the isoquant at the small rice mills. It is understandable then, why small rice mills predominate in the study area. Where the price mechanism has been allowed to operate, the efficiency of small rice mills has been evi-

* These are the 8% and 10% isocost lines constructed at the wage rate of ₦3 per day, both of which are tangent to the isoquant at the existing large rice mills.

Table 5.12

THE PRESENT VALUES OF ALTERNATIVE WAGE RATES DISCOUNTED FOR 25 YEARS*

Discount Rates	Wage Rates			
	1.40	1.70	2.0	3.0
8%	4535.2	5507.0	6478.0	9718.2
10%	3557.1	4319.3	5081.5	7622.28
15%	2271.8	2758.6	3245.4	4868.1
20%	1633.1	1983.3	2333.0	3499.5

* It is interesting to note that when these present values were also discounted for 35 years and 50 years, the conclusion remained valid in both cases.

dently apparent to investors and these facilities have indeed mush-roomed throughout the rice producing areas of Kwara State. The only existing large rice mill is owned by the government who, understandably, pays relatively little attantion to market forces in decision making.

The policy implication is fairly clear: given the input and output data used in the analysis, one can venture the judgment that the present move in favour of large rice mills does not appear to be a step in the right direction. In the light of the analyses, what is needed, as indicated earlier, is efforts aimed at encouraging prospective millers to purchase simple but modern rice mills with facilities for sorting extraneous matters from paddy rice and for separating bran from husks. Corresponding efforts should be made to increase the supply of paddy rice to feed the mills so as to make possible the full utilisation of the mills' capacity.

The point must be made, however, that economic theory can only be, at best, a guide to action. This is because the dimensions to any planning process transcends the narrow confines of theories, especially in situations where the issues at stake have social, political and economic implications, some of which are not quantifiable. Moreover, the applications of economic theories are generally limited by lack of reliable data. Whereas the theory of production which embraces technology and its choice calls for accurate data on production processes and estimates of the opportunity costs of production factors, it cannot be claimed that the data and the technique utilised in the present analysis are error-free.

Besides, there are generally conflicts among objectives- as between economic growth and employment generation, for example. A facility which is optimal from the point of view of economic growth may be sub-optimal in terms of employment generation. At the other end of the spectrum, for instance, the employment potential of hand-pounding technique is fascinating. Table 5.10 provides an estimate of the potential employment effect of different milling techniques, assuming full utilisation of milling capacity. Total number of labourers employed in hand-pounding facility is 137.0 per 1,000 tons of paddy rice, (using the data for " Alternative A "), while the corresponding figures for small mills, large rice mills and "proposed" large mills are 4.9, 3.2, and 2.7 respectively. Although these are very rough estimates they give some idea of labour absorption in hand-pounding unit vis-a-vis the other facilities. Evidently, the loss of jobs resulting from the elimination of hand-pounding technique is substantial, although it is necessary to weigh this against the increased employment resulting from the marketing and handling of the large output from the mechanical mills.

4. Concluding Remark

The foregoing analysis reveals that although the existing small-scale processing units were making statisfactory performance, there is room for improvement. With regards to milling units, one major factor responsible for the present relatively high milling cost was found to be the under-utilisation of milling plants, thus calling for, among other things, an increase in the supply of paddy rice to feed the mills. The analysis shows that the small (mechanical) rice mills are the least-cost milling facilities in Kwara State - a result which is amply confirmed by recent evidence on actual investments in rice processing facilities in the study area.

One aspect which is apparently neglected in the state is the need for providing millers with technical knowledge regarding the establishment and operation of simple but modern rice milling and parboiling plants. Rather, the government's attention is currently concentrated on providing millers with loans with which to purchase paddy rice for milling and then selling the milled rice, instead of merely servicing paddy owners as at present. It is necessary to point out, however, that the success of this policy will depend, among other things, on whether or not adequate marketed surplus of rice can be generated from the surplus sector of the rice economy. Herein lies the rationale for a critical evaluation of the factors influencing the marketed surplus of rice in Kwara state. This is the subject of the next chapter.

CHAPTER VI

MARKETED SURPLUS OF RICE

1. Preliminary Discussion

This Chapter is devoted to the analysis of marketed surplus and home consumption of rice in Kwara State. As a background to this study, some marketing aspects of rice will be briefly examined*.

The starting point in the marketing channel is of course the paddy rice producer, who generally offers his produce for sale only after making provision for consumption requirement and after sufficient amount has been reserved for seed, wage payment in kind and other necessary requirement. The summary of the general pattern of disposal in the study area is presented in Table 6.1. The table shows that 33% of the total output produced during the period under study was marketed while 28% was used for family consumption. The proportion utilised for other purposes were as indicated in the table, although this aggregation conceals the observed variation among individual farmers. The survey revealed, for instance, that a sizeable number of the respondents (mostly small farmers) had no marketed surplus while some farmers sold as much as 70% of their rice output. The

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* Briefly, because these aspects have been discussed in the literature (130).

Table 6.1

PATTERN OF RICE DISPOSAL AMONG RICE PRODUCERS IN KWARA STATE

Pattern of Disposal	Percentage of Total Output
Used for family food	28.0
Sold in the market	33.0
Used as gifts	10.1
Reserved for seed	7.8
Used for entertainment	6.7
Loaned out	6.7
Used for wage payment	5.6
Amount in stock	2.1

farmer either sells the paddy to a paddy dealer or processes it himself before marketing.

In typical peasant farming, output is generally sold in small lots depending on the needs of the family for essential goods and services. About 62% of the farmers interviewed indicated that they normally sold in small lots while 38% stated that they sold in bulk. 78.8% of them sold in paddy form while 21.2% processed the paddy before selling as shown in Table 6.2 . The processed rice is sold to the middlemen or in some cases to the consumers at the local markets. Generally, there is little or

Table 6.2

PERCENTAGE OF FARMERS SELLING THEIR PADDY RICE BEFORE OR AFTER PROCESSING

How sold	Percentage of farmers responding
On the farm before harvesting	5.4
On the farm after harvesting but before treshing	14.5
On the farm after threshing	24.5
At home/market before processing	34.4
At home/market after processing	21.2

no specialisation with regards to the roles played by these middlemen in the marketing process; usually an average trader engages in the marketing of various food crops, including rice.

One major feature of the marketing process is the relatively high losses* frequently sustained, particularly by the rice farmer, due mainly to inadequate transportation, processing, and rudimentary storage processes. However, while the storage of milled rice constitutes a major problem with which producers and dealers frequently grapple, the storage of rice in paddy form does

* Harvested grains are perhaps reduced by about 25% on account of these losses.

not appear to pose a serious problem. More than 85% of the farmers interviewed indicated that they always stored their paddy rice either inside their houses or in local silos (rhumbus). Admittedly, the technology involved is crude, but the paddy rice stored in this way can keep for a relatively long time (about a year) without any appreciable loss.

The existing market organisation ranged from co-operatives to loose associations of middlemen and individual buyers. About 40% of the respondents stated that they preferred selling to individual customers who came forward for rice purchase, on the grounds that they pay promptly. The remaining farmers preferred selling to associations of middlemen, co-operatives, wholesalers, ministries or corporations either on the grounds that these bodies tend to pay good prices or that they often provide the farmers opportunities for borrowing cash for further investment in rice production.

According to the farmers interviewed, difficulties experienced in rice marketing in order of importance were lack of prompt payment, inefficient processing facilities, poor transport facilities and poor prices. These prices, according to about 46% of the respondents, were strongly influenced by the existing association of middlemen; only 2.6% considered that government has any influence on rice price.

In summary, rice marketing in Kwara state is characterised by poor organisation, inadequate transportation and processing facilities, rudimentary storage processes, poor prices and monopsonistic practices by loose association of middlemen. This calls for the promotion of rice marketing cooperatives and marketing services such as storage, processing and transportation, an improvement of marketing environment and regulatory policy for the removal of market 'power' reportedly wielded by middlemen.

2. Model for Marketed Surplus

The rice economy can be viewed as consisting of two sectors, namely, the surplus sector and the deficit sector. The surplus sector is made up of only those farmers whose home consumption is less than their total annual production while the deficit sector includes the non-agricultural sector, those farmers producing crops other than rice, the rice producers who consume their total annual production and those rice producers whose home consumption exceeds their total annual output. In this study, attention shall be focussed on the surplus sector.

The point of departure, then, is a rice farmer in the surplus sector and with a given resource endowment. In a monetised economy, the farmer has the opportunity to exchange some of his rice output for a basket of other commodities, X, which he does not produce. Ignoring wage employment in non-agricultural sector (which is assumed to be negligible), X may alternatively be regarded as the farmer's real cash income, representing his generalised purchasing power in the monetised economy.

If we take the price of the X good as a numeraire, we may write

$$X = P . M \tag{6.1}$$

where

P = the exchange rate between X and M

M = total rice sales

Denoting total rice production by Q, and volume consumed by C we have*

$$M = Q - C \tag{6.2}$$

Re-arranging, we have

$$Q = C + M \tag{6.3}$$

Q, M, and C are each assumed to be a function of P, i.e

$$Q = Q(P) \tag{6.4}$$

$$M = M(P) \tag{6.5}$$

$$C = C(P) \tag{6.6}$$

Thus, the farmer may be expected to respond to higher prices by producing more rice, increasing his rice sales, or by reducing his consumption, other prices remaining the same.

The economics of allocating Q between C and M is illustrated in figure 6.1. The quantity of rice output is measured on the horizontal axis. The distance from O to the right measures the quantity of rice marketed and the distance from H to the left measures the quantity reserved for home consumption. The quantity of X is measured on the vertical axis.

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* The model excludes stock and abstracts from the disposal of output other than consumption and sale, implying that the farmer always have positive marketings. This model, originally proposed by Krishna (91) was employed by Toquero et al (174) and Mubyarto and Fletcher(113) among others.

Fig. 6.1: Allocation of Output of Rice Between Market Sale and Home Consumption: Effects of Changes in Price

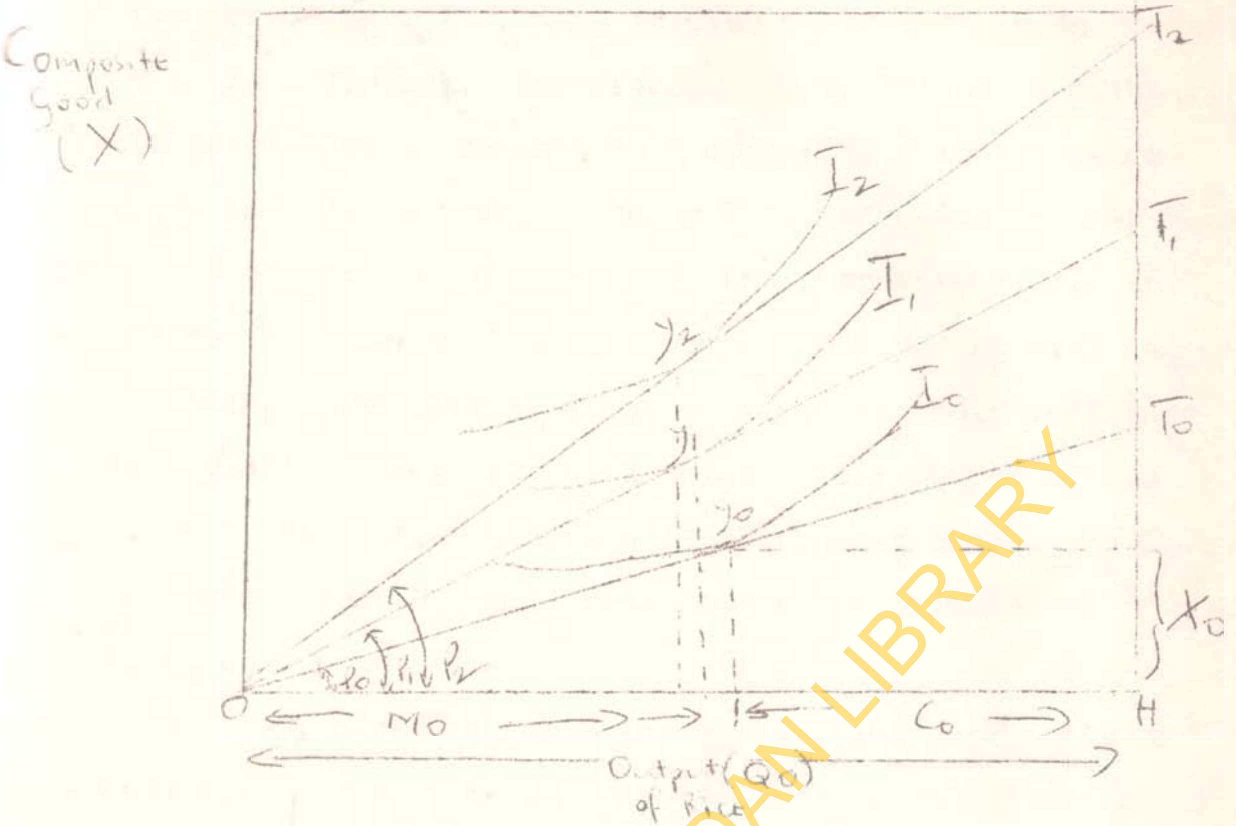
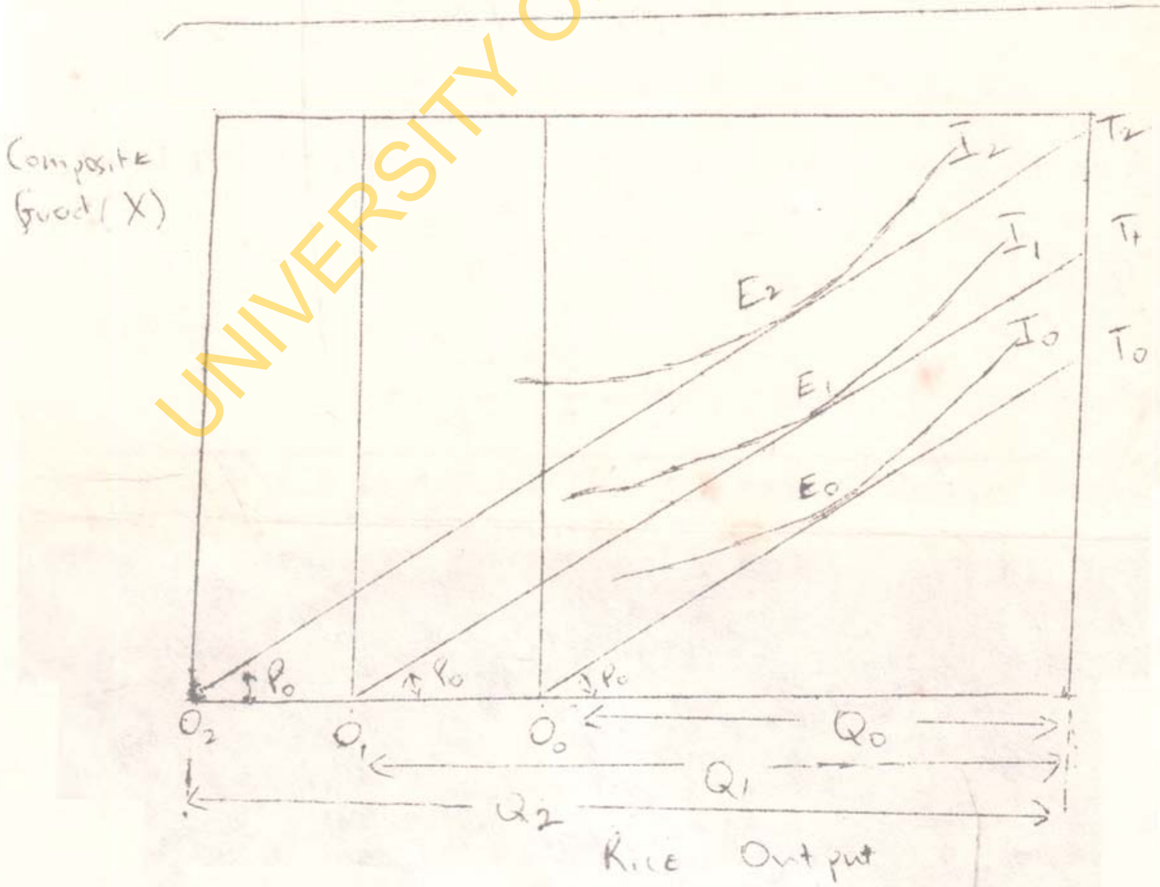


Fig. 6.2. Allocation of Output of Rice Between Market Sale and Home Consumption: Effects of Changes in Output



Assuming that the farmer's income is generated solely from rice sales and that utility is derived from the consumption of both rice and X, then at the initial relative price (P_o) the farmer can move along P_oT_o , thus trading rice for X in an attempt to maximise satisfaction. Satisfaction is maximised at point y_o where the price line is tangent to a consumption indifference curve (I_o), with the farmer consuming C_o of rice (out of the total Q_o produced) and trading M_o for X_o of the composite good. Any change in the relative price, say from P_o to P_1 to P_2 will change the equilibrium point from y_o to y_1 to y_2. As shown in figure 6.2, these equilibrium points will shift as the output of rice changes. For instance, an increase in rice ouput from Q_o to Q_1 to Q_2 for a given price (P_o) will shift the equilibrium point from E E_o to E_1 to E_2 .

It is clear, therefore, that the equilibrium quantities of marketable surplus and home consumption are a each a function of both P and Q. This relationship is shown in equation(6.7) and (6.8) for the marketed surplus and home consumption functions respectively (174) .

$$M = f(P, Q) \tag{6.7}$$

$$C = g(P, Q) = Q - f(P, Q) \tag{6.8}$$

The total price elasticity of marketed surplus is given as *

$$b = b_p + b_qY \tag{6.9}$$

where

$b_p = \frac{\partial M}{\partial P} \cdot \frac{P}{M}$, the partial price elasticity

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* Equation: 6.9 is derived from the reduced form of equations 6.15, 6.20 and 6.21 .

of marketed surplus

$$b_q = \frac{\delta f}{\delta P} \cdot \frac{\bar{Q}}{\bar{M}}, \text{ the output elasticity of marketed surplus}$$

$$Y = \text{the price elasticity of output}$$

Similarly, the total price elasticity of home consumption is given as

$$a = a_p + a_q Y, \qquad (6.10)$$

which, from equation (6.8), is equivalent to

$$a = -\frac{M}{C} b_p + \left(\frac{Q}{\bar{C}} - \frac{M}{C} b_q \right) Y \qquad (6.11)$$

where

a_p = partial price elasticities of home consumption

a_q = output elasticity of home consumption,

other parameters are as defined earlier.

Alternatively, differentiating equation (6.2) with respect to P we have

$$\frac{dM}{dP} = \frac{dQ}{dP} - \frac{dC}{dP} \qquad (6.12)$$

Expressed in terms of elasticities, we have

$$eP_M = m \cdot eP_Q - (m - 1) eP_C \qquad (6.13)$$

where

eP_M = price elasticity of rice marketing,

eP_Q = price elasticity of rice production,

eP_C = price elasticity of home consumption,

$m = \frac{Q}{M}$, the output-marketing ratio.

Thus, the marketed surplus of rice is shown to be a function of the price elasticity of rice production, the price elasticity of home consumption and the output-marketing ratio(113). Therefore, the problem of computing the price elasticity of marketed surplus is to obtain empirical estimates of each of these magnitudes.

The marketing ratio, m, has already been estimated in the preceding section. Following Toquero *et al*[174], Mubyarto and Fletcher[113] and Mangahas *et al*[102] the price elasticity of rice production can be approximated by the price elasticity of hectarage. In the sections that follow, both hectarage and home consumption elasticities will be estimated. These estimates will then be employed to compute the price elasticity of marketed surplus, using equations (6. 9) and (6.13) for comparative purpose. In addition, an alternative method of estimating home consumption function will be attempted, employing equation (6.11) .

3. Hectarage Elasticities

(i) Hectarage Response Model:

To estimate the elasticities of rice hectarage, a modified version of equation (2.19) is employed as shown below:

$$A = f(P, H, D, U) \quad .. \quad (6.14)$$

where

A = proposed hectares of rice planting

P = producer price of rice

H = existing hectares of rice planting

D = dummy variable which takes the value of one for all the areas in Edu Division and zero otherwise.

U = error term

The postulated relationship between the dependent and the independent variables can be expressed as follows:

$$A = a_o + a_1P + a_2H + D + U \quad (6.15)$$

$$\text{Log } A = \log a_o + a_1\log P + a_2\log H + a_3D \quad (6.16)$$

$$\text{Log } A = a_o + a_1P + a_2H + a_3D \quad (6.17)$$

$$A = \log a_o + a_1\log P + a_2\log H + a_3D \quad (6.18)$$

These equations were fitted to the cross-sectional data which were obtained from the field survey as explained in

Chapter I. Specifically, farmers were asked to indicate the number of hectares of rice they would like to cultivate at alternative producer prices. From economic theory, it is expected that a_1 and a_2 will be positive, implying that an increase in producer price and existing hectarage leads to a rise in the proposed rice hectarage. The coefficient for dummy variable can take any sign depending on the influence of production area on proposed rice hectarage.

(b) Hectarage Response Estimates:

The result of the different equations are presented in Table (6.3).

Table 6.3

REGRESSION COEFFICIENTS FOR HECTARAGE RESPONSE AMONG RICE FARMERS

Equation form	Constant	Regression Coefficients P	H	D	R^2	F
Linear	-4.6403	0.0927+ (3.914)	0.4958+ (4.833)	1.440* (1.4643)	.40	19.2
Double log	-2.5641	0.6414+ (3.7531)	0.6479+ (4.4820)	0.6597+ (7.5343)	.60	42.9
Exponential	-1.4604	5.0671+ (3.6671)	4.708+ (5.808)	1.83* (1.43)	.47	25.5
Semi-log	-2.134	2.1748** (2.0622)	2.7001+ (3.0267)	2.6087+ (4.828)	.38	17.7

* Significant at 10% level

** Significant at 5% level

\+ Significant at 1% level

In both the linear and the exponential equations, the price variable (P) and the hectarage variable (H) are both statistically significant at 1% level of probability while the dummy variable (D) is significant at the 10% level. The R^2 is 0.40 and 0.47 in the two equations respectively. In the double log equation, all the variables are significant at 1% level, the R^2 being 0.60 - the highest among the fitted equations. The coefficients of the dummy and hectarage variables are both statistically significant at 1% level in the semi-log function while that of the price variable is significant at the 5% level of probability. This function gives the poorest "fit" among the fitted equations, its R^2 and F value being 0.38 and 17.7 respectively.

Thus in all the fitted equations, the included variables account for between 38 and 60% of the variability in the rice farmers desired hectarage. All the coefficients are statistically significant as measured by the t-test. The signs of the price coefficients suggest a positive price response, that is, a price increase induces an increase in the aggregate hectarage cultivated while a price decrease results in hectarage decline. The coefficients of both the existing hectarage and the dummy variable are also positive and statistically significant.

The hectarage response elasticities with respect to the variables of concern are computed at their means values for each of the equations, using the following formula:

$$Es = \frac{\delta A}{\delta Xi} \cdot \frac{\bar{Xi}}{\bar{A}} \qquad (6.19)$$

where

$\bar{Xi}$ and $\bar{A}$ are the means of the respective variables and $\frac{\delta A}{\delta Xi}$ the partial derivative of A with respect to Xi. The estimates of these elasticities are presented in Table (6. 4).

Table (6.4)

PROPOSED HECTARAGE RESPONSE ELASTICITIES

Functional Forms	Elasticities with respect to Producer Price	Elasticities with respect to existing hectarage
Linear	0.89	0.45
Double log	0.64	0.65
Semi-log	0.61	0.58
Exponential	0.55	0.47

The elasticities with respect to existing hectarage ranged from 0.45 to 0.65 while those with respect to price ranged from 0.55 to 0.89. In the double log equation (the lead equation), the price elasticity of hectarage response was 0.64, indicating that a 10% change in producer price would tend to generate a 6.4% change in rice hectarage. These estimates, in general, suggest that under the current production conditions, rice hectarage (i.e. the production component of the rice marketing response function) is faily highly responsive to price changes and therefore likely to give rise to a vigorous short-run positive relationship between rice prices and quantities marketed.

The point must be made, however, that the responses obtained in this study are essentially normative in the sense that they represent only what the farmers assumed they would do. As Olayemi and Oni (129) rightly pointed out, what farmers want to do often tend to diverge from what they actually do, owing to such factors as lack of perfect knowledge, capital, rationing, inertia and catastrophic conditions.

4. Home Consumption Elasticities

As indicated in section 2, estimates of price elasticity of home consumption are needed to complete an empirical evaluation of the marketed surplus function of rice. Ideally, time series data on home consumption of rice are required for this purpose. Since these data are not available, cross-sectional data were obtained during the survey as explained in Chapter I. These are used to compute the income elasticities of home consumption which in turn are employed to estimate price elasticities of marketed surplus. For comparative purpose, a more direct estimate of price elasticity of home consumption is attempted in a subsequent section, employing the relations developed in equation (6.11).

(a) Home Consumpiton Model:

It is postulated that the home consumption of rice is a function of total household income, household size and the volume of rice output. The model employed in the study can therefore be represented as.

$$Y = f(E, H, Q, U) \tag{6.20}$$

where

Y = quantity of rice consumed per month (kg.)

E = total household income.

H = household size.

Q = volume of output (kg.)

U = error term.

In line with the common practice, aggregate monthly expenditure was used as an approximate measure of aggregate monthly income in view of the non-availability of data on rice farmers' total income.** On a priori grounds, it is expected that the coefficient of the expenditure variable will be positive if rice is a normal good or negative otherwise. It is also expected that the coefficient for the household size variable will be positive or negative depending on the influence of this variable on the home consumption of rice. Finally, the volume of rice output is expected to be positively correlated with home consumption.

(b) Home Consumption Estimates:

The postulated home consumption model was tried, utilising the linear, double log and semi-log functions. The estimated regression coefficients are presented in Table 6.5.

In the linear equation, the coefficients for H and E were statistically significant at the 1% level and that of Q at the 5% level. The R^2 and F values obtained for this equation were 0.65 and 37.2 respectively. In both the double log and semi-log functions, the coefficients for H and Q were statistically significant at 1% level while the coefficient for E was significant at the 5% level. The R^2 and F values were respectively reduced to 0.58 and 27.2 in the double log function, and to 0.48 and 17.9 respectively in the semi-log function.

** The use of aggregate monthly expenditure as a proxy for aggregate monthly income assumes zero saving i.e. that a farmer's total expenditure approximates closely to his total income. This method is commonly employed in the literature. See for instance Mubyarto and Lehman B. Fletcher(113).

Table 6.5

Regression Coefficients for Home Consumption of rice

Equation No.	Form of Equation	Constant	E	H	Q	R^2	F
1	Linear	12.034	5.5569** (6.494)	0.2122** (2.716)	0.0051* (1.966)	.65	37.2
2	Log-log	3.029	0.5634** (5.644)	0.2746* (1.771)	0.3762** (3.313)	.58	27.2
3	Semi-log	2.384	45.4158** (4.1695)	23.3259** (2.3573	18.4401** (3.52)	.48	17.9

** Significant at 1% level

* Significant at 5% level

It is clear then that all the regressors accounted for between 48 and 65% of the variability in the dependent variable. The regression coefficients were all positive and statistically significant (most of them at 1% level), thus satisfying "a priori" expectations. Judging from the magnitude of the coefficients and their level of significance, household size appears to be the most important factor influencing home consumption of rice.

Estimates of the home consumption elasticities are presented in Table 6.6. The computed expenditure elasticities ranged from 0.84 in the semi-log equation to 1.1 in the linear. Output elasticities were 0.001, 0.37 and 0.34 in the linear, double log and semi-log equations respectively.

Table 6.6

ELASTICITIES OF HOME CONSUMPTION WITH RESPECT TO EXPENDITURE, VOLUME OF OUTPUT AND HOUSEHOLD SIZE

Equation No.	Form of equation	Elasticity with respect to Expenditure.	Elasticity with respct to Output.	Elasticity with respect to household size
1.	Linear	1.1	0.001	0.15
2.	Double-log	0.96	0.37	0.27
3.	Sémi-log	0.84	0.34	0.46

What is of major interest for the purpose of this study is the estimated expenditure elasticities. The result shows that these elasticities were positive and relatively high, implying that rice is a normal good. In the rest of this study these and other estimates would be employed to compute the price elasticity of marketed surplus.

5. Marketed Surplus Function

(a) Estimating Procedure

In this section, statistical regression analysis will be employed to examine the relationship between the marketed surplus of rice and selected variables. The estimated regression coefficients will be used together with the parameters computed in the preceding section to derive the partial and total elasticities of marketed surplus.

Corresponding to equation 6.7, it is hypothesised that factors which may significantly influence the level of marketed surplus include producer price, level of output and household size. Possible changes in farmers' behaviour over time and space were adjusted by including the time and area dummies. With the inclusion of these additional explanatory variables, the relevant model for marketed surplus becomes:

$$Y = f(P, Q, N, T, D, U) \tag{6.21}$$

where

Y = level of marketed surplus

P = Producer price

Q = level of output

N = household size (total number of people in the family)

T = time dummy (takes the value of 1 for 1977 and zero for 1978)

D = dummy variable (1 for areas in Edu division and zero otherwise)

U = error term.

It is postulated that producer price variable (P) would be positively correlated with the level of marketed surplus, implying that marketed surplus of rice should increase with an increase in producer price. The level of output (Q) has been considered to be possibly the most important factor affecting the level of marketed surplus[111], although findings in this connection are not yet conclusive.* Similarly, conflicting findings have been observed between the proportion of marketed surplus and the size of holdings.** For example, whereas Bansil[10] found positive correlation between the two variables, Rao's study indicated that the correlation is negative in five out of seven villages[152]. With regards to family size (X_3), it is expected that this variable will be negatively correlated with the level of marketed surplus since the larger the family the greater will the food requirement in the family tend to be and the smaller the proportion of output marketed, although some previous studies have shown that this relationship is not very significant.***

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* For instance, Saran[161] showed that there is not always a positive relationship between production and marketing.

**This variable was included in the present model but was dropped owing to its relatively high correlation with the level of output and the resulting non-statistical significance of its regression coefficient.

***See, for instance, Misra and Sinha[111].

(b) Empirical Findings

To examine the relationship between the marketed surplus of rice and selected explanatory variables, a number of functions - the linear, double log, semi-log and exponential-were fitted to the available cross-sectional data, showing the disposition of output by the same farmers for the years 1977 and 1978. As usual, the lead equations were selected on the basis of the value of the coefficients of multiple determination (R^2), the statistical significance of regression coefficients and the correct signing of these coefficients. The results are presented in Table 6.7.

The coefficient of multiple determination ranged from 0.46 in Lade to 0.89 in Otube, indicating that the explanatory variables explained between 46% and 89% of the variation in the regression. All the F values were statistically significant at the 1% level.

The regression coefficient for time dummy variable was statistically significant at 10% level in Shonga and Lade. The coefficient for output was positive and statistcally significant at 1% level in most of the equations, suggesting that marketed surplus increased with increase in the volume of output. The high significance of the coefficient for output shows that volume of output is a major factor determining the level of marketed surplus of rice*.

*This conforms with the findings of Bhargaya and Rustogi(22), Parthasarathy and Kamalakar(146), Raj Krishna(91) and Rao(152).

Table 6.7

Estimated Regression Coefficients for Marketed Surplus of Rice in Kwara State

Area	Form of equation	Constant	Regression Coefficients P	Q	N	T	R^2	F
1. Shonga	Linear	-76.032	0.8340* (1.4367)	0.21919*** (4.6117)	-30.7177*** (-2.889)	0.652* (1.437	0.50	18.0
2. Pategi	Double Log	3.561	0.5886 (0.5056)	0.63778*** (5.0345	(0.51141*** (3.2523)	0.158 (0.67)	0.48	22.1
3. Lade	Linear	11.9512	0.1747* (2.3009)	1.9478*** (5.6548)	-0.7853* (-1.4347)	0.7281* (1.5820)	0.46	12.0
4. Otube	Double log	-1.678	0.456* (1.724)	1.0525** (2.2967)	0.6422* (1.4947)	0.4213 (0.0231)	0.89	42.2

* Statistically significant at 10% level

** Statistically significant at 5% level

*** Statistically significant at 1% level

On the other hand no clear pattern was evident with respect to the relationship between marketed surplus and family size. While the coefficient for this variable was negative in Shonga (significant at the 1% level) and Lade, it was positive in Pategi (highly significant) and Otube. The reason could be that in the former, additional family labour input consumed more than it contributed to output while the reverse was true of the latter. The coefficients of producer price are positive and significantly different from zero in Shonga, Lade and Otube, showing that price has a significant effect on the level of marketed surplus of rice in these areas.

This is confirmed by the result of a motivation survey showing farmers' disposition of rice in response to changes in output and price (Table 6.8). In response to an output increase of 2 bags, 51.2% of farmers indicated that they would sell off the output increase; 39% indicated they would sell part of it and consume the rest while only 7.5% indicated that they would consume all of it. Similarly, a majority of the farmers (68.7%) indicated that they would decrease their home consumption if the price of rice rose by ₦5 per bag while 29.2% planned no change in home consumption. Only 2.1% indicated that they would decrease home consumption in response to a price increase.

Table 6.8

Farmers' Disposition of Rice in Response to Changes in Output and Price

Item	Percentage of Farmers Responding.
1. Farmers response to an output increase of 2 bags.	
sell all of it	51.2
sell part and consume the rest	39.0
consume all of it	7.5
others (include gifts and loans to neighbour)	2.3
Total	100.00
2. Farmers' response to a price increase of N5 per bag.	
Decrease home consumption	68.7
Increase home consumption	2.1
No change	29.2
Total	100.00

(c) Elasticities of Marketed Surplus

Table 6.9 shows the estimates of the elasticities based on the regressions presented in Table 6.7.

Table 6.9

Elasticities of marketed Surplus with respect to output and hectarage

Area	Partial Elasticities with respect to price	Total Elasticities with respect to price	Elasticities with respect to output	Household size elasticities
Shonga:				
Marketed Surplus	0.39	0.90	0.80	-0.44
Home Consumption	-0.86	-0.53	0.26	
Pategi:				
Marketed Surplus	0.58	0.98	0.64	0.51
Home Consumption	0.57	-0.27	0.34	
Lade:				
Marketed Surplus	0.31	1.91	2.5	-0.014
Home Consumption	-1.6	-0.69	0.15	
Otube:				
Marketed Surplus	0.46	1.16	1.1	0.64
Home Consumption	-0.73	-0.38	0.32	

The computed elasticities with respect to output range from 0.64 in Pategi to 2.5 in Lade. The conspicuously high elasticity of sales with respect to output in Lade needs further comment. The result suggests that in this area, a 1% increase in output leads to a 2.5% rise in sales. From the policy standpoint, this means that as rice output increases, farmers in this area will retain a smaller proportion for consumption and sell larger proportion. The reason for this rather high output elasticity is not quite clear. What is known is that in Lade, there is a rice irrigation scheme (established about 10 years ago) which is at present the most developed scheme in Kwara State and evidently offers irrigated rice farmers the opportunity of relatively close contact with the recommendations and the assistance of agricultural extension workers. It is possible that this close contact has significantly influenced farmers' market orientation, especially when it is realised that a large proportion of the farmers' output on the scheme is bought directly by the government both for grain reserve and for seed multiplication purposes.

The total price elasticities were derived using the relations shown in equations 6.9. The computed total elasticities are in the range of 0.90 for Shonga to 1.91 for Lade area as shown in Table 6.9. The estimates of the partial output elasticity of home consumption ranged from 0.15 in Pategi to 0.54 in Lade while those of price elasticity ranged from 0.27 in Pategi to 0.69 in Lade. These estimates imply that the total price elasticity of home consumption are in the range of 0.57 and 1.6 in the area of study.

It will be instructive to compare these estimates with the total price elasticity derived from the relations shown in equation 6.13. Earlier in this chapter, both the price elasticity of hectarage and the output marketing ratio were estimated at 0.64 and 3.0 respectively. In addition, the income elasticity of home consumption was estimated at 1.1. Employing these data and following Mubyarto and Fletcher's proposal that "the price elasticity of home consumption would equal the income elasticity weighted by the budget proportion of expenditures on rice", (113) the total price elasticity of 1.65 was estimated for the whole area. Alternatively, estimates of total price elasticity of home consumption shown in Table 6.9 can be substituted into equation 6.13. This gives an estimate of the total price elasticity of marketed surplus ranging from 0.48 to 1.85.

The estimates presented above might tend to conceal some of the differences existing between different farm sizes. To examine this, farms were grouped into two sizes. Those cultivating 1.23 hectares (the mean size) or less were grouped as small farms while those cultivating above 1.23 hectares constituted large farms. Linear, double log, semi-log and

Table 6.10

Regression Coefficients for Marketed Surplus of rice by farm sizes

Farm size	Form of Equation	Constant	Q	P	N	T	D	R^2	F
1. Large farms	Double log	-1.6120	1.101^{**} (5.4934)	0.6257^{+} (1.448)	0.4378^{*} (1.7177)	0.1234^{+} (1.531)	0.5206^{*} (1.812)	0.38	15.0
2. Small farms	Double log	-4.502	1.9062^{**} (8.1533)	0.1820^{+} (1.4239)	-0.8705^{**} (-3.146)	0.6123 (0.0451)	0.3861 (1.0213)	0.40	27.14

** Significant at 1% level

* Significant at 5% level

\+ Significant at 10% level

exponential functions were fitted to each size group. However, only the double log provides a reasonable fit in each case. The results are presented in table 6.10. The R^2 was 0.38 and 0.40 for the large and small farms respectively. The regression coefficient for the output variable was highly significant in the fitted equations. The size of this coefficient is found to be roughly equal in the functions, indicating that the marginal change in marketed surplus with a change in production was roughly the same in eadh size group. The coefficients for household size was positive and statistically significant at the 5% level of probability for the large farmers, but negative and statistcally significant at 1% level for small farms. This could be interpreted to maan that in the case of small farmers, the larger the family size the greater the output reserved for family consumption and hence the smaller the surplus offered for sale. The reverse is true of the large farmers. The coefficient for producer price was positive and statistically significant at 5% level for both small and large farms.

The estimated elasticities for each size group are presented in Table 6 11. The elasticity with respect to volume of production was 1.1 and 1.9 on large and small farms respectively while the respective household elasticity of marketed surplus was estimated at 0.44 and -0.87 for large and small farms. The respective partial and total price elasticities were 0.63 and 1.31 for large farmers while the corresponding

Table 6.11

MARKETED SURPLUS AND HOME CONSUMPTION ELASTICITIES: LARGE AND SMALL FARMS .

Farm Size	Output Elasticities	Partial Price Elasticities	Total Price Elasticities	Household Size Elasticities
Large Farms				
Marketed Surplus	1.1	0.63	1.31	0.44
Home Consumption	0.32	-0.81	-0.41	
Small Farms				
Marketed Surplus	1.9	0.18	1.33	-0.87
Home Consumption	0.41	-0.78	-0.38	

figures for small farmers were 0.18 and 1.33. The estimated total price elasticity of home consumption was -0.41 and -0.38 respectively.

6. Concluding Remarks

In this study, some of the factors influencing marketed surplus of rice were analysed and some elasticities computed. The study raises some points of interest which are highlighted in this concluding section.

The first point is with regards to the models employed in this study. It is not pretended that the models are entirely satisfactory, although as Olayemi rightly noted, it is generally difficult to find a model which is adequate on the basis of all theoretical and empirical considerations[132]. Nonetheless, these limitations should be borne in mind when employing the estimated response elasticities as a basis for agricultural policy.

The second point of interest is in connection with price policy. It is shown that the production of rice as well the allocation of rice output between market sales and home consumption are both sensitive to price changes. By implication, any policy which depresses producer prices may have adverse effect on the mobilisation of the marketed surplus of rice.* On the other hand, it is evident that increasing producer price as a policy instrument both for rice crop expansion and for generating

increased marketed...

* Discussion with farmers in the study area revealed that as a result of the current mass importation of rice and the consequent fall in the price of locally produced rice, some farmers decided to hoard paddy rice in the 1976/77 season in anticipation of better prices the following season. However, not only did the price fell further in 1977/78 season, a large proportion of the hoarded rice deteriorated in the course of storage.

surplus of this commodity will achieve appreciable success and a vigorous use of this instrument is expected. However, the point must be made that, like in many other price response studies, it is assumed in this study that the resource level in rice production is given. In general, a change in the level of farm resource is expected to alter the estimated response elasticities. Specifically, if the prices of inputs are too high or if these inputs are in short supply, farmers' reaction to price increase may fall below expectation; hence the need to provide farmers with adequate inputs and at the price they can afford.

Of more relevance to this study is the fact that, besides those factors analysed, there are several other factors which, though unquantifiable, are crucial in their influence on marketed surplus. For instance the effectiveness of any policy measures depends on the socio-economic characteristics of the farmers and the promise of marketing outlet for the commodity. An increase in producer price may generate only limited increase in marketed surplus if farmers lack economic motivations, or if the marketing of the commodity is characterised by poor organisation and monopsonistic practices by middlemen. It is therefore necessary, among other things, to supplement price policy with intensive extension education which should aim at increasing rice farmers' awareness and inducing their economic motivation. In addition, there is the need to remove marketing bottlenecks not only to facilitate efficient distribution of rice but also to ensure that farmers are aware of the existing market conditions.

The third point of interest is that volume of production was found to be more significant than family size and producer price in its influence on the marketed surplus of rice. The strategy for increasing marketed surplus of this commodity will therefore focus largely on increasing the level of output, for instance through adequate application of fertilizer, the development of new technology such as high yielding varieties or the improvement in irrigation facilities and other basic infrastructures. Needless to say, corresponding measures should be taken to ensure that output increasing policies do not depress farm prices with consequent decline in farm income.

The logical question to ask at this stage is, therefore, in connection with rice consumption. Specifically, what can we say about consumers' preference for locally produced rice and about rice consumption pattern of non-rice producing units in Kwara State? And what are the factors influencing the consumption of this commodity? These questions are treated in the next chapter.

CHAPTER VII

RICE CONSUMPTION

The preceding chapters took the demand for rice for granted and concentrated mainly on measures for increasing output and marketed surplus of the crop. To complete the analysis of Kwara State rice industry, it is necessary to examine the pattern of rice consumption in the state and to evaluate the factors influencing the consumption of this commodity. This chapter is comitted to that end.

1. Preliminary Discussion

Consumption pattern is generally influenced by the aggregate disposable income and household size among other things. Table 7.1 shows the average monthly disposable income, average household size and the proportion of income spent on rice. The first column indicates the average household size for the different areas and income groups. The number of people per household was roughly 7 for both urban and rural/semi-urban areas. The size ranged from 5.5 for low income to 8.5 for high income group. Column two shows the average income per area/income group. Average monthly disposable income for the urban and rural/semi-urban areas was ₦727.7 and ₦250.1 respectively while those for the income groups ranged from ₦97.8 for the low income group to ₦951.0 for the high income group.

Table 7.1

AVERAGE MONTHLY EXPENDITURE ON RICE IN KWARA STATE BY AREA AND INCOME GROUP

Area/Income Group (1)	Average Size of family (2)	Average monthly disposable income (₦) (3)	Average spent on food (4)		Average spent on rice (5)	
			(₦)	% of income	(₦)	% of income
Urban Area	6.8 (3.0)	727.7 (11.07)*	185.0	25.6	9.0 (8.2)	1.2
Rural/Semi-Urban Area	7.2 (4.9)	250.1 (243.1)	106.16	42.4	10.8 (10.4	4.3
Low	5.5 (3.0)	97.8 (63.4)	51.7	52.9	9.5 (10.1)	9.7
Medium	7.1 (4.0)	299.7 (8.1)	114.8	38.3	10.1 (9.8)	3.3
High	8.5 (4.0)	951.0 (6.5)	181.9	19.1	9.7 (7.2)	1.0

* Figures in parentheses are the standard deviations of the estimates above them.

A marked diversity in the average monthly disposable income for the rural areas and the low income group is evident from the high standard deviation of these estimates relative to the other area/income group. It is noted also that the average for both the urban area and the high income group seems to be exceptionally high. This diversity could be explained by the fact that, in general, housewives contribute significantly to the aggregate household income in both the urban area and the high income group.

The third column of table 7.1 indicates that the proportion of aggregate income spent on food was 25.6 and 42.4% in urban and rural/semi-urban areas respectively. The corresponding figure for the low income group was 52.9% which declinedto 38.3 and 19.1% for the medium and high income groups respectively. This confirms Engel's law which states that there is an inverse relationship between increase in income and the marginal propensity to consume food (138).

It is more relevant for the purpose of this study to examine the pattern of expenditure on rice. Column five in the table shows the average monthly expenditure on this food item. On the average, total monthly expenditure on rice was respectively ₦9.0 and ₦10.8 in urban and rural/

semi-urban areas which represents 1.2% and 4.3% of aggregate monthly disposable income respectively in these areas. The average monthly expenditure on rice was estimated at 4.8% of total food expenditure in urban area and 10.2% in rural/semi-urban area (column 5). With regards to the different income groups, average monthly expenditure on rice was ₦9.5 for the low income group, ₦10.0 for the medium income group and ₦9.7 for the high income group. On the whole 9.7% of the monthly expenditure (or 18.4% of total monthly food expenditure) was spent on rice by the low income group. The corresponding figure for the medium and high income groups was 3.3 and 1.0% of total monthly expenditure, or 8.7 and 5.3% of aggregate monthly food expenditure respectively.

This analysis clearly reveals that the proportion of income spent on rice is higher in rural/semi-urban area than in urban area, and higher for low income group than for high income group. Further discussion of this result is left for section five of this chapter. Meanwhile, it should be mentioned that a majority of the non-rice producing units are currently shifting away from locally produced rice to imported rice. Of the total number of consumers interviewed, 52.1% indicated that they preferred imported rice to any other type of rice in the country (Table 7.2). On the

Table 7.2

CONSUMERS PREFERENCE FOR RICE; KWARA STATE

Type of rice Preferred most	Percentage of consumers responding
1. Imported Rice	52.1
2. Local rice processed by food companies and sold in packets	21.5
3. Local rice processed at local rice mills	15.3
4. "Tapa" rice	11.1
	100

other hand, only 21.5% stated that they preferred local rice processed by food companies while 15.3% preferred local rice processed by the local rice mills.

To examine consumers' preference further, the consumers who preferred imported rice were asked to give the most important reasons for their preference. Their responses are shown in Table 7.3. The reasons given by 49.6% of these

Table 7.3

CONSUMERS' REASONS FOR PREFERRING IMPORTED RICE

Reasons	Percentage of consumers responding
It is relatively cheap	7.3
It has better cooking quality	49.6
It tastes better	5.4
It contains low percentage of broken grains	20.0
It is whiter and longer	8.4
It is more readily available	9.3

consumers was that imported rice has better cooking quality than locally produced rice, thus agreeing with "a priori" reasoning. Other reasons given in order of importance were that imported rice contains low percentage of broken grains, it is more readily available, whiter and longer, relatively cheap and that it tastes better.

2. Regression Analysis and Consumption Elasticities

(a) Consumption Model

The consumption of a commodity is a function of the price of the commodity, prices of related commodities, income, and other factors like size of household, education and taste. Since price observations are taken over the same period, it can be safely assumed that there would be no significant inter-household variation in rice prices. Some other variables are also excluded largely because of non-availability of relevant data.

The model employed in this study can therefore be represented as:

$$Y = f(X_1, X_2, X_3, U) \qquad \ldots\ldots \qquad (7.1)$$

where

Y = Quantity of rice consumed per month (kg)

X_1 = total household income

X_2 = household size

X_3 = education

U = error term

(b) Variable Specification

Quantity of rice consumed per month is the dependent variable; it is based on the information collected from consumers during a single visit. In some of the fitted equations, this variable is expressed on per capita basis. Few comments on each of the independent variables are in order.

(i) Household income or expenditure

Although there has been a protracted debate* on whether household income or expenditure should be used as the measure of purchasing power, the common practice is to use income

* See, for instance, Wold and Jureen(181), and Houthakkers(82)

in cases where a large proportion of the respondents are salary or wage earner and to use expenditure where most of the respondents are self employed. In this study, aggregate monthly disposable income is used as a measure of purchasing power. On a priori grounds, one would expect the coefficient of X_1 to be positive if rice is a normal good or negative otherwise.

(ii) Household size (X_2)

In studies of expenditure patterns, the unit of observation is the household. This unit is not homogeneous however, since there are differences with regards to composition in terms of such factors as age and sex. It is generally believed that in view of the influence of these characteristics on consumption patterns, to rely on household size in terms of absolute number of persons could be misleading. Hence in some studies, households are usually put on comparable basis by using an equivalent adult scale that converts the number of persons in a household to equivalent number of adults. However, this approach is not adopted in this study largely due to non-availability of data . Instead the number of people in the household was used on the assumption that household composition has no appreciable influence on rice consumption pattern.* It is expected that the coefficient for the household size variable will be positive or negative depending on the influence of this

* This assumption is, admittedly, a limitation to the study. The assumption is necessary in view of the fact that a majority of the respondents appeared more cooperative in disclosing the number of people in their households than in giving details about the household composition.

variable on the household consumption of rice.

(iii) Education (X_3)

It is postulated that in so far as education is taste-changing, the educational level of the household head has significant effect on household consumption pattern. On this basis, level of education has been used as an explanatory (dummy) variable in the analysis of household rice consumption in the study area. The variable takes the value of one if the household head has gone through post primary institution and zero otherwise. We expect a positive correlation between this variable and the consumption of rice.

(c) Estimating Procedure

In practice there are several functional forms which may be used in budget studies, both the advantages and limitations of which have been discussed by Goreux(50). While many writers have used the double-log function very often*, Lesser(96) and Prais(148) regarded the semi-log as the most satisfactory. It is very doubtful, however, if "priori" one functional form can be regarded as "better" than another, although many researchers have found it feasible to limit the forms to the linear and the double log. In addition to these two forms, semi-log was also tried in this study. These functional forms are shown in equations 7.2 - 7.4

$$Y = b_o + b_1 X_1 + b_2 X_2 + b_3 X_3 \quad \text{.... linear} \quad (7.2)$$

$$\text{Log } Y = \log b_o + b_1 \log X_1 + b_2 \log X_2 + b_3 X_3 \quad \text{.... Double log} \quad (7.3)$$

$$Y = \log b_o + b_1 \log X_1 + b_2 \log X_2 + b_3 X_3 \quad \text{.... Semi-log} \quad (7.4)$$

where the variables are as defined earlier. The parameters of the variables are derived by the ordinary least squares method.

(d) <u>Empirical Results</u>

Table 7.4 shows the results of the lead equations for rice consumption function by the non-rice producing units. The results for the urban and rural/semi-urban areas are shown in equations 7.5 - 7.10 while equation 7.11 - 7.19 for different income groups.

For the urban area, the co-efficients for the income variable (X_1) was positive and statistically significant at the 5% level when regressed against the quantity demanded (Equation 7.5) The adjusted co-efficient of multiple deter-

Table 7.4

REGRESSION COEFFICIENTS FOR RICE CONSUMPTION IN KWARA STATE

Area	Equation No	Form of Equation	Constant	X1	X2	X3	$\bar{R}^2$	F
Urban (N=110)	7.5	Double log+	1.341	0.1434* (0.109)			.04	4.45
	7.6	Linear	2.043		0.9761** (3.8596)	1.5631 (0.881)	0.015	9.27
	7.7	Double log+	1.005	1.374 (0.5815)		2.7256 (0.7461)	0.11	3.45
Rural/ Semi-Urban (N=73)	7.8	Linear+	3.406	0.0112** (2.479)			0.08	6.14
	7.9	Linear	1.682		0.7749** (3.1833)	0.61402 (0.2545)	0.14	5.58
	7.10	Double log+	1.8820	0.5123 (0.421)		1.0012 (0.7405)	0.15	6.21
High Income (N=53)	7.11	Double log+	2.8264	0.016** (5.785)			0.40	33.5
	7.12	Linear	-0.507		0.5672** (2.673)	0.5102 (0.312)	0.14	20.42
	7.13	Linear+	1.5280	0.1231 (0.567)		0.4320 (0.1234)	0.16	16.13
Medium Income (N=67)	7.14	Linear+	1.2301	0.0079* (2.058)			0.11	8.4
	7.15	Linear	1.2301		1.0895** 3.9877	2.050 (0.640)	0.08	4.25

Table 7.4 (Contd)

REGRESSION COEFFICIENTS FOR RICE CONSUMPTION IN KWARA STATE

	7.16	Double log+	-9.345	1.3210 (1.204)		2.4561 (1.3041)	.14	6.13
Low Income (N= 61)	7.17	Semi log	2.3502	1.1974** (3.313)			.16	10.54
	7.18	Linear	6.3001		1.2624** (3.1793)	5.3082* (1.8177)	.29	30.11
	7.19	Double log+	4.231	0.4561 (0.212)		0.5672 (0.5102)	.18	14.30

* Significant at 5% level

** Significant at 1% level

\+ with Y and X_1 expressed on per capita basis mination ($\bar{R}^2$) was 0.04, showing that this variable alone accounted for only 4% of the variability in rice consumption. In equation 7.6, X_1 was replaced by the household size (X_2) and education (X_3) variables. Although the coefficients for both variables were positive, only that of household was statistically significant. The $\bar{R}^2$ was raised to 0.15. In equation 7.7, both X_1 and X_3 were regressed against quantity demanded, the purpose being to examine which of them was more statistically significant in their influence on rice consumption. Both variables were not statistically significant in the equation, evidently owing to multicollinearity*. Similar pattern was revealed with regards to the rural/semi-urban area. X_1 was highly significant when regressed on the quantity consumed (equation 7.8) but not statistically significant when regressed in conjunction with X_3. While X_2 was highly significant (at the 1% level), X_3 was not statistically significant in any of the equations.

The result for the income groups (equations 7.11 - 7.19) also showed that income variable was, in all cases, statistically significant when regressed on the quantity consumed. Similarly, household size was significant at the 1% probability level in all cases. On the other hand, education

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* The zero order correlation among different variable are as shown in Appendix I.

was not statistically significant except in equation 7.18. In equations 7.13, 7.16 and 7.19 where X_1 and X_3 were regressed together, none of the variables was significant for reasons given earlier*.

Certain points should be noted in connection with these regression results. The adjusted coefficient of multiple determination $\bar{R}^2$ was low in each of the fitted equations. It ranged from 0.04 to 0.40, indicating that other variables besides the ones in which we are interested are more important in influencing rice consumption behaviour of the non-rice producing households. However, all the F values and many of the regression coefficients are statistically significant. The coefficients for income are all positive, suggesting that a change in income will cause the quantity of rice consumed to change in the same direction. It is shown too that while income and family size have significant positive effect on rice consumption education does not appear to be a significant explanatory variable.

(e) Consumption Elasticities

Table 7.5 shows the estimated consumption elastici

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* When the three variables were tried together, the result (not shown here) produced some wrongly signed coefficients, many of which were not statistically significant.

ties with respect to income and household size.* Income elasticity was 0.14 in the urban area and 0.25 in the rural/semi-urban area.

Table 7.5

INCOME ELASTICITIES OF RICE CONSUMPTION

Area/Income group	Equation Number	Income Elasticities	Household size Elasticities
Urban area	7.5	0.14	
	7.6		0.54
Rural/Semi-Urban area	7.8	0.25	
	7.9		0.46
High Income	7.11	0.02	
	7.12		0.58
Medium Income	7.14	0.16	
	7.15		0.57
Low Income	7.17	0.38	
	7.18		0.51

* For the linear and semi-log functions, the elasticities are respectively given as

$$b_i \frac{\bar{X}_i}{\bar{Y}_i} \quad \text{and} \quad \frac{b_i}{\bar{Y}_i}, \quad \text{where } \bar{Y}_i \text{ and } \bar{X}_i$$

are the mean values of the respective variables. In the double log function, the regression coefficients are the elasticities.

The corresponding figure for the high income, medium income and low income groups was 0.11, 0.16 and 0.38 respectively. Household size elasticities were estimated at 0.51 and 0.36 respectively for the urban and rural/semi-urban areas. For the high income group, the household size elasticity was estimated at 0.58; this declined to 0.57 and 0.51 for the medium and low income groups.

This analysis reveals that the household size elasticities were, in general, relatively high. This magnitude was higher for the urban area than for the rural/semi-urban area, and higher for the high income group than for the low income group. On the other hand, the income elasticities, although positive in all cases, are relatively low, implying that while rice is not an inferior food item, the demand for it is fairly inelastic. Furthermore, the result indicates that the income elasticity coefficient is higher for the rural/semi-urban area than for the urban area, and lower for the high income group than for the low income group, thus confirming the result obtained earlier in this chapter. This suggests that, contrary to expectation* an increase in income leads to a decrease in the proportion of expenditure being spent

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* It is generally expected that as income increases, a higher proportion of the household expenditure will be spent on protein foods such as rice. On this, see Oni and Anthonio(138).

on rice. All this coupled with the non-statistical significance of education variable, shows that rice is no longer a "rich man" or a "white man" food in Kwara State- a result which can be attributed to the effect of mass importation of this commodity in the past few years, making it cheaper than many other food items.

3. Summary and Conclusion

An attempt has been made in this chapter to analyse the pattern of rice consumption behaviour of the non-rice producing household in Kwara State. The functional relationship between the consumption of rice and selected variables was examined with a view to identifying the influence of these variables on consumption. Some consumption elasticities were also computed.

The analysis showed that the average monthly expenditure on rice was 4.8% of total food expenditure in urban area and 10.2% in rural/semi-urban area. The corresponding figures for the low medium, and high income groups were 18.4, 8.7 and 5.3% respectively. It was further shown that while family size and income were positively and significantly correlated with the consumption of this commodity, education appears to be an insignificant variable. Both household size and income elasticities were found to be less than unity. The latter was, however, relatively low, implying that although rice is a normal food, the consumption of it is fairly inelastic with respect to income.

The result of the investigation also points to the conclusion that, as at present, consumers' preference for imported rice is rather strong owing largely to the relatively high cooking quality of this commodity vis - a - vis that of the locally produced rice. In this connection, it is necessary to stress that unless domestic production is significantly increased, the current massive importation of rice may continue*, which will tend to stimulate consumers' preference for imported rice further; hence the need for vigorous efforts in employing the measures suggested in the preceding chapters for the purpose of increasing local production and generating adequate marketed surplus of rice in Kwara State. And, assuming negligible inter-state variation in both the production and the consumption of this commodity, it is reasonable to expect that these findings will be valid, to a large extent, for other rice producing states in the country.

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* It was estimated (See Appendix II)that at this current rate of rice importation, about 391, 889 metric tons of imported rice will be consumed in Nigeria by 1985.

CHAPTER VIII

SUMMARY AND POLICY RECOMMENDATION

This study examines the structure and performance of rice production and processing enterprise in Kwara state with a view to identifying possible ways of transforming the industry. Analysis of resource situation and utilisation are carried out and farmer's response to price incentives was investigated. The study also identifies and evaluates some of the factors determining the level of marketed surplus and consumption of rice. The sections that follow are devoted to the summary of major findings and policy recommendation.

1. Resource availability and use.

(a) Land:

The analysis on land resource situation indicates that about 60% of the total rice farm used was family land, 30% gifts, 14.7% rented, and 2. 1% borrowed. No case of land purchase was reported during the study. The modal farm size was found to be relatively small (approxmiately 1.2 hectares), due perhaps to the existing complicated land tenure system, paricularly the evolution of family (as against communal) ownership. It was shown further that managerial ability and family needs are the major factors influencing rice farmers' investment decision, and that other factors such as availiability of land and agricultural officials recommendation did not appear to have any significant effect. production was characterised by a relatively high degree of crop diversification and subsistence production, a factor which necessarily affects farmers responsiveness to price incentives.

(b) Labour:

Family and communal labour were found to be the major sources of farm labour in Kwara state peasant rice production, with about 60% of the respondents depending on family labour, 30% on communal labour and only 19% on hired labour. The observed potential family labour force ranged between 1.0 and 14.0 corrected man-years per family, the model size being 4.0 man-years. Our analysis reveals that not only are many of the rice farmers fairly old, also the level of human investment is abysmally low. About 50% of the respondents were more than 30 years old while over 70% had never attended either adult education class or primary school. Moreover, less than 8% of all the farmers interviewed could either read or write any language. This indicates that for effective dissemination of information among rice farmers, written materials are of little or no practical use; rather, much reliance would have to be placed on other forms of extension education conducive to rapid progress in rice production.

Labour input ranged from 92.6 man-days per hectare in Shonga to 234.4 in Otube, with an average of 122.1 for the whole area. A high degree of diversity was observed particularly among different farm sizes; whereas the labour input on large farms was 98.0 man-days per hectare on the average, the corresponding figure for medium and small farms were 106.3 and 144.8 respectively, thus lending support to the view that small farms, in general, tend to use labour less intensively than large farms. On the whole, labour input per hectare appears to be lower in the study area than in some other rice producing areas, although these differences may merely reflect differences in method of data collection, cultural practices, ecological condition as well as the period of investigation. In general, while labour may not be an extremely scarce factor in rice production, the observed ageing population, the widespread illiteracy, and the attachment to subsidiary occupations are all expected to have adverse effect on the level of productivity, the degree of mobility, the degree of aversion to investment risk and the adoption of innovation in rice farming.

(c) Capital:

The findings on capital resource situation point to the rudimentary nature of fixed capital asset, the increasing demand for government tractor hiring service and the increasing use of fertilizer and improved seeds. The percentage of farmers who made use of government tractor hiring service in Otube, Shonga and Pategi was 70, 50 and 21.3% respectively, with an average of 47.1% for the whole area. About 97.8% of the respondents applied fertilizer, the average dose being 123 kg. per hectares as against the 228.6 kg. per hectare recommended. Most of the farmers grew recommended rice varieties, particularly Mass-2401, and BG-79. The observed seed input per hectare, 17.6 kg., was more than the amount recommended.

The result of our analysis lends support to the view that capital is the most limiting factor in Kwara State rice production. It was shown further that while non-institutional sources of credit play dominant role in peasant rice production, the role of institutional sources is almost nil. The percentage of rice farmers who have ever obtained loan from institutional sources was only 13.3% as against 86.7% who depended on non-institutional sources. In general, considerable credit experience was observed among rice farmers, which suggests that contrary to orthodox view, peasant rice farmers do not have negative

attitude towards credit. Farmers' demand for loan from credit institution will evidently grow, and given the present drive towards farm mechanisation and the increased use of new inputs, it is reasonable to expect that non-institutional source of credit will become inadequate. Hence the need for over-hauling public credit institutions with a view to making loans available to farmers,*
although great care should be taken to avoid problems of non-repayment and excessive costs of supervision. It is reasonable to expect that when combined with programmes providing adequate extension education, timely and adequate supplies of other inputs, and profitable market outlets at the village level, such loans would play vital role in rice production industry.

2. Rice Production and Processing:

Attempt was made in the study to analyse the costs and returns in Kwara State paddy rice farming. Estimated

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* A step in this direction was taken few years ago with the establishment of the Kwara State Agricultural Credit Committee. The function of the committee was to help secure a package loan from the Nigerian Agricultural Bank to the Kwara Cooperative Federation for on-lending to farmers for a range of crops determined annually. Under this scheme, both individuals and groups of farmers could apply for aid on a maximum of 1.22 hectares per crops per farmer. A loan of ₦250,000 granted for 1974 was operated (in kind) throughout the state for selected crops, including rice. However, none of the farmers interviewed appeared to have had access to this scheme.

cost of paddy production was ₦205.8 per hectare, with labour alone accounting for about 70% of total cost. The contribution of working expenses and durable capital input was 12.6 and 17.5% respectively. Yields per man-day were 31.7 kg., 26.5 kg. and 7.9 kg. in Shonga, Pategi and Otube respectively, the average for the area being 22.1 kg. The yield for the whole area was 1506.9 kg. per hectare which is less than the recent national estimate of 1,942 kg., and much below the yields obtained on experimental plots for some swamp rice varieties in Nigeria. These figures were used to compute technical efficiency for rice, and the result indicates low technical efficiency in Kwara State peasant rice production.

Within the limits imposed by the quality of data, our analysis indicates that an average rice farmer was making a quite satisfactory performance, with an average net returns of ₦251.6 per hectare for the area. The observed variation in net returns was attributed to a number of factors, prominent among which is inadequate fertilizer application, late planting/transplanting, availability of irrigation facilities, damage by predatory birds and crop failure due to shortage of rainfall in some areas. These are therefore some of the major areas that call for attention in Kwara State rice production.

The production function analysis carried out in the study revealed points that are worth noting. In all the areas, the land variable alone explained over 70% of the variability in the aggregate production of rice, showing clearly that land was the most crucial determinant of the production of this commodity. The MVP of land ranged from 39.14 in Pategi to 63.8 in Otube. In contrast, the MVP of labour was relatively low, ranging from 0.14 in Shonga to 0.42 in Otube. The ratio of the MVP of labour resource to its acquisition cost was not significantly different from unity in each of the rice producing areas under study. The MVP of operating expenses was 0.19 in Shonga, 0.47 in Pategi and -0.20 in Otube; the allocation of this variable was found to be inefficient in Pategi.

An analysis of farm size and resource use revealed that the MVP of labour was 0.86 on large farms as against 0.06 on small farms, reflecting the higher labour input per hectare on the latter than on the former. The MVP of operating expenses was positive on large farms but negative on small farms. The study further revealed constant returns to scale on both large and small farms, and rejected the hypothesis of inverse relationship between output and farm size in paddy rice farming. In addition, it was shown that while labour was efficiently utilised on small farms, the use of this input was found to be inefficient on large farms. On the other hand, the allocation of operating expenses was efficient on both large farms and small farms.

On the whole, only few significant inefficiencies in resource use were observed in the study area, thus implying that a mere reallocation of resources may not have any appreciable effect on rice output. This points to the need for exploring other measures for increasing rice production in Kwara State; some of these measures are highlighted in a later section.

With regards to rice processing, it is evident from the analysis that in spite of the rather high processing costs, rice processing units were making satisfactory performance, the estimated net return being ₦7.96 and ₦51.51 per ton for parboiling and milling units respectively. The relatively high processing costs was attributed to the under-utilisation of milling plants, among other things. A number of factors accounted for the under-utilisation, prominent among which are inadequate supply of paddy rice to the mills, the proliferation of small rice milling units, and heavy competition from the government-owned Pategi rice mill.

A comparative analysis of the existing rice milling techniques was carried out with a view to identifying the optimal milling facilities in Kwara State. For this purpose a unit isoquant in value added from rice processing was constructed. Nearly all the estimated isocost lines have corner tangencies to the isoquant at the small rice milling facility, thus suggesting that at the wage levels assumed, small rice mills are the optimal techniques in Kwara State - a result which corroborates the observed decline of hand-pounding technique and the recent evidence on actual investments in rice processing facilities in the state.

3. Marketed Surplus of Rice:

Chapter VI was devoted to the analysis of marketed surplus of rice. A brief summary of some aspects of rice marketing was presented in the study and some factors influencing marketed surplus of rice were evaluated. Rice marketing in Kwara State was found to be characterised by poor organisation, inadequate transportation and processing facilities, rudimentary storage facilities, poor prices and monopsonistic practices by loose association of middlemen. This calls for the promotion of rice marketing cooperatives, improvement of marketing environment, and regulatory policy for the removal of market 'powers' reportedly wielded by middlemen.

The study shows that the production of rice as well as the allocation of rice output between market sales and home consumption are both sensitive to price changes. Total price elasticity of marketed surplus ranged from 0.90 to 1.91 while output elasticity fell within the range of 0.64 to 2.5. Price elasticity of home consumption ranged from -0.27 to -1.6; home consumption elasticity with respect to output fell in the range of 0.001 to 0.37. This result is confirmed by the findings of a motivation survey. 51.2% of the rice farmers interviewed indicated that they would sell all of a given output increase while 68.7% stated that they would decrease their home consumption in response to a given price rise.

By implication, increasing producer price as a policy instrument both for rice crop expansion and for increasing the marketed surplus of this commodity will achieve appreciable success, and a vigorous use of the instrument is expected. However, it is necessary to supplement price policy with, among other things, intensive extension education which should aim at increasing farmers awareness and inducing their economic motivation. In addition, there is the need for removing marketing bottlenecks, not only to facilitate efficient distribution of rice but also to ensure that farmers are aware of the existing market conditions.

The study further reveals that volume of production was more significant than family size and producer price in their influence on the marketed surplus of rice. The strategy for increasing marketed surplus of this crop will therefore focus largely on increasing the level of output.

4. <u>Rice Consumption:</u>

An attempt was made in Chapter VII to analyse the pattern of rice consumption behaviour of the non-rice producing household in Kwara State. The analysis showed that the average monthly expenditure on rice was 4.8% of total food expenditure in urban area and 10.2% in rural/semi-urban area. The corresponding figures for the low, medium, and high income groups were 18.4, 8.7 and 5.3% respectively. It was further shown that while family size and income were positively and significantly correlated with the consumption of rice, education appears to be an insignificant variable. Household size elasticities ranged from 0.46 to 0.58 while income elasticities ranged from 0.01 to 0.38.

The positive but relatively low income elasticity of consumption implies that although rice is a normal good, the consumption of it is fairly inelastic with respect to income. The result of the investigation also points to the conclusion that, as at present, consumers' preference for imported rice is rather strong, owing largely to the relatively high cooking quality of this commodity vis-a-vis that of the locally produced rice.

5. Policy Recommendations:

Several policy measures evolve from the foregoing discussions most of which centre around increasing both the output and the marketed surplus of rice in Kwara State. Some of these measures have already been highlighted in the preceding sections. In most of the remaining sections, attention will be concentrated on measures for reducing cost and/or increasing returns in rice production.

(a) Measures for increasing returns:

(i) High Yielding Varieties (HYV)

Evidence in many rice producing countries have pointed to the considerable effect of HYV on rice output. These improved varieties have caused significant upward shift in the production function, thus indicating their high response to changes in the level of inputs. It has been shown for instance that in India and Japan where the HYV are widely adopted, 57 and 91% respectively of the increased production were explained by yield increase, whereas in

Burma and Thailand where HYV are less adopted, only 39 and 47% respectively of the rice production increase were explained by increased yield.(16) Similar findings have been reported in West Africa.*

The present demand in the study area is for HYV maturing earlier than B.G. 79 and Mass - 2401, and therefore less succeptible to late season drought. Although the SML - 140/10 and IR 8 are currently being distributed to farmers for this purpose, only very few of the respondents used these varieties. This calls for efforts to promote the wide adoption of the varieties and a corresponding effort towards increasing the yield (and cooking quality) of IR 8 under local conditions.** In addition, there is the need to encourage farmers to separate rice varieties when planting. As at present, there are grounds to suspect that varieties are being mixed during planting/transplanting. When varieties of uneven maturity dates are mixed, the result is uneven ripening; some over-ripe grain shatter during harvest while other grains are immature, thus reducing the yield per hectare. In addition,

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* On this, see P.R. Herington(63).

** The problem of poor cooking quality of IR 8 has been discussed in the literature. See for instance Barker R.(16) and Castillo G.T. (27).

the practice of mixing seeds of different maturing dates, size, shape and hardness opens rice to bird and rodent damage and lowers milling out-turn.

(ii) Fertilizer Application:

One factor that makes for the realisation of the full yield potential of the HYV is adequate fertiliser application. Available evidence indicates that these varieties not only respond to heavier doses of fertiliser but also use fertilizer more efficiently than traditional varieties [63, 83]. In the present study, it has been shown that fertiliser application on rice farms was grossly inadequate and that this was due more to shortage of capital than to the non-availability of this input. This points again to the need for efficient agricultural credit programme capable of effectively widening farmers credit base in Kwara State.

(iii) Irrigation and Water Control:

Apart from fertilizer, another factor essential for the realisation of full rice yield potential of HYV is the availability of water in adequate quantity and at the right time[51, 69]. According to Barker:

> the availability of these two highly complementary inputs largely determine the sustained rate of growth in rice production that can be achieved by any country with the existing form of the seed-fertiliser technology (16).

The study revealed that apart from draining rice fields during fertilizer application and harvesting, very little effort was made by the irrigated-rice farmers with regards to water control on their irrigated-rice fields. Obviously, the planning of the amount and frequency of application of irrigated water is a technical matter, depending as it is on the effective depth of the soil (i.e. the amount within the range of the plant's roots), its texture, and daily rate of evapo-transpiration[51]. It is therefore necessary that irrigation officers and extension workers increase their effort in encouraging farmers to control the level of water in their rice fields according to the needs of the rice plant at different stages. Apart from drought effect, the observed water shortage on the rice fields could be due to untimely planting and transplanting. The present practice of late and non-uniformity in planting/transplanting time not only opens rice to the danger of possible drought but also accentuates the problem of pests, birds and water control. Sufficient publicity and education is therefore needed to point farmers to these disadvantages.

The study also points to the need for irrigation development in Kwara State. A recent study in Niger State[3] indicates that resource productivity is considerably higher on irrigated than on non-irrigated rice farms, and the present study revealed that output elasticity of marketed surplus was higher on irrigated rice farms than on other areas, thus, showing the importance of irrigation facilities in both the production and the marketed surplus of rice. As already indicated, large irrigation potentials exist in Kwara State some of which are currently being studied or developed for rice irrigation purpose. In such areas where no close perennial streams exist, small tube wells could be sunk for rice irrigation purpose provided the water table is sufficiently high. It is necessary to stress, however, that the shifting of land from swamp to irrigated rice cultivation should be confined to areas most suitable ecologically and at such a rate that the education of farmers can keep pace with the transition.

(iv) <u>Rice Prices:</u>

There is the need to ensure that farmers receive adequate farm gate prices for paddy rice. As indicated earlier, there are grounds to believe that there is a wide margin between producer prices and retail prices for rice which cannot be satisfactorily accounted for by value added to paddy in the course of processing, transporting and marketing. This points further to the need for removing marketing bottlenecks in Kwara State.

(b) <u>Measures for reducing cost:</u>

From the analysis on production costs, it has been shown that labour was the dominant item of cost in paddy production, accounting for about 70% of total cost. One possible way of reducing labour cost is through selective, small-scale mechanisation, defined to include cost-reducing, labour-saving machines, tools and equipment. The cry of most of the farmers interviewed was on the non-availability of tractors at the right time during the crucial period of land preparation. Apart from land preparation, other operations that could be economically mechanised include planting, weeding, threshing and bird scaring. For instance simple machines like foot-pedal rice threshers and Japanese rotary hoes have been found useful where they have been tried. In Sierra Leone for example, available evidence reveals that mechanisation of threshing operation enables more prompt threshing after harvest and thus avoids losses in the stack; besides, it may indirectly lead to some increase in hectarage under cultivation.(82) Similarly, when the foot-pedal thresher and Japanese rotary weeder were introduced to a group of farmers in Nigeria, these machines were well received and farmers expressed the desire to pruchase them (4, 120). Farmers could therefore be encouraged to own some of these machines.

The study shows that a large proportion of labour input was devoted to bird scaring, especially on non-irrigated fields. Since bird scaring problem occurs mostly when rice is planted either too early or too late, reduction of labour requirement in bird scaring requires correct timing of the planting/transplanting operations so that the heading of rice plants may coincide with that of some other plants in the area. To the predatory birds, the seeds of these other plants are good substitutes for rice seeds. Secondly, pooling rice fields together will make it possible to protect the greatest possible area with the least possible trouble and therefore minimise the amount of labour required for bird scaring. It has been observed that farmers who cultivate large blocks of contiguous rice plots used less labour per hectare for bird scaring than farmers with widely scattered plots. In addition, it may be necessary to device indigenous scarers which will actually scare the birds away. For example, small cans could be fitted with stones or other objects which can make the cans rattle when shaken. Series of such cans could be tied to the top of some sticks erected on various spots on the rice field and connected from a common point by a rope. When this rope is pulled at the common point, it sets all the cans along the line rattling, and the noise thus produced could be sufficient to effectively scare away the birds. This method is relatively inexpensive and labour saving.

It is necessary to point out that such judicious mechanisation as is discussed in this section will not necessarily lead to unemployment. It can, in fact, be argued that in a dynamic setting, selective mechanisation could develop non-agricultural job opportunities and therefore create more jobs than it eliminates, particularly in situations where local manufacturers are provided with the needed incentives.*

Another factor that makes for effective use of labour is increase in human investment. Since only a very insignicant proportion of the farmers interviewed were literate, little wonder why the management performance of an average rice farmer was sub-optimum. This points to the need for intensifying adult education programme in the area and for improving agricultural extension activities in order

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* For a discussion on farm mechanisation, see Essang, S.M.(39)

that research findings might be effectively disseminated among farmers.

Some economy could also be achieved in the use of other inputs. The survey data indicate excessive use of seeds due largely to poor planting technique and poor quality of seeds*, both of which often result in low germination percentage and the need to replace missing stands. Furthermore, not all the seedlings raised were actually transplanted in many cases; some were left on the seed beds and these eventually withered away. Efforts to control these factors are called for. Farmers could also be encouraged to use organic fertilisers such as farm yard manure and composts, both of which have been shown to be as nutritious to paddy rice as chemical fertiliser[(51)]. Recommendation on the application of such fertiliser should be made available to farmers and efforts made to popularise their use.**

With respect to rice processing, some policy measures have already been suggested. These include improvement in perboiling technique and effective dissemination of research

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* Most of these seeds were reserved from previous harvests, some of which often deteriorate due to poor storage techniques.

** The point must be made, however, that at the present 50% input subsidy, it is probable that organic fertilisers are not as "cheap" as chemical fertiliser in Kwara State.

findings among rice parboilers. Consideration could be given to the possibility of establishing modern parboiling systems with mechanical drying components which might not only improve the quality of parboiled paddy but also reduce parboiling cost. Suggested measures for transforming milling industry include adequate supply of paddy rice to feed the mills, adequate maintenance of milling plants in order to reduce the rate of breakdowns, provision of facilities for servicing and reparing mills, and replacing existing machines with modern ones which have facilities for sorting extraneous matters from paddy rice and for separating husks from bran. For this purpose, millers could be encouraged to form themselves into cooperatives in order to attract loans for the purchase of modern rice mills.

6. Conclusion and Suggestions for Further Studies:

The result of this study provides some useful information about the structure and performance of Kwara State rice industry. Resource utilisation in peasant rice production was analysed and estimates of resourse productivity and farmers response to price changes computed. Rice processing, marketing and consumption were also analysed and some policy measures suggested. The study has no doubt uncovered various areas demanding further study. First, results on the analyses of paddy production are indicative rather than conclusive, since the study is restricted to a single state and a single crop season, both of which cannot be said to be typical. A more thorough analysis is needed which might cover a number of years and a number of rice producing states in order to obtain more valid results.

Second, it is necessary to note that the present study has not examined the gains or losses that could be foregoneor incurred from increasing the production of rice at the expense of alternative enterprises. Besides, the objective of farmers is generally to maximise income from their farming enterprises as a whole, and not from just one enterprise. Where capital is limited (as it is in the study area), an average farmer is interested in knowing which of his enterprises give the highest return. It is suggested therefore that complete enterprise studies should be carried out so that rice farmers may have some notion of the marginal returns of each possible enterprise and optimum enterprise combination.

Third, there is the need for a thorough feasibility study of the potential areas for more small-scale rice irrigation schemes in Kwara State.

Finally the point must be made that the result of any model is a function of both the assumptions made and the quality of data used. At best one can only attempt to strike a balance between the two, given the time and other constraints. The use of alternative models and/or the relaxation of assumptions may probably enhance the validity of the results of the present study. Similar studies should therefore be undertaken using alternative models and input - output data.

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APPENDIX I

(a) Correlation Matrix: Rice Production Function Estimates, Pategi.

	X_1	X_2	X_3	X_4
X_1	1.0			
X_2	0.77	1.0		
X_3	0.55	0.63	1.0	
X_4	0.74	0.89	0.59	1.0

where

X_1 = land (in hectares)

X_2 = labour (in man-hours)

X_3 = operating expenses

X_4 = durable capital input

(b) Correlation Matrix: Rice Production Funtion Estimates, Shonga.

	X_1	X_2	X_3	X_4
X_1	1.0			
X_2	0.22	1.0		
X_3	0.17	0.21	1.0	
X_4	0.47	0.74	0.41	1.0

(c) Correlation Matrix: Rice Production Function Estimates, Otube

	X_1	X_2	X_3	X_4
X_1	1.0			
X_2	0.77	1.0		
X_3	0.23	0.15	1.0	
X_4	0.71	0.51	0.66	1.0

(The variables are as defined earlier)

(d) Correlation Matrix: Rice Consumption Function Estimates, Ilorin.

	X_1	X_2	X_3
X_1	1.0		
X_2	0.53	1.0	
X_3	0.77	0.57	1.0

where

X_1 = total monthly disposable income of the household

X_2 = household size

X_3 = education variable.

(e) Correlation Matrix: Rice Consumption Function Estimates, Omu-aran.

	X_1	X_2	X_3
X_1	1.0		
X_2	0.11	1.0	
X_3	0.91	0.25	1.0

(The variables are as defined in the preceding section)

APPENDIX II

RICE IMPORT DEMAND IN NIGERIA 1954 - 1976

The attempt here is to estimate the amount of imported rice that will be consumed in Nigeria by 1985. To this end, time-series data were obtained from the Federal Office of Statistics and the FAO publications. Multiple regression analysis was employed to estimates the required parameters. The result of the lead equation is shown below:

$$\text{Log } Q_t = 2.4670 + \underset{(2.265)}{0.668} \log Q_{t-1} - \underset{(1.953)}{1.2109} \log P_t$$

$$+ \underset{(1.6801)}{1.4866} \log Y_t + \underset{(2.681)}{0.5503} \log F_t - \underset{(1.1332)}{0.0866}T - \underset{(0.040)}{0.0251} D$$

$$R^2 = 0.61$$

where

Q_t = quantity of rice imported in year t

Q_{t-1} = lagged quantity of rice imported

P_t = price of imported rice measured as the value of a metric ton of rice in year t, and deflated by the cost of living index.

Y_t = per capita income in year t

F_t = foreign exchange variable, measured as the value of merchandise exports plus reserves,

T = trend variable.

D = war dummy variable (one for the civil war period, 1967-70, and zero otherwise)

Figures in parentheses are the t ratios.

The short run elasticities of demand with respect to price and income are respectively 1.21 and 1.48. Given the income elasticity of 1.48, the demand for rice import in Nigeria is projected to 1985. The projecting equation, following Goreux (50), can be written thus:

$$Q_t\ 1985 = Q_{to} + (Q_{to} \times Ey\ (\frac{y^1}{y} - 1))$$

where

$Q_t 1985$ = quantity imported at the end of projection period, 1985

Q_{to} = quantity imported at the base period, 1976

Ey = income elasticity of demand

y = index of per capita income at the base period

y^1 = index of per capita income at the end of the projection period

Employing this projection equation, it is estimated that about 391,889 metric tons of imported rice will be consumed in 1985, which gives a rough idea of the amount of foreign exchange expected to be expended on rice import by the end of the projection period. While this figure cannot be taken as representing the actual future effective demand, particularly as increased foreign exchange outlay might call for additional restrictions on rice import, it is necessary to realise that such restrictions would naturally have adverse effect on nutrition levels and on the economy in general unless domestic production was sharply increased.

APPENDIX III.

QUESTIONARIES: RICE INDUSTRY IN KWARA STATE

A. QUESTIONS TO RICE FARMERS

Farmer s No. __________ . Acreage __________

Farmer's Name __________ Interviewer __________

Village __________

I. PERSONAL INFORMATION

1. What is your age? __________ years.

2. Did you a end any school? Yes/No __________

3. If yes, how many years did you spend in the following schools

   Koranic school ________ years

   Adult education class ______ years

   Primary school ________ years

   Secondary/Technical School and equivalent ______ years

4. Can you

	vernaculars	English	Others (specify)
read			
write			

5. For how long have you been farming in this area?

   (a) ________ less than 5 years (c) _______ 11 - 15 years

   (b) ________ 5 - 10 years (d) _______ 16 - 20 years

   (e) _______ more than 20 years

6. For how long have you been growing rice in this area?

   (a) _______ less than 1 year. (c) _______ 6 - 10 years

   (b) _______ 1 - 5 years (d) _______ more than 10 years

7. What other occupations do you have besides farming? __________

II. LAND OWNERSHIP AND USE.

1. How much land do you actually use for growing rice this season? ________ acres

2. How did you obtain your land? (state number of acres in each case)

   (a) Family land ______ acres (c) Gift _______ acres

   (b) Rented at ______₦/yr. _____ acres (d) Purchases______ acres

   (e) Others(specify) _______ acres

3. Can you get extra land in this area if you want to expand your rice production? Yes/No: ____________

4. If yes, how will you get the land?

   (a) Family land; _______ acres

   (b) Purchase at ₦____per acre; _______ acres

   (c) Rent at _________ per year _______ acres

   (d) Gift _______ acres

5. What other crops do you grow in this area apart from rice?

   (a) Yam ______ (c) Banana ________ (f) Millet _________

   (b) Cassava ____(d) Vegetables_______(g) Guinea Corn _______

   (e) Maize ____________(h) others _________

6. Why do you grow these other crops?

   (a) ____________ they are needed for family food

   (b) ____________ they fetch more money than rice

   (c) _____________ they are recommended by Ministry officials

   (d) _____________ others (specify)

7. What things do you consider before you decide the amount of acres of rice you would like to have?

(a) ________ whether land is available (d) ______ depends on family needs

(b) ________ whether labour is available (e) ______ as much as I can manage

(c) ______ whether capital is available.

(f) ______ others (specif

III. LABOUR AVAILABILITY AND USE.

1. Please give the names of all those living with you and supply the information required as stated below:

NAMES OF THOSE LIVING WITH YOU	RELATIONSHIP TO FARMER	SEX		AGE	MARRIED	SINGLE	OCCUPATION	ECONOMIC ROLE		ALWAYS LIVE WITH YOU	I W O S
		Male	Female					earner	dependant		
(a)											
(b)											
(c)											
(d)											
(e)											
(f)											

2. How do you obtain labour for your farming operations?

(a) Members of family __________

(b) Exchange labour __________

(c) Hired labour at ₦/k ________ per day month/year.

3. Can you obtain labour anytime you need it?

(a) Always: ______ (b) Occasionally: ________

(c) Most of the time: ________

4. What is the daily wage rate here? ____________

IV. CAPITAL AVAILABILITY AND USE.

1. What did you use in ploughing and ridging your rice plot(s) this season?
   (a) hand tools only ________
   (b) tractor only ________
   (c) hand tools and tractors ________
   (d) others ________

2. If by hand tools only, give reasons:
   (a) ______ rice plot is too small; (d) ______ tractor did not arrive in time
   (b) ______ tractor is not available;
   (c) ______ tractor is too expensive; (e) ________ others

3. If by tractor, from where did you get the tractor?
   (a) ______ from private tractor hiring unit
   (b) ______ from government tractor hiring unit
   (c) ______ the tractor is owned by me
   (d) ______ the tractor belongs to our group
   (e) ______ others.

4. Which hand tools, equipment, etc., do you use for your farming?

Tools	Quantity	When purchased or built	Useful life	Cost per unit
Hoes				
Cutlasses				
Shovels				
Knives				
Sickles				
Mathets				
Axes				
Baskets				
Rhumbu (storage)				
Others				

5. Did you ever apply for loan? Yes/No

6. If yes, to whom or where? ______________________

(a) To your neigbours, friends/relatives ______________________

(b) To commercial bank ______________

(c) To money lenders __________ (d) To the government ________

(e) Others ____________

7. How much did you ask for? ________

8. How much did you get? ____________

9. What did you do with it? __________

10. Suppose you want to borrow money to expand your rice farming business, from where would you borrow it?

(a) From neighbours ______; (d) From local money lenders

(b) From commercial banks __________________

________________ (e) From other sources (specify) _______

(c) From Cooperative Society ___________

11. Have you ever borrowed rice from other producers, sellers or any other body? Yes/No -

12. If yes what was the purpose of such borrowing

(a) _______ for planting

(b) _______ for family consumption

(c) _______ for debt repayment

(d) _______ others.

V. FERTILIZER AND SEED USE

1. Do you normally use fertilizer on your plot? Yes/No ____________

2. If yes, which type of fertilizer do you use? ______________

3. How much fertilizer did you obtain for use on your rice plot this year? ____________ bags

4. Where did you get the fertilizer?
   (a) bought locally ____________ bags
   (b) gift ________ bags/cwt. (c) supplied __________ bags/cwt

5. How did you apply the fertilizer?
   (a) ____________ by broadcasting
   (b) ____________ by replacement in holes dug on the plot
   (c) ____________ other method (specify)

6. If you did not use fertiliser, give reasons ________________

7. Which variety of rice do you grow on your ricc plot this year?

(a) BG-79 ______________	(d) Siam-79 ____________
(b) IR-8 ________________	(e) SML-140/10 __________
(c) Mass-2401 __________	(f) others (specify) __________

8. How much seed did you use for planting this season? ________ ______________________ anani as/mudus/bags.

9. If you were to buy the seeds, how much would you have paid for them? ___________________

VI. IRRIGATION SERVICE AND WATER CONTROL (QUESTIONS TO FARMERS ON IRRIGATION SCHEMES)

1. For how long have you been on the scheme? ____________

2. What problems do you have with the irrigation services?
   (a) Water charges too expensive ________________
   (b) Your farm does not receive enough water from the irrigation system ________________________
   (c) Occasional breakdowns in the irrigations system ___________________________________
   (d) Others (specify) __________________

3. Do you occasionally drain the water on your price plot?
   Yes/No ______________

4. If yes, when do you normally drain the water ? __________

5. (Questions to farmers who are not on the irrigation schemes)
   (a) Did you apply any supplementary irrigation at all?
   Yes _____________
   (b) If yes, briefly describe how you applied the supplementary
   (c) irrigation ____
   ____
   ____

VII. MARKETED SURPLUS RESPONSE AND HOME CONSUMPTION

1. How do you normally sell your rice?
   (a) _____________ in bulk
   (b) _____________ in small quantities depending on family needs

2. When do you normally sell your paddy rice? (in each case indicate the proportion (%) of the rice sold)
   (a) __________ on the farm before harvesting (________%)

(b) ________ on the farm after harvesting but before threshing ________%)

(c) ________ on the farm after harvesting and threshing ________%)

(d) ________ At home before processing (________%)

(e) ________ At home/market after processing (________%)

(f) ________ Others (specify) (________%)

3. If you normally sell in paddy, how much do you sell one bag of paddy rice?

(a) During harvesting ____________

(b) 5 months after harvest ____________

4. To whom do you normally sell your rice?

(a) ________ Individual customers in the market (________%)

(b) ________ Individual customers who come to your house to buy rice (________%)

(c) ________ Cooperatives (________%)

(d) ________ Wholesalers who buy in bulk (________%)

(e) ________ Government (Ministries, Corporations Colleges etc) (________%)

5. Which of these do your prefer most? ____________

Give reasons ________________________________

6. What determines the price at which you sell your rice

(a) ____________ presure from the big middlemen.

(b) ____________ the price of other things in the market

(c) ____________ the price agreed upon by rice association

(d) ____________ the rice price fixed by the government

(e) ____________ the variety or grade of rice you produce

(f) ____________ the type of buyers you sell to

(g) ____________ Others (specify)

7. What difficulties do you experience in selling your rice? ______

8. About how much money did you realise last season from
   (a) the sale of paddy rice ₦ __________, (Number of bags marketed __________)
   (b) the sale of all other crops __________
   (c) the sale of livestock __________
   (d) the sale of poultry (e.g. hens, ducks etc.) __________
   (e) your other occupations (specify). __________

9. Do you normally store your rice Yes/No __________

10. If yes how do you generally store your rice? (indicate the proportion stored in each case)
   (a) __________ local silos, (__________%)
   (b) __________ Government silos (__________%)
   (c) __________ in a store inside your house (__________%
   (d) __________ Others __________ (__________%)

11. How much rice does your household normally consume at a meal __________ mudus

12. How many times does your household eat rice per week __________

13. On the whole, how much did you consume of your total rice output last year? __________

14. How much do you spend on food every month __________

15. How much are you spending every month on all other things apart from food __________

16. What proportion of your family food (from farm sources) do you normally produce on your own farm?
   (a) 75 - 100% __________
   (b) 50 - 74% __________
   (c) 25 - 49% __________
   (d) - 25% __________

17. If the price of rice would increase by ₦5 per bag (and the price of other things do not change), would you change the amount of rice you consume? (tick only one out of these 3 answers)

(a) No change ________

(b) Eat more rice ________

(c) eat less of rice ________

18. If your rice yields would increase by 2 bags, What would you do with the increased output? (Tick only one out of these 4 answers)

(a) sell all of it ________

(b) sell part of it and consume the rest ________

(c) consume all of it ________

(d) others (specify) ________

19. If the price of unmilled rice is increased to ₦60 per bag, how many acres of rice will you plant (assuming you can get more land, labour and capital, and asuming the prices of other things do not change)? ________ acres.

20. Suppose the price of unmilled rice falls to ₦15 a bag, how many acres of rice will you like to cultivate (assuming other prices remain the same)? ________ acres.

21. How many acres of rice would you have liked to cultivate at the following suggested prices (assuming that necessarily resources are available, and assuming other prices do not change)

₦30 per bag ________ acres

₦40 per bag ________ acres

₦50 per bag ________ acres

₦60 per bag ________ acres

VIII. GENERAL PROBLEMS

1. List all the major problems that you have been facing in your farming business. ____________________

2. What is your general impression about your rice this season?

   (a) ____________ it performed very well

   (b) ____________ it was just average

   (c) ____________ it was very poor

3. If poor gave ONE reason (the most important reason) for the poor performance.

   (a) ____________ lack of rain

   (b) ____________ very poor soil

   (c) ____________ attack by pests & diseases

   (d) ____________ planting too early

   (e) ____________ planting too late

   (f) ____________ Others (specify).

4. Make any further comments you like about your farming business:

   ____

   ____

IX. LABOUR RECORDS

Farmers' No. ______________ Acreage ______________

Village ______________ Interviewer ______________

DATE	OPERATION	FAMILY/GROUP LABOUR						HIRED LABOUR						
		Men		Women		Children		Men		Women		Child		COST (₦)
		No.	HRS.	No.	HRS.	No.	HRS.	No.	HRS.	No.	HRS.	No.	HRS	

X. GENERAL EXPENSES, REPAIRS, PURCHASES ETC

Farmers' No. ______________ Acreage ______________

Village ______________ Interviewer ______________

DATE	DESCRIPTION	AVERAGE USEFUL LIFE	QUANTITY	COST PER UNIT (₦)	TOTAL COST (₦)

XI. PATTERN OF RICE DISPOSAL

Date	Rice Disposal	Quantity of Rice Used

B. Questions to Millers

Millers's Name ____________________ Village ________________

Interviewer's Name ________________________

1. Personal Particulars

(a) Age of Miller ______________

(b) Home town ____________________

(c) Did you attend any school? Yes/No _____________

(d) If yes, how many years did you spend in

Koranic School ________ years

Adult education class ______ years

Primary school __________ years

Secondary/Technical

school and equivalent ______ years

2. For how long have you been milling rice? _______years

3. How did you obtain money to start your rice milling business?

(a) from personal saving ₦ ____________________

(b) from relatives/friends ₦ __________________

(c) from money lenders ₦ _____________________

(d) from the bank ₦ __________________________

(e) from the government ₦ ____________________

(f) others (specify) _________________________

4. How do you get the mill you are using?

(a) ________________ it belongs to you

(b) _________________ it belongs to some one else (you are just an employee)

(c) ________________ it belongs to a group of people of which you are a member

(d) __________ it is hired at ₦ _________ per month/year.
(e) ___________ others (specify)

5. If bought, how much did you buy it? ______ Date bought ______

6. How much did you pay to transport the mill from where you bought it to this place? __________________

7. How much did you pay to install the mill? ______________

8. What is the capacity of your engine? ________ horse power.

9. What is the type (or make) of your engine? _____________

10. Do you have problems in servicing and repairing your Mill? Yes/No ___________________

11. If yes, what problems ____________________________________
____

12. How many bags of paddy rice can the mill process in one hour?

(a) during peak season ________________________
(b) during slack season _________________________

13. How many bags of paddy rice do you normally mill in one hour?

(a) during peak season _____________________
(b) during slack season _____________________

14. How many bags of paddy rice do you normally mill per day?

(a) during peak season _________________
(b) during slack season _________________

15. For how many hours does the mill work per day, on the average?

During peak season ____________ hrs
During slack season ____________ hers

16. How many days per week? ____________

17. How many do you spend on the following:

Item	amount spent per month	amount pent per year
(a) Fuel and oil		
(b) Spare parts		
(c) Repair and maintenance		
(d) Wages and salaries		
(e) Others		

18. How many workers do you have in the milling business?

	No of daily paid workers	No of monthly paid workers	Daily wage per worker	Monthly wage per worker
Unskilled labourers				
Skilled lanourers				
Supervisory/Managerial Staff				

19. Which of these do you use in your business?

	Quantity	average useful life	Cost per unit
(a) Buildings			
(b) Baskets			
(c) Bags			
(d) Buckets			
(e) Kerosine tin			
(f) Others			

20. How much do you charge per bag of milled rice? ________
During peak season ______; during slack season ______

21. Do you keep records? Yes/No __________

22. If yes, may I see them? (interviewer should check the records and extract relevant information)

23. Do you have any documents, receipts and other particulars about your Mill? Yes/No __________

24. If yes, may I see them? (interviewer should extract relevant information)

25. What was your previous occupation before you joined this business? ______________________

26. What other occupation do you have apart from this business
____

27. Suppose you want to expand your business, can you get additional capital? Yes or No ______________

28. If yes, how will you get the capital

Personal or family saving ________
Loan from bank ________
Loan from govt ________
Loan from neighbours ________
Others ________

29. What new changes would you have liked to introduce in your business?

buy a new machine ________
build larger premises ________
produce raw materials yourself ________
Other changes ________

30. Why have you not made these changes ______________________

31. How do you normally get technical information about your business?

    from discussion with other millers ______________
    from personal training and experience ______________
    from govt. extension workers ______________
    from trade association ______________
    through overseas trip ______________
    by reading pamphlets, newspapers etc ______________

32. What other information would you like to give about your business ______________________________

____

C. QUESTIONS TO RICE PARBOILLERS

Parboiler's No. ______________

Village ______________

Interviewer ________________

1. Since when have you been parboiling rice? ________ years.

2. How do you normally get the rice you perboil?

   (a) Bought __________

   (b) Supplied by your husband and others __________

3. How much does it cost to buy a bag of paddy rice from farmers during the harvesting period? ______________

4. What is the distance from where you get your paddy rice to your house? ____________________

5. How do you transport the rice from where you bought it to your house?

	Transport cost per bag (in cash or kind)
By head load	________________________
By Donkey	________________________
By Bicycle	________________________
By Truck	________________________
By Lorry	________________________

6. How many hours or minutes will it take an average woman to transport a bag of paddy rice from where you bought it to your house (by head load)? ____________ minutes/hours.

7. What is the distance between your house and the place where you normally mill your rice? ____________

8. How do you transport the rice from your house to the mill ?

Transport Cost per bag

By head load ____________________

By Donkey ____________________

By Bicycle ____________________

By Truck ____________________

By Lorry ____________________

9. How many hours or minutes will it take an average woman to transport a bag of rice from your house to the mill (by head load) ______________ hours/minutes.

10. How much does it cost you to mill a bag of rice?

During peak season ____________________

During slack season ____________________

11. Do you normally parboil each variety of rice separately?

____

12. Do you normally mill each variety of rice separately?

____

13. How many bags of rice do you parboil per month?

(a) during peak season __________

(b) during slack season __________

14. How many big ananias of paddy rice do you normally soak per day?

(a) during peak season ________

(b) during slack season ________

15. Suppose you want to parboil one bag of paddy rice, what major operations will you carry out and how many minutes will it take you to carry out each operation?

OPERATIONS	MINUTES

17. For how many hours do you normally soak your paddy rice before boiling? ______________________

18. For how long do you normally boil or steam your paddy rice? ______________ minutes/hours.

19. How do you normally dry your parboiled rice?

    (a) Dried in the sun ________

    (b) Dried in the room ________

    (c) Dried outside when the sun is not shining ______

    (d) Dried in a shade _______.

20. What to-ls and equipment do you normally use in parboiling?

Item	Quantity	Cost per unit	When bought	Average useful life
a.				
b.				
c.				
d.				
e.				
f.				
g.				
h.				
i.				
j.				

21. How long does it take an average woman to winnow a bag of paddy rice which has just been milled? ____________________

22. How much do you sell a bag of milled rice during harvesting? ____________________

Have you ever hand-pounded your paddy rice? Yes/No __________

23. If yes when last did you hand - pound your rice? ____________

24. How much paddy rice can an average woman hand-pound in a day (8 hours)? ____________________

25. What other information do you want to give about your rice parboiling business ? ____________________

____

____

D. QUESTIONAIRE FOR CONSUMERS: NON-RICE PRODUCING HOUSEHOLD

An economic study of rice consumption in Nigeria is being undertaken with a view to identifying the functional relationship between the demand for rice and selected variables. The findings will hopefully provide useful guideliness to policy makers in their effort to accelerate food production in the country. Your cooperation is therefore of vital importance. Any information supplied will be treated as strictly confidential.

Respondent's Name ____________________

Town/Village ____________________

Interviewer ____________________

1. Size of household

   (1) No of wives living with you ____________________

   (2) No of children living with you: (a) always ____________
   (b) occasionally ____________

   (3) No of other people living with you:
   (a) always ____________
   (b) occasionally ____________

2. Education of household head (check whichever is applicable)

   (1) No education ____________
   (2) Primary School leaving and below ____________
   (3) Secondary technical, teacher training ____________
   (4) Post Secondary ____________
   (5) University or equivalent ____________

3. Occupation of household head ____________________

4. Estimated gross annual income of the household head (check whichever is applicable)

(1) ₦0 -150 ________ (2) ₦151 - 200 ________
(3) ₦201-500 ________ (4) ₦501 - 1000 ________
(5) ₦1001-2000 ________ (6) ₦2001 -4000 ________
(7) ₦4001-6000 ________ (8) Above ₦6000 ________

5. Estimated gross annual income of all the other household members

(1) ₦0 - 150 ________ (5) ₦1001 - 2000 ________
(2) ₦151 - 200 ________ (6) ₦2001 - 4000 ________
(3) ₦201 - 1000 ________ (7) ₦4001 - 6000 ________
(4) ₦501 - 1000 ________ (8) Above ₦6000 ________

6. Estimated monthly expenditure on food ________

7. Do you normally consume rice? Yes/No ________

8. If yes,

(a) On the average, how may times do you eat rice per week? ______

(b) On the average, how much rice do you consume at a meal?
________ mudus/empty tins of milk

(c) On the average, how much rice do you consume
(i) per week ________ mudus/kerosine tins (Cost ₦____)
(ii) per month ________ mudus/kerosine tins/medium-size bags (Cost ₦ ______)

9. Which type of rice do you normally consume? (List in order of preference)

(a) Imported rice
(b) Rice locally processed by food companies and sold in in packets e.g. "eagle rice"
(c) local rice processed at local rice mills
(d) "Tapa" rice
(e) Others

10. Which of the types listed above do you prefer most? __________

Give reasons (list in order of importance)

(a) It is relatively cheap
(b) It has better cooking quality
(c) It tastes better
(d) It contains less percentage of brokens
(e) It is whiter and longer
(f) It is more readily available
(g) Other reasons (state them)