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RICE MARKETING IN GUINEA-BISSAU: A STUDY TO DEVELOP INFORMATION FOR POLICY MAKERS

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RICE MARKETING IN GUINEA-BISSAU:

A STUDY TO DEVELOP INFORMATION FOR POLICY MAKERS

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EXECUTIVE SUMMARY

The primary purpose of this study is to provide in-depth information on and analysis of the domestic rice marketing, distribution, and processing system from its first assembly points to the wholesale level. Secondary purposes are:

1. to assess the efficiency of the system.

2. to identify major deficiencies in the system.

3. to provide a model of the domestic rice industry that can be used:

   A. to evaluate the impacts of government policy on the ability of domestically produced rice to compete with imported rice, and

   B. to evaluate the financial feasibility of alternative market channel configurations, focusing on alternative sizes and locations of rice mills.

The study findings related to these purposes are briefly discussed first in this executive summary followed by a discussion of our conclusions and recommendations.

FINDINGS

Description of the System. The domestic rice marketing system is composed of two subsystems. One is centered around Catio and markets rice grown by farmers using traditional, human-powered production systems. The second subsystem is centered around Bafata and markets rice grown primarily by farmer using mechanized production techniques. This second subsystem is a relatively new phenomena. In the area around Catio, the assembly of rice from farmers is handled by approximately 100 merchants who are coordinated by two or three wholesale merchants. Mechanized farmers near Bafata by-pass the assembly merchant and sell directly to wholesalers, rice millers or to consumers.

The transportation and milling resources of the system are more than adequate for marketing current and anticipated domestic production. Water and road transportation services are available from both the private and public sectors. The operating rice milling capacity of the industry includes approximately 35 very small village-level mills in the two southern regions of the country, a new, privately owned, intermediate-sized mill at Bafata and a publicly owned, 53 year old industrial-sized mill at Bissau. An additional, publicly-owned mill exists at Cumere near Bissau but has never been into operation. The prospects of operating the mill at Cumere are dim. Together the 35 small mills have the capability of processing about 10,000 tons of paddy per year. The other two mills could annually process more than 20,000 tons. Since sales of paddy into the rice marketing channel have not amounted to more than 10,000 tons in recent years, the existing, operational capacity exceeds industry needs.

The grain storage resources of the system are inadequately distributed. The small, village-level mills as well as the rice mill at Bafata do not have enough storage capacity to store the quantities of grain that would insure the mills can operate at capacity throughout the year. Publicly owned storage facilities have

not always been available for use in marketing rice. For example, the parastatal Armazens do Povo, did not purchase rice at Catio during the 1989-91 season. implying that its 1,000 ton warehouse at Catio was not used as an assembly point during that year. The future of the rice marketing assets of the parastatal and this important warehouse in particular remain a source of uncertainty within the assembly stage of the marketing channel, since it is uncertain whether or not these facilities can or will be privatized.

The financial resources of the system are less than adequate. The most common comment heard from assembly and wholesale merchants interviewed during the survey phase of this study was that they could not obtain adequate supplies of credit to purchase available supplies of rice offered by producers. The distribution of available credit flows primarily through a very limited number (less than four) individual wholesale merchants.

The policy environment in which rice marketing takes place has improved significantly during recent years. Road barriers that once interrupted transport between regions have been abolished. Fees and customs procedures that once impeded shipping from Catio are no longer enforced. However, some policies that are incompatible with marketing efficiency remain. Pricing guidelines continue to be set for commodities at the farm level, even though these prices are supposed to have been liberalized. This practice creates uncertainty as to its enforcement and is not conducive to the development of private enterprises which can operate confidently in the formal sector. Adhering to these guidelines reduces the ability of domestic rice to compete with imported rice. Marketing regulations requiring that rice millers purchase rice only through licensed assembly merchants have recently been enforced. This has prevented the establishment of direct marketing relations that have the potential of increasing returns to producers while improving the efficiency of the assembly process. Taxes and fees on imported rice have recently been increased such that there now exists a defacto tariff equal to 10.3% of the cif value of the imported rice.

The Major Deficiencies of the System. As pointed out above and further discussed below, the major deficiency of the system is the lack of operating capital. Storage facilities, transportation and milling services can be hired. Policies, except for a couple of exceptions, are generally supportive of private-sector initiative. Profitable markets and knowledgeable merchants exist. Although not part of the rice marketing system as described for purposes of this study, the lack of domestically produced and marketed rice lowers the rate of capacity utilization of existing marketing resources and thus lowers their efficiency.

Efficiency of the System. The least efficient component of the entire system is the assembly stage of the subsystem marketing traditionally grown rice from the area around Catio. These assembly merchants purchase small quantities of rice from many small-scale producers and thus "assemble" the grain into lots that can be more efficiently handled. During our survey of these merchants, they reported that their marketing margins (the difference between the price they pay for grain and the price they sell the grain to wholesale merchants divided by the price paid by the wholesaler) amounted to approximately 35%. Our calculations indicate that this assembly margin could be approximately 10% if the process was done more efficiently, that is, with greater volumes of grain handled per person and per investment in physical capital.

The economic efficiency of rice mills in the system is constrained by the volume of grain processed. The profitability or capability of any rice mill to be self-sustainable increases as the volume of grain milled approaches the mill's operating capacity. Given the low level of domestic production vis à vis the capacity of existing mills, it is obvious the lack of available raw material constrains the profitability of all mills in the system. The large mills mill only grain that has entered the marketing channel. Thus, they are constrained not only by total domestic production but also by the fraction of domestic production that is marketed. The small village-level mills are not so constrained, since they can process both grain intended for the market and grain intended for home consumption by its producer/owners. In spite of this access to an additional market for milling services, most of these small mills have not been able to attract sufficient volumes of grain to utilize their capacity efficiently.

The traditional method of milling rice with mortar and pestle is still the most common way rice is milled in Guinea-Bissau. It is the least costly method in terms of imported resources and could possibly provide a ready source of income for certain members of the population.

Transportation within the rice marketing system appears to be quite adequate; however, there appears to be under-utilization of public- and private-sector water transportation resources. Water transport is less expensive than truck transport. Fees paid for unloading boats at Bissau may be excessive. Road transport is hampered by 60 km of unimproved road connecting Buba and Catio.

The Model of the Domestic Rice Marketing Industry. A linear programming model of the rice marketing subsector was developed from the knowledge of marketing costs, markets, and distances collected during the field survey phase of the study. The major findings from the linear programming analysis of the system as a whole include the following:

1. Under current policies and assuming the farm-level minimum price was strictly enforced, the least-cost method of supplying the national demand for purchased rice would be to rely primarily on imported rice. The only domestic rice used would be a small amount produced and milled in the South to satisfy the demand for marketed rice in that area.

2. Improving the efficiency of the assembly process and/or allowing farm-level prices to be market-determined should result in a greater dependence on domestic rice. With improved assembly-level marketing efficiency and/or liberalized prices, the only constraint to increased national self-sufficiency in rice is the lack of domestic production. Since marketing costs increase the cost of domestic rice, any measure that increases the efficiency of domestic rice marketing tends to increase the capability of domestic rice to compete with imported rice.

3. The setting of a single farm-level price for the nation discriminates against rice grown in the South in favor of rice grown in the North.

4. Given adequate financial resources and a liberalized internal policy environment the rice marketing system can compete with imported rice. Under these circumstances, protection from imported rice, in the form of importation fees or tariffs are not needed for domestic rice to compete successfully with imported rice.

Feasibility Studies. Feasibility studies were used to develop estimates of costs of various marketing activities such as transportation and milling services. An attempt was made to include all costs plus a reasonable return to the invested resources. Costs developed in this manner are close approximations of the economically efficient cost of the services. As such they are standards that can be used for comparison purposes. These costs were used in comparisons with observed costs to gauge the efficiency of the observed operations. Complete feasibility studies were made on the rice mill at Bafata and a representative village-level mill. These feasibility studies yielded recommendations for the managers of these mills and are discussed in the feasibility studies which are included in this report as appendices.

CONCLUSIONS

The major conclusion of this study is that the assembly stage of the rice marketing industry is the most inefficient portion of the rice marketing channel. We conclude that there is significant scope for improving the efficiency of the assembly process. Improvements in the efficiency of the assembly process can significantly enhance the ability of domestic rice to compete with imported rice. Further, increased efficiency at the assembly stage can result in higher prices at the farm level. The major constraint hindering the assembly process is a general lack of credit to finance assembly operations. The development of a high level of competition--which would tend to insure that farm-level prices increase with increased assembly efficiency--is hindered by the restricted credit capacity of most assembly merchants. A secondary constraint on assembly level efficiency is the existence and enforcement of marketing regulations which require that millers purchase grain through assembly merchants.

RECOMMENDATIONS

The government should implement policies that enhance the level of competition within the assembly stage of the rice marketing industry. In a liberalized market this can best be done through polices that encourage more independent businesses to enter the business of assembling rice from producers. Since credit is the major constraint faced by assembly merchants, encouraging independent assembly agents can be addressed through policies that allow the development of institutions that can economically provide credit to any merchant capable of pledging the required collateral. An institution that can assist in the development and management of collateral (in the form of stored rice) is a bonded warehouse. A bonded warehouse accepts deposits of rice in return for warehouse receipts that can either be sold or assigned as collateral for a loan. Thus, we recommend the government consider the implementation of policies that will encourage the establishment of bonded warehouses.

Increased completion and marketing efficiency is also enhanced by policies that allow marketers the flexibility to develop alternative marketing methods. This implies that government should not impose marketing patterns such as the current regulation requiring millers to buy from assembly merchants.

The government should discontinue the practice of setting minimum farm-level prices primarily because it places marketing firms in an uncertain legal standing and exposes them to the possibility of selective enforcement when the market price drops below the official price. A more preferred method of assuring producers receive the highest price economically possible is to encourage competition among the buyers of farm products.

SECTION I

INTRODUCTION

The rice industry in the Republic of Guinea-Bissau (RGB) is undergoing significant change as the RGB transforms from a centrally-directed economy to a market-directed or market-oriented economy. The parastatal that once controlled the marketing of the nation's basic food, rice, is being privatized. Although the private sector is moving rapidly to take over the task of marketing rice as the former system is dismantled, significant problems remain to be solved.

The Government of the RGB and the international donor community would like to assist the transition process in a way that results in the development of a private rice marketing sector that is a positive force in the nation's development. Clearly, government will play a significant role in structuring the new order through the decisions it makes on the transfer to the private sector of tasks and responsibilities formerly carried out by government. Its influence will be felt in the manner in which it transfers former governmental assets to the private sector and in the manner in which it encourages or facilitates the buildup of private and public assets needed to get the job of marketing rice done.

An obvious example is credit policy. Government credit policy can have a significant impact on who will own the reconstructed marketing system. There may be a trade-off between efficiency and equity that should be considered in developing and implementing these policies. There may also be a difference in the developmental impact of different organizing philosophies. For example, it is quite possible that concentrating the assets of the restructured marketing system in the hands of a few people will result in a very efficient system. However, such a concentration may not maximize the need for independent business people as would a decentralization of ownership. A decentralized ownership pattern demands that more people become entrepreneurs and spreads the important learning and wealth accumulating experiences of entrepreneurship among a larger number of people. This may be a more effective path to follow in completing the transformation to a market-oriented economy lead by individually-directed initiative. To consider such trade-offs, public and private sector decision makers need information.

Study Purposes. The primary purpose of this study is to provide in-depth information on and analysis of the domestic rice marketing, distribution, and processing system from its first assembly points to the wholesale level. Secondary purposes are:

1. to assess the efficiency of the system.

2. to identify major deficiencies in the system.

3. to provide a model of the domestic rice industry that can be used:

   A. to evaluate the impacts of government policy on the ability of domestically produced rice to compete with imported rice, and

B. to evaluate the financial feasibility of alternative market channel configurations, focusing on alternative sizes and locations of rice mills.

Coincidentally, the study provides information on the equity or distributional impacts of selected investments by focusing on different scales and methods of organizing the marketing of rice. In general, small scale implies a broader distributional impact than larger scale. Given this information, the responsibility of choosing and acting remains with the decision makers who must weigh the information provided here in light of their vision of the correct distribution of wealth in their society.

The study develops information on the rice marketing system by focusing at two levels: a) the individual enterprises that are the components of the system and b) the system as a whole. The focus at the individual enterprise level develops enterprise feasibility studies as a basis of understanding the profits derived from these individual components. The feasibility studies of individual marketing activities often yield obvious recommendations for improving the profitability of the individual activities. Most of these recommendations are more appropriate for implementation by the private sector; however, they also carry implications for government action. The feasibility studies also serve as benchmarks of efficiency for comparison with existing enterprises. For example, one of the major conclusions of the study is that the assembly stage of the marketing system is inefficient. This conclusion is based on:

1. the finding that the average marketing margin at the assembly stage is 35%, and;

2. feasibility-based analysis that indicates the marketing margin could be about 10%.

The information developed through feasibility analyses of individual marketing activities is supplemented with information collected via interviews with the business people doing the work. This information helps explain how the marketing system works at the present time and allows the people involved in the system to explain what they feel are the system's major constraints.

The focus at the level of the system as a whole is accomplished by developing a linear programming model of the system. The model was then used to determine the least-cost method of marketing rice in Guinea-Bissau. Given data on transportation costs, milling costs at various locations and demand for rice in various locations, the model determined the milling/distribution pattern that will minimize the total cost of satisfying the demand for rice in RGB with domestic and imported rice. The information developed from several runs of this model, using varied assumptions relating to prices and supply availability, provides an understanding of the behavior of the system as a whole and indicates the impact of policies. Questions such as the following can be addressed:

1. Should rice production in RGB be encouraged?

2. How large should a tax on imported rice be?

3. Should government dictate marketing patterns (such as farmer/middleman/miller) or prices?

4. Would a rice mill be profitable in Catio?

The final section of the report summarizes the findings and offers some recommendations for action. The appendices of the report carry detailed descriptions of the feasibility studies conducted and the linear programming model.

Marketing Terms Defined. The purpose of this material is to define selected terms we use in this report. Throughout this report reference is made to the "rice marketing system" or the "market channel." Both "rice marketing system" or "market channel" are used interchangeably and refer to the complex of businesses which assemble rice from producers and supply it to consumers in the form, place, and time they desire. Businesses within the marketing system or channel purchase, store, process (milling), distribute, wholesale and retail rice. All of these processes are included when we speak of "marketing rice."

We also speak of the various "stages" of the marketing channel. These are illustrated in Figure 1, which is a simple diagram of a rice marketing system or channel. The important stages of the system are the assembly stage, processing stage, wholesale stage, and retail stage. At the assembly stage, assembly merchants assemble rice from many producers into lots that are economically appropriate for further marketing processes. Wholesale merchants purchase the assembled lots from assembly merchants and resell to retail merchants who resell to consumers. Processing, storage, and distribution can be handled by merchants at any stage of the market channel; however, these activities are generally handled by merchants above the assembly stage.

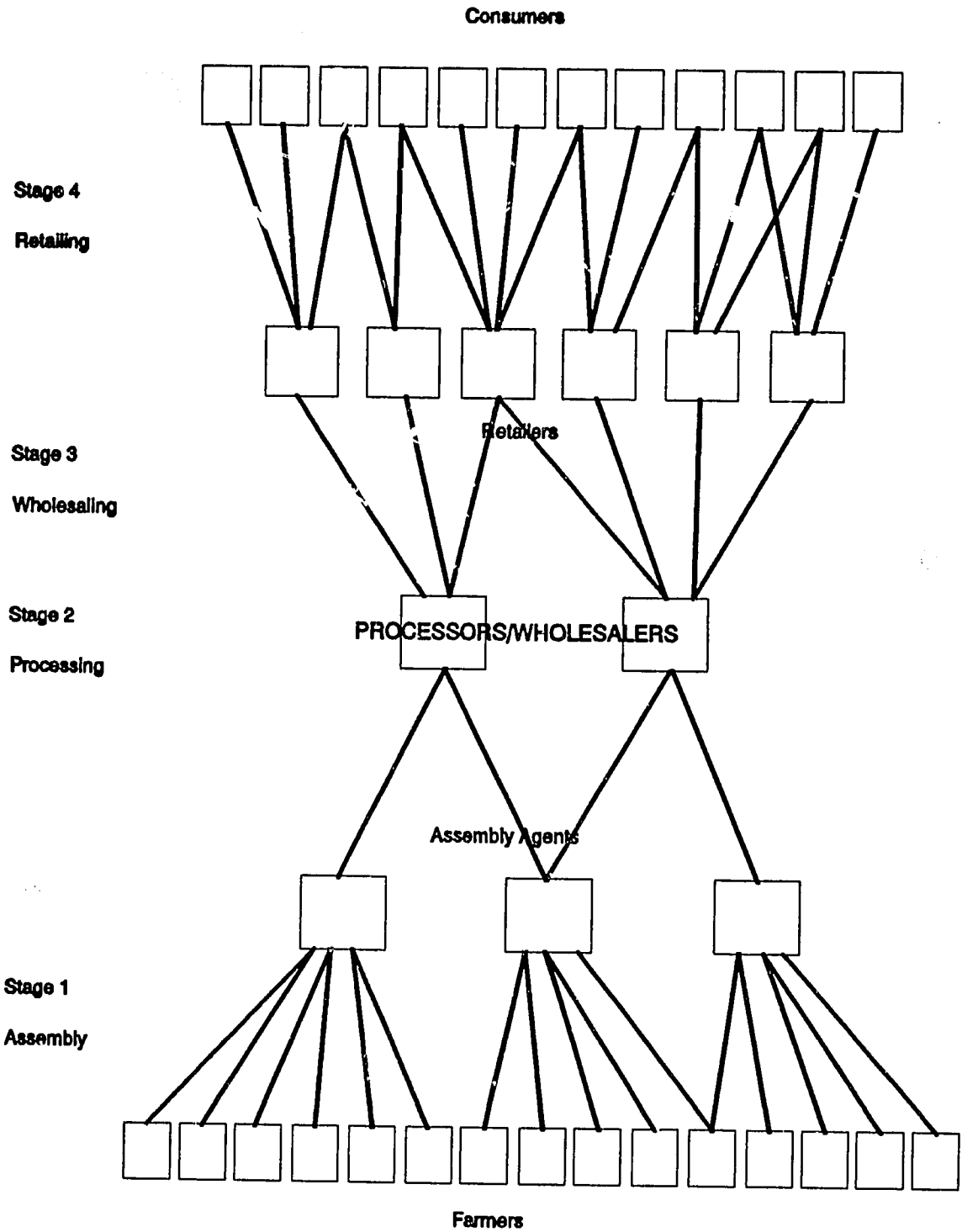


FIGURE 1. Diagram of a Rice Marketing System

SECTION II

THE RICE MARKETING SYSTEM IN GUINEA-BISSAU

This section describes the existing domestic rice marketing system in Guinea-Bissau in terms of the people and locations involved and the observed marketing costs. A summary of the findings closes this section.

The Participants and Pattern of Rice Marketing Activities

There are two distinctly different categories of rice production systems in Guinea-Bissau--human-powered systems and machine-powered systems. Each system is associated with a particular system for moving the marketed portion of the crop to market. Of the several types of human-powered production systems in Guinea-Bissau, the system employed by the Balanta people is the most productive in terms of output per day of human labor (IRAM). Not surprisingly it appears that this system contributes the largest proportion of the rice in the rice marketing channel. Parenthetically, it appears significant that marketed supplies from this type of culture are concentrated in the Southern region of Tombali, a region offering few nearby alternative employment opportunities.

Human-Powered Rice Culture. Assembly of marketed rice from human-powered farms begins after the grain has been threshed in the field. Women are the prime movers in this operation and transport the grain in baskets balanced on their heads. Typically, the weight of grain carried is approximately 30 kg. Figure 2 shows aspects of this operation. Often the rice is transported to on-farm granaries for a period of storage before being transported to market. The trip to market typically begins as another head-load carried by a female; however, the study team observed one male transporting to market a sack of paddy rice which he carried on his head.

If the market buying station or assembly point is within walking distance, there would normally be no shift in transportation modes. However, in a substantial number of cases, this is not true. Often the rice grown in the Southern Region is grown on farms that are only accessible by boat. In these cases, the grain would be transferred to a boat for the trip to the port near the main market, such as Catió. At the port near the main market, the rice is reloaded into head-baskets for the final leg of the trip to the assembly point. Alternatively, merchants meet the boats at the port and purchase the grain as it is unloaded. In this case, the grain is loaded into sacks and then into the merchant's truck for transport to the merchant's warehouse.

If relatively small quantities of grain are involved such as might occur if a single family or small group of families are selling grain, the grain can go directly from the home granary to the boat. Small, 2 ton capacity dugout canoes are available for hire for these purposes. Getting the grain into the canoe is complicated by the absence of docks or piers at the loading points. Loading is further complicated by the large daily tidal fluctuation. This means that loading is done at high tide with the remaining distance between the boat and shore spanned by a wooden plank. Low tide usually exposes an expanse of mud that half-way swallows people unburdened with 30 kg of rice. See Figure 2.

At Left:

Woman transporting paddy rice to market.

Below:

Woman transporting 30 Kg of paddy rice from boat up slippery river bank.

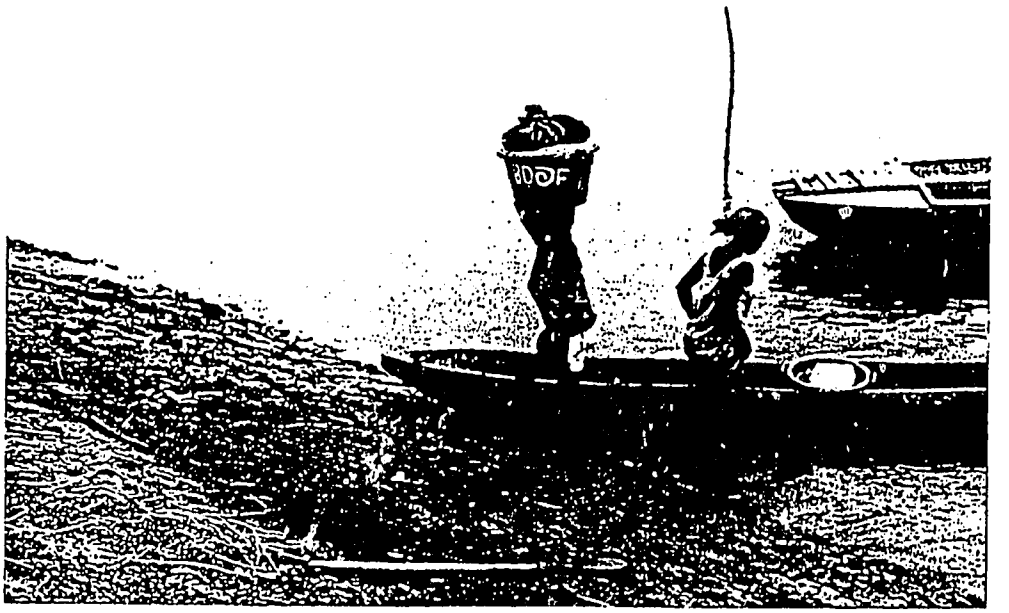


FIGURE 2. Illustrations of Women's Involvement in Paddy Rice Transportation

If a buying station is located on an "island" as was often the case when the parastatal operated the buying stations, the rice is first assembled at the buying station until a boat load had been accumulated. Then the manager of the buying station arranged for a boat. When the parastatal was in charge, the boat sent to pick up the grain was often one of the parastatal's 10 ton motorized barges. Figure 3 contains a picture of two of these barges. The barges were ten years old at the time of the photo. Also available from the parastatal transportation company, Rodofluvial, were boats with capacities of 60 or 200 tons. Figure 3 contains a picture of the 200 ton boats.

An additional problem is that of transferring the grain from the buying station warehouse onto the boat. In the past, local village women could be called upon to transfer the grain, via head-baskets. In some cases, the women were paid an amount equal in current Pesos values to approximately 90 Pesos per head-basket. During the study team's survey of assembly merchants, the manager of an assembly point on the island of Como, told us he was unsuccessful in obtaining the local women's assistance in making this transfer in the previous season. As a point of reference, a typical cost of both loading and unloading a 15 tons of sacked rice in Bissau is 30,000 pesos or about 60 Pesos per head basket equivalent.

The number of persons involved in cultivating rice grown for market can provide some indication of the benefits the rice market provides to the producers. This number can be estimated using information on the productivity of Balanta labor in producing rice. The Balanta system is considered to be the most productive of the human-powered systems and the only system capable of covering its costs of production, including a charge for labor (IRAM, page 75). The IRAM report estimates Balanta productivity in kilograms of paddy per person-day of labor at approximately 19 kg/person-day. Using this figure and assuming that approximately 5,000 tons of paddy are marketed, one can estimate that approximately 263,000 days of labor are required under this system. Assuming a 250 day work year, one can estimate that the rice industry provides the equivalent of 1053 full-time jobs to rice producers. The current market value of 5,000 tons of paddy rice is approximately 545,000 US dollars.

Most of the marketed production from human-powered farms appears to originate within 30 to 40 kilometers of Catio. Figure 4 is a reproduction of a map of the area with a 40-kilometer radius circle drawn around Catio. This conclusion is supported to some degree by data that relates areas planted and local self-sufficiency needs. The assumption is that areas producing quantities of rice above those needed for self-sufficiency are producing for the market. Table 1 presents this data. There is some question about the reliability of the data and this approach to estimating the location of marketed production. Note that the data in Table 1 indicate that an excess of only about 1,000 tons of rice above requirements is produced in Tombali. The study team estimates that approximately 6,000 tons of rice were purchased in the southern two regions of Quinara and Tombali during the 1989-91 season. The parastatal buying operation at Catio purchased at least 1,000 tons and a private merchant purchased 5,000 tons that year.

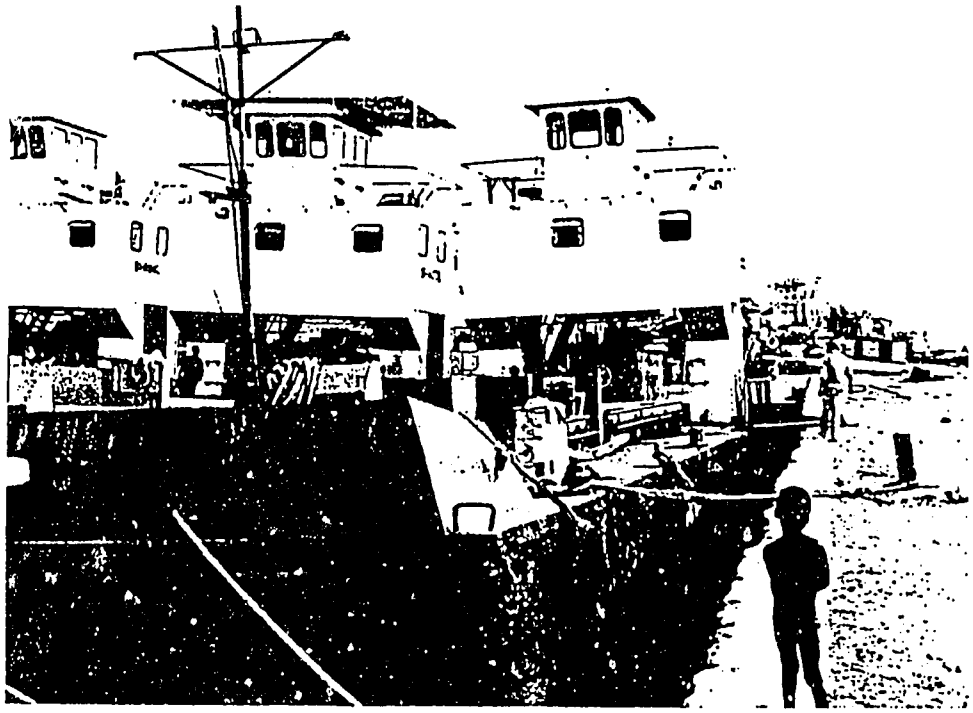
TABLE 1

Estimated Annual Production and Rice Requirements by Region

ADMINISTRATIVE DIVISION	POPULATION (1990)	Net Polished Rice Production	Tons Required Annually	Surplus Production	Tons Marketed Polished Rice Required Annually
BISSAU	170665	3756	18602	-14846	14846
BAFATA REGION	134815	8765	14695	-5930	5930
GABU REGION	128072	7161	13960	-6799	6799
BIOMBO REGION	55483	4709	6048	-1338	1338
CACHEU REGION	135555	13663	14775	-1112	1112
OIO REGION	148740	13865	16213	-2348	2348
BOLAMA REGION	29637	5769	3230	2538	
Population Buying Rice	2963.7				323
QUINARA REGION	39999	5465	4360	1105	
Population Buying Rice	3999.9				436
TOMBALI REGION	67616	8372	7370	1002	
Population Buying Rice	6761.6				737
TOTALS	917545.6*	71524	99253	-27729	

* This total does not include the estimates of the population buying rice. The estimates of the population buying rice were used to develop estimates of marketed rice needs for use in the linear programming analysis discussed in Section III.

Source: Division of Statistics, Secretariat of State for Planning, Ministry of International Cooperation



Above: 200 ton capacity Rodofluvial boats. Note boat length between the child and the man on the dock.

Below: 10 ton capacity Amazens do Povo boats at Catio. These boats measure about 10m x 3.5m.

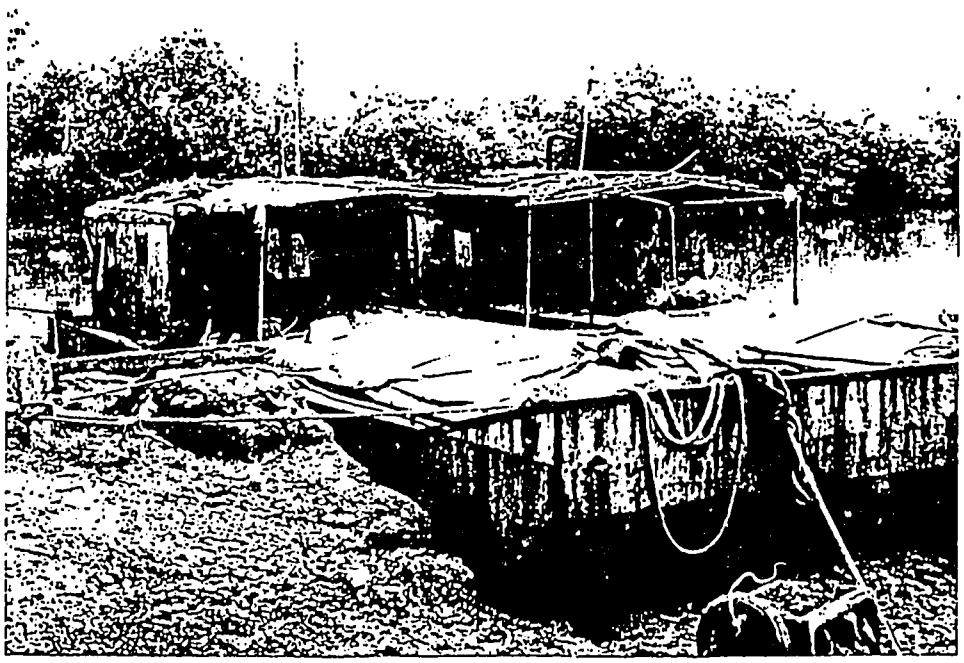


FIGURE 3. 200 and 10 Ton Boats

The study team's survey of assembly merchants, conducted in December 1991, provided additional evidence that most of the marketed rice from the Southern Region comes from within 40 kilometers of Catio. During the interviews, the team asked assembly merchants about the prices they paid to producers. A pattern in the responses quickly became evident as the survey progressed. Prices paid to producers in Quinara Region were generally higher than in Tombali Region. An analysis of the collected data showed that weighted average prices in Quinara were 1.63 times greater than in Tombali. This seems to correspond the theory of supply and demand. In areas with relatively high production, perhaps, production levels greater than required for self-sufficiency, one would expect prices to be relatively low in comparison to areas where local production may not satisfy local needs.

The comments of the assembly merchants also tended to support the hypothesis that Quinara is a rice deficit region. Merchants in Tite explained that not much rice was marketed from the area in recent years. One merchant explained that a large area of productive rice land had been lost when a critical dam broke and allowed salt water to enter the area. The same merchant had purchased locally produced rice in the previous year but did not ship it out of the area. Instead, he simply stored it and resold it later in the season. At Jabada, a Balanta village on the Geba River inland from the Bissau-Enxude ferry landing, the study team expected (because it appeared to be a Balanta village) that substantial amounts of rice had been marketed in the previous year. However, we were disappointed. The one local merchant had only purchased 50 tons of paddy in the previous year.

At Fulacunda, merchants the team spoke with related similar stories. Not much locally produced rice in the market. Most of the locally produced and marketed rice remained in the area, being used in the local barter trade for cashew nuts or simply resold after a period of storage. A couple of the local merchants spoke of substantial quantities of rice being grown to the northeast of Fulacunda on the Corubal River. However, a visit to the area did not corroborate the stories. At Campada, a village located on the peninsula formed by the Corubal and the Geba rivers, a man in the process of building a temporary granary for locally harvested rice told the study team that rice production in the area had fallen in recent years. As one explanation for the decrease in production, he said that the young people of the village no longer wanted to help with the rice crop.

At Sao Joao, near Bolama, interviewees told the study team that very little rice was grown in the area.

On the peninsula southwest of Empada the study team found a slightly different but familiar situation. The major agricultural crop is cashew and rice is imported. A local rice buyer told us that some small quantities of rice were being exported to Bolama by local producers with access to fishing canoes. However, none of the eight (8 out of 12-15 merchants on the peninsula) shipped rice out of the area. Their preferred use of any locally produced rice is to trade it for locally produced cashew. At the western tip of the peninsula, the team encountered a merchant who imported rice from Catio for the local cashew trade.

In summary, the impression one gathers from talking to merchants and observing prices is that Quinara and the northern-most peninsula in Tombali are not areas that produce surplus quantities of rice. A similar situation exists in the Cacine area near the southern border of RGB (Lea, Hugo, and Ribeiro). Thus, it is quite likely that a circle with a 40 kilometer radius centered at Catio would encompass the farms of the majority of Guinea-Bissau's commercial rice producers who produce their crop with human-power.

Machine-Powered Rice Culture. Mechanized cultivation of rice is concentrated near Bafata. Accordingly, no water transportation is involved. Mechanically grown rice is usually harvested by combine harvesters which combine the cutting and threshing operation. The grain is bagged at the farm and trucked to storage. With the opening of a modern rice mill at Bafata, the need for the bagging operation can also be eliminated. The rice mill at Bafata is capable of receiving bulk or unbagged rice. Minor additions of bulk grain handling equipment would allow the large mill at Bissau to receive bulk grain. Truck bodies can be modified to carry the grain. With these modifications, mechanized grain would flow directly from the combine harvester into transporting vehicles and then into storage at a mill.

The rice marketing channel for mechanized rice is much more vertically integrated than the marketing channel for human-powered rice. Being vertically integrated means that the producers perform some of the functions otherwise performed by other marketers in the marketing channel. Mechanized producers tend to market their rice to wholesalers, by-passing the assembly stage. Such producers have "vertically integrated" into the assembly stage. Some producers are also wholesalers/retailers (wholesalers owning retail outlets). At least one producer owns a rice mill.

Mechanically grown rice is a fairly new phenomena in Guinea-Bissau. There are several reasons to expect that this type of rice culture will expand. First, the people involved are generally well educated and politically influential managers. Thus, these new manager-farmers are not as constrained by the lack of technical knowledge or financial resources as are the traditional farmers of Guinea-Bissau. If the resources are available and the farming enterprise is profitable, the new manager-farmers will be able to hire any resources they do not own.

Secondly the mechanized production of rice appears to be profitable. One of the leaders of the movement estimated that the costs of mechanized rice culture are recouped or covered by only 40 percent of the revenue generated from the sale of the crop. Thirdly, there appear to be substantial areas of unused or under-utilized land that can be brought into mechanized production. The manager-farmer just cited estimates that 10,000 hectares of land could be brought into production in the area around Bafata within the next five years. Most of this land is located within 40 kilometers of Bafata.[1] Figure 4 is a map of the area.

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[1] Although mechanized production does not occur in the southern region of the RGB, it is possible that an area equal or greater to the area at Bafata could be brought under mechanized cultivation in the South. The study team did not include a soil scientist or agronomist; so, the team is not qualified to judge capacity of land. Nevertheless, the team was impressed by the large amounts of unused land in the South that appeared to be appropriate for rice culture.

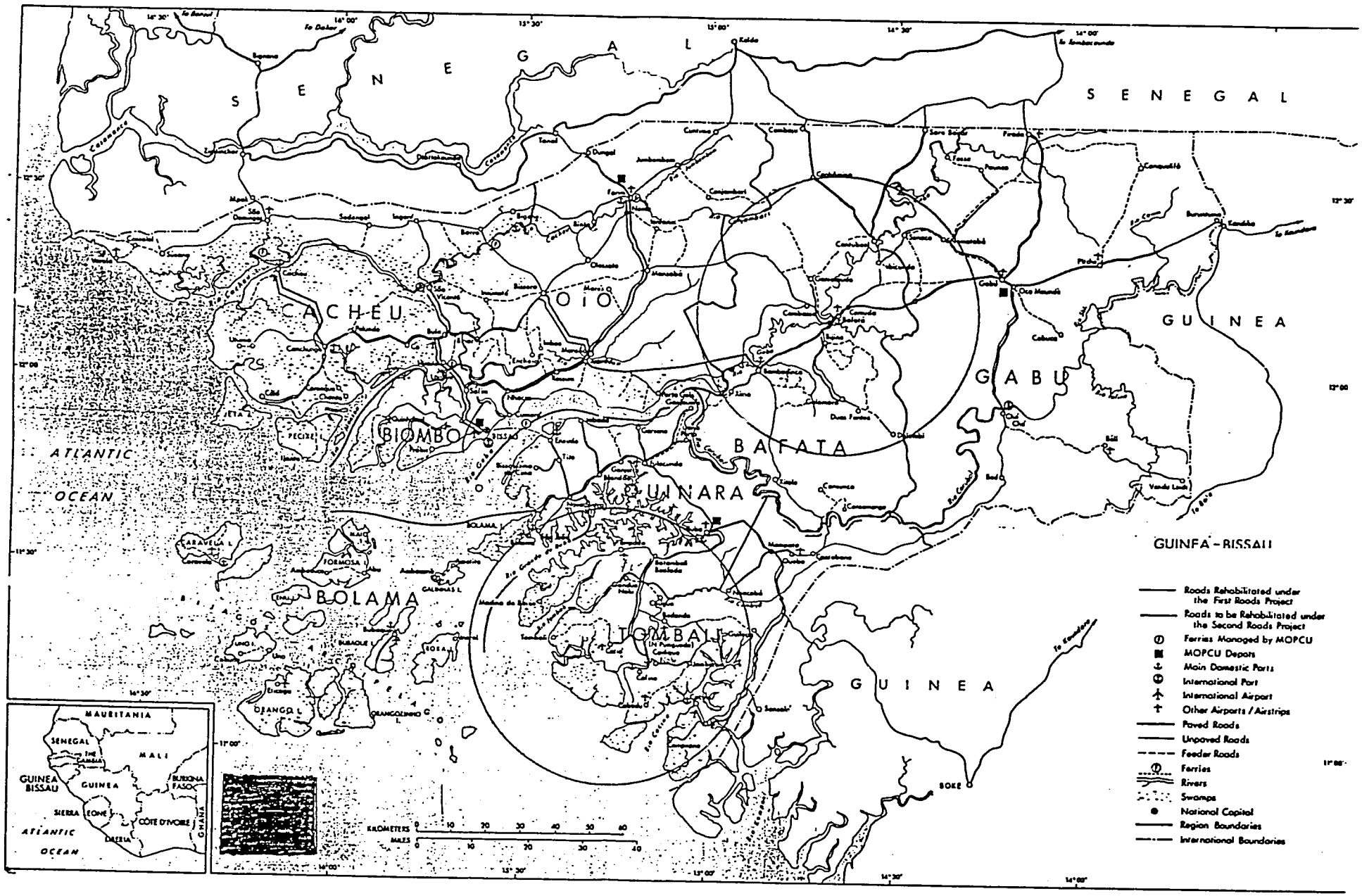


FIGURE 4. Map of Guinea-Bissau

At present, the area under mechanized rice production is estimated to be 2,000 hectares. Finally, the possibility of double-cropping the existing land under cultivation is limited only by the profitability of the enterprise, since the new manager-farmers are capable of hiring the technology and resources needed.

Participants in the Marketing Channel. Women typically provide the first link in the marketing channel from human-powered farms. Trucks are used for this job on mechanized farms. In the South, the women deliver the rice, either paddy or polished rice, to a local assembly merchant who weighs the rice and pays the women in cash. The use of cash is significant since in the recent past barter was the more common form of the transaction. The assembly merchant generally resells the rice to a wholesale merchant who has advanced the assembly merchant the cash to make the transactions. There is typically a continuing relationship between the assembly merchant and the wholesale merchant that spans the agricultural year and can include several agricultural commodities. Some assembly merchants assemble not only rice but other agricultural commodities, such as cashew nuts, palm kernels, and honey. The wholesale merchant not only supplies cash to the assembly merchant but also goods for resale. Thus, villagers selling basic commodities to the assembly merchant often spend their earnings at the merchant's shop.

Assembly merchants often depend on their wholesale merchants for both goods and operating capital. Of the 86 assembly merchants the study team interviewed in the Southern Region, 53 percent said they had received an operating loan from a wholesale merchant. The most commonly mentioned wholesale merchant was Farra Henini of Bafata. Mentioned less often were Mamadu Djabi and Mamadu Jaité of Bissau. In only one case was another wholesale merchant mentioned. When asked if they had received a loan from a bank, 48 percent of the assembly merchants responded affirmatively. The loans were from the Credit Bank of Guinea-Bissau. Generally, the loans were for amounts less than $200 and often these loans were arranged and handled by the wholesale merchant. Of those who received bank loans, 43 percent indicated the bank was their only source of borrowed capital.

Clearly, there are very few wholesale merchants working with the assembly merchants of the Southern Region. The relative importance of the very small number of wholesale merchants was evident during the study team's survey of assembly merchants. Farra Henini, who appeared to be the most important wholesale merchant in the Southern Region, was having difficulty obtaining a working capital loan to finance his wholesaling operations for 1992. This meant that he had less funds to relend to the assembly merchants working with him. This meant that the operations of the assembly merchants would be significantly reduced. Further out the marketing channel, rice producers would find fewer markets for their product. Although the current problem appears to have been caused by a restriction of credit at the national level, the level of dependance it revealed on one or two sources of credit should cause concern among decision makers who wish to establish a stable rice industry.

The other major participant in the rice marketing channel from the Southern Region of Guinea-Bissau is the parastatal, Armazens do Povo. Since this organization has not yet been completely privatized, it stills controls substantial rice marketing resources in the South. The major resource is its assembly facility at Catio. In addition to an experienced group of employees,

the facility includes a 1,000 ton warehouse near Catio and at least two motorized barges. The future role of this facility is uncertain. However, it could play a major role in the marketing channel by simply assembling rice into efficient sized lots for shipment via truck or boat. It could also serve as the storage facility for a 1 ton/hour rice mill.

Patterns of Rice Movement. The major portion of the rice purchased in the South is transported into the Northern Region of the country. Often the rice is transported in paddy rice form and traded in that form to cashew producers. It is said that some groups, especially the Papel of Biombo, prefer the rice in paddy form so that they can hand-mill it and obtain both the rice and the rice bran. The bran is either fed to their animals or sold on what appears to be a growing market for animal feed. In this way, they can make some income on the milling process.

In the past, the major destination for paddy rice from the South was the parastatal rice mill at Bissau. Often the rice was transported via boat. Today this still appears to be the most economical route for rice from the South. A new pattern of flow is becoming possible as the new rice mill at Bafata begins milling rice in 1992. Plans are being made to truck rice from the South to the mill at Bafata. It also seems obvious that rice from the mechanized farms near Bafata would be milled at Bafata. However, this will only occur if the profits associated with milling at Bafata are higher than those associated with available alternatives. An attractive alternative could be milling at Bissau, since the mill at Bissau may offer rates that are publicly subsidized. The management of the rice mill at Bafata plan to sell the rice in Bissau; however, it is obvious that the merchants handling the rice will have an incentive to sell it where-ever the resulting profit is greatest. Transportation costs and geography suggest that the greatest profits may be obtained by selling in areas away from Bissau.

An obvious alternative to shipping the rice in paddy form and milling it in Bissau or Bafata, is to mill it in the South prior to shipment. At the present time the milling can be done either by traditional hand-pounding or by one of nearly 35 very small (.25 ton/hour rice) mills. As with other decisions in the marketing of rice, the decision on milling location depends on the milling costs at various locations. At the beginning of the marketing channel, women consider the prices they will receive for paddy or decorticated rice. As the price differential between paddy and decorticated rice widens, more women decide that it is better to mill the rice before selling it, thereby, capturing the milling margin.

A woman hand pounding paddy is said to be able to mill approximately 5.87 tons of paddy per year working six hours per day for 250 days (Pearson et al, page 406). That is about four kg per hour. If she could capture a 175 Pesos per kg milling margin, she would make about 700 Pesos per hour or 4,200 Pesos per day. Merchants in the South pay their labor about 5,900 per day.

A portion of the rice purchased in the South does not leave the area. If not stored and resold in the same village, then it may transported to a deficit area within the South to be bartered for other agricultural commodities. One would expect this phenomenon to increase with the increase in cashew plantations in the South.

Rice milling capacity in the nation as a whole appears to be more than adequate to process currently marketed production. Together the 35 small mills have the capability of processing about 10,000 tons of paddy per year. The other two mills could annually process more than 20,000 tons. Since sales of paddy into the rice marketing channel have not amounted to more than 10,000 tons in recent years, the existing, operational capacity exceeds industry needs.

Rice Marketing Costs and Margins

The marketing costs presented in Table 2 and used in the analyses discussed in later sections of the report are a combination of reported costs and calculated costs. The reported costs were obtained through interviews with the persons involved in marketing rice. When reported costs were not available or when a market for a particular service was not well established, the cost was calculated. The calculated costs are based on knowledge of the reported costs. Also, an attempt was made to be conservative by making uncertain costs a bit higher than what might appear to be adequate. This was done with the ultimate objective of testing the competitiveness of domestic rice with imported rice. With uncertain costs set comfortably high, one would have greater confidence in a result that indicated that domestically produced rice could compete with imported rice.

One example is the cost of transporting bagged grain within a commercial area such as a town. Merchants in Bissau report that they normally employ six men to load and unload trucks when receiving imports of grain. In this operation, efficiency can be maximized since large quantities of material can be moved in a nearly continuous operation. Trucks can be loaded to their maximum, since they will not be driven over rough country roads. They estimate a load/unload cycle time of 2.5 hours and a 15 hour working day. The calculated figure reported in Table 2 is based on the assumption that the trucks could only be loaded to 75 percent of their maximum capacity. This increased the per ton cost for both truck rental and labor. This resulted in a calculated price 1.52 times higher than the reported price. It was felt this was justified since the operations to which the cost was applied were not continuous operations and therefore likely to be less efficient.

Over-the-road trucking costs are an important factor in marketing rice. Therefore, the costs used throughout the analyses reported here should be well understood. Operating costs for a hypothetical trucking enterprise were developed and are presented in Table 3. The analysis assumes that two trucks are owned and that they are used in a full-time operation that achieved an 80 percent truck-time utilization rate. The enterprise was assumed to transport bagged grain between Bissau, Bafata, and Catio. The calculated cost per ton per kilometer transported for the trip between Catio and Bafata was quite close to that reported by the major merchant operating in that area when a charge for overhead of 17 percent was added to the operating cost. The calculated cost for the trip between Catio and Bissau was about 11 percent higher than that charged by the parastatal transportation company Rodofluvial.

Road conditions hamper truck-based movement of rice between the South and the North. However, road construction is closing this gap. Currently, only 60 km of unimproved road, between Buba and Catio, constrain all weather road transport between Catio and the norther portion of the country.

TABLE 2

Marketing Costs Used in Analyses

(Thousand Pesos Per Ton)

Cost Item			Truck Cost or Rental		Total Calculated Cost	Source of Information
Truck Transport	Loading Cost	Unloading Cost	Calculated	Reported		
Catio - Bissau	3.3	5.5	225	203	234	Rodofluvial
Catio - Bafata	3.3	3.3	150	150	157	Henini
Bissau - Bafata	5.5	3.3	121	108	130	Rodofluvial
In-Town Delivery						
Bissau - Bissau	5.5	5.5	18	14	29	Djabi
Catio - Catio	3.3	3.3	16.5	9.5	23	Survey
Bafata - Bafata	3.3	3.3	16.5		23	
Boat Transportation	Warehouse to Boat Costs	Boat to Warehouse Costs	Boat Rental Stenaks	Boat Rental Rodofluvial	Calculated and Used in the Analysis	
Catio - Bissau	23	47*	144	60	215	Stenaks and Rodofluvial
Milling Costs				Reported	Calculated	Source
Bafata Mill				800	318	Bafata Mill
Bissau Mill				131		Engineering Consultant
Small Village Mill				100	315	

* Includes port fees of 18 Pesos.

The cost of shipping rice to Bissau via water is interesting since it shows that water transportation is competitive with road transport from the South. Table 4 presents calculation of the cost of transporting rice via boat from Catio to Bissau and compares this cost with a similar calculation of truck transportation. Note that the calculated shipping cost between Catio and Bissau is 215,000 Pesos per ton while the calculated trucking cost is 234,000 Pesos per ton. In keeping with stated objective of being conservative in calculating costs, the calculated costs shown in Table 2 uses quoted transportation prices from a private sector shipping company, Stenaks Trading and Shipping Company, rather than from the parastatal, Rodofluvial, which quoted a much lower transportation charge.

TABLE 3

Estimated Cost of Trucking Services

Cost Item		Price/ Unit	25 ton Truck Km Useful Life/ Unit	Use @ Factor	Cost/Km	
Truck @	$83,333	500000	200000	0.000004	1.875	
1st Driver's annual salary		6000	93200	0.000011	0.064	
1st Driver's salary benefit		840	93200	0.000011	0.009	
2nd Driver's annual salary		6000	93200	0.000011	0.064	
2nd Driver's salary benefit		840	93200	0.000011	0.009	
Diesel		2	2.5	0.4	0.800	
Oil		18	150	0.006667	0.120	
Lubrication		110	5000	0.0002	0.022	
Maintenance		275	10000	0.0001	0.028	
Tires (10+(8*.5))	$800	79200	30000	0.000033	2.640	
Parts (5% of truck value)		25000	30000	0.000033	0.833	
Insurance: Drivers		720	93200	0.000011	0.008	
Insurance: Truck		194	93200	0.000011	0.002	
Licenses and Fees		2114	93200	0.000011	0.023	
Interest @	0.25	46875	93200	0.000008	0.377	Cost per Ton Including Overhead charge of 17%
Total Cost Per Kilometer					6.874	
Total Cost per Ton per Km					0.344	
Cost/Ton from Catio					127.862	149.5989
Cost/Ton Catio-Bissau					192.481	225.2026
Cost/Ton Bafata-Bissau					103.1148	120.6443

@ Use Factor = 1/(Km Useful Life per Unit)
Example: 1 liter of fuel has useful life of 2.5 km.
Its Use Factor is 1/2.5 = .4
Cost/Km = Price per Unit X Use Factor
@ Truck use factor: (1 - salvage percentage)/(km life)

Assumptions Used to Calculate Trucking Expenses

I. Vehicle Types, Costs, Capacities, etc.:

Item	Vehicle Type 25 ton Escudos	Pesos
Acquisition Cost	12500	500000
Loading Cspacity	20	
Salvage Percentage	0.25	
Number of Trucks Owned	2	

II. Transportation Distances and Times

Type of Trip	Distance One Way Km	Round Trip Km	Time Loading Hours	Travel Hours	Total Hours
Bafata-Catio-Bafata	186	372	3	13	16
Bissau-Catio-Bissau	280	560	3	9.5	12.5
Bissau-Bafata-Bissau	150	300	3	3	6

III. Tonnage Delivered and Kilometers Run:

Type of Trip	Truck Type	Number Trucks	Time Frame Days	Trips/ Day	Number Trips
Bafata-Catio-Bafata	25+ tons	2	125	1.60	200
Bissau-Catio-Bissau	25+ tons	2	125	1.60	200
Total for 25 ton truck unit			250		

Type of Trip	Truck Type	Total Km	Tonnage Delivered	Trucks Required	Required	Available
Bafata-Catio-Bafata	25+ tons	74400	4000	1.6	3200	6000
Bissau-Catio-Bissau	25+ tons	112000	4000	1.6	2500	
Total for 25 ton truck unit		186400	8000		5700	

TABLE 4

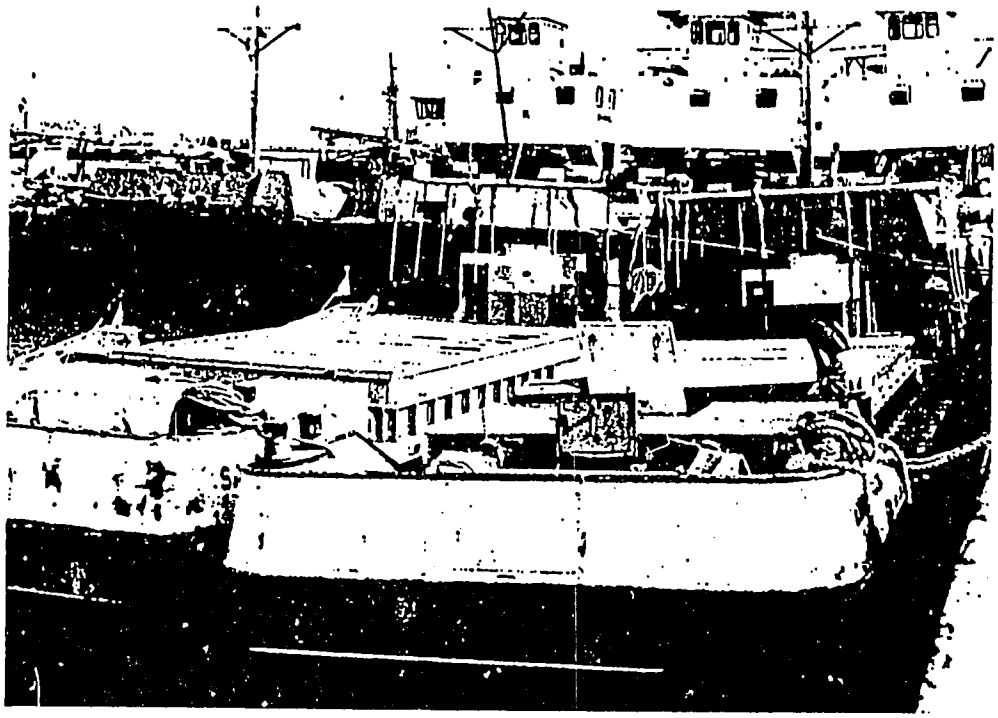
Comparison of Water Versus Road Transportation: Catio-Bissau

CALCULATION OF MARINE TRANSPORTATION COST: CATIO-BISSAU	
Transportation Cost in Catio (warehouse to boat)	
Truck Rental	16.5
Loading\Unloading Labor	6.6
20 Ton Vessel Cost	
Per Ton Catio-Bissau Charge	84.5
Additional Charge for Fuel	60.0
Transportation Cost in Bissau (boat to warehouse)	
Port Fees	17.7
Truck Rental	18.3
Loading\Unloading Labor	11.0
Total Transportation Cost per Ton	214.6
CALCULATION OF TRUCK TRANSPORTATION COST: CATIO-BISSAU	
Loading from Warehouse to Truck in Catio	3.3
Truck Transportation Cost	225
Unloading from Truck to Warehouse in Bissau	5.5
Total Transportation Cost per Ton	233.8

Note: These calculations are based on private-sector quotes and calculated trucking costs. If parastatal quotes had been used, the advantage of water over road transportation would have been more pronounced.

An additional factor which tends to support the assertion that this comparison between boat and truck is conservative is the fact that the Stenaks boats are rather small in capacity (20 tons). Thus, the favorable price for water transportation does not depend on the shipment of large quantities of goods. These small boats carry just about what a truck would carry. Figure 5 is a picture of these small vessels.

If the cost per ton quoted by the parastatal, Rodofluvial, were used in this comparison, water transportation would be substantially less expensive than truck. Rodofluvial's quote for truck service between Bissau and Catio is approximately 203,000 Pesos per ton. Its quote for water transport is 60,000 Pesos per ton. Even with the addition of necessary trucking, loading and unloading expenses at the dock at each end of the water borne portion of the trip, Rodofluvial's water borne rate is about 60 percent of their truck-only



Above: Two 20 ton capacity Stenaks boats. Three 200 ton capacity Rodofluvial boats are seen behind the 20 ton boats.

Below: 15-20 ton capacity truck.

FIGURE 5. 20 Ton Capacity Boats and Truck.

rate. However, it is appropriate to point out that the Rodofluvial rate is dependant on the quantity shipped being at least 67 tons or one-third of the Rodofluvial vessels' capacity, 200 tons. Figure 3 contains a picture of these 200 ton capacity vessels.

Note that the cost of unloading at Bissau includes port fees equal to approximately 18,000 Pesos per ton. These fees include a mandatory labor charge for unloading the vessel equal to 0.72 US dollars per ton, a surcharge of 1.5 US dollars per ton for the use of stevedores at the port (estiva), and a port use fee of 1.00 US dollars per ton. Note that the calculated charge includes two charges for unloading labor: the charge mandated by the port authorities and the charge for the hired labor that accompany the truck. This situation was difficult for the study team to comprehend; therefore, we point it out here for clarity.

Some major merchants own and operate boats with capacities of approximately 60 tons. The apparent lack of use of water-based transportation by smaller-scale merchants is somewhat more difficult to explain. A possible explanation is the lack of operating capital for use in hiring the boast. Additionally, some merchants have expressed reservations in entrusting their products to the former parastatal transportation company.

The milling costs reported in Table 2 also require some explanation. The calculated charges for the mill at Bafata and the small-scale mill were developed through feasibility studies of hypothetical milling enterprises employing these sized mills. These feasibility studies are included in this report as appendices. The calculated milling cost for the mill at Bissau was developed by a Guinean engineering firm, Empreendimentos, Sistemas Informaticos e Consultoria, Lda. Pearson et al (page 406) report milling charges for industrial-scale mills in West Africa ranging between 27 and 119 US dollars (1976 figures) per ton. They report charges for small-scale hullers between 14 and 52 US dollars per ton (1976 figures).

Our analysis of responses from assembly indicates that they pay, on average, about 175 Pesos/kg more for decorticated rice than for paddy rice. We use this figure as an estimate of the cost of rice milling using traditional hand-pounding techniques. This charge also includes the cost of transporting the rice to the assembly merchant. Under these circumstances, the producer (or the person who pounded the rice) keeps the rice bran, which is worth about 500 Pesos/kg. Since the yield of bran is about 10 percent, the value of bran from one kilogram of paddy rice is about 50 Pesos.

Clearly, the least expensive place to mill rice in Guinea-Bissau is in the mill at Bissau. That milling rice from Catio in Bissau is potentially profitable can be demonstrated using the marketing costs shown in Table 2 and some reasonable assumptions relating to farm-level prices and marketing margins. Alternatively, the same data and assumptions can be used to demonstrate that the rice could be profitably milled at Catio before shipping to Bissau. These analyses are presented in Table 5.

TABLE 5

Illustrative Costs of Marketing Southern Rice in Bissau:

Two Alternatives

Item	Mill Rice At: Bissau	Catio
	Pesos/Kg	
Farm-Level Price	600	600
Assembly Merchant's Margin (20%)	150	150
Cost to Wholesaler	750	750
Transportation to Mill at Bissau	215	
Milling Cost	131	315
Less Value of Associated Rice Bran	50	50
SUBTOTAL	1046	1015
Cost of Milled Rice (65% yield)	1609	1562
Delivery to Retailer in Bissau	29	215
SUBTOTAL	1638	1777
Wholesaler's Margin (10%)	164	178
Cost to Retailer	1802	1955
Retailer's Margin (5%)	90	98
Cost at Sale	1892	2053
Selling Price	2200	2200
Profit	308	147

The profits indicated in the table would likely be shared between the wholesaler and retailer depending on their relative bargaining power. Thus, under fluctuating market conditions it is likely that the margins captured by the wholesaler and the retailer would be different from those used in the table. The important point of the table is that agents in the marketing channel can make reasonable margins and thus would have the incentive to market rice from Catio in Bissau.

Assembly merchants in our survey of assembly merchants (located predominately in Tombali and Quinara Regions) were asked what they paid employees. The reported monthly wages ranged between 40,000 and 250,000 Pesos with an average of about 118,000 Pesos per month. These wages sometimes included the value of rice (usually 50 Kg) given as part of the wage.

Marketing margins at the assembly/wholesaler interface were calculated from survey responses. Assembly merchants were asked the usual price paid to producers for paddy rice and the usual price received from wholesale merchants when the paddy was sold. The margin was calculated by subtracting the purchase price from the selling price and dividing the result by the selling price. The calculated margins ranged between ten and 53 percent. Using the number of tons

handled by the merchants to weight the reported/calculated margins, the weighted average assembly margin ranged between 33 and 38 percent (depending on the season). These high margins appear to be related to the low volume of grain handled by each merchant per season. Average tonnage of paddy handled by the assembly merchants in our survey was about 60 tons. Analysis of assembly costs, discussed in Section III, imply that the assembly margin could be as low as ten percent. This implies the potential exists for substantial improvement in the assembly stage of the marketing channel.

Section Summary

This section has described the domestic rice marketing system in Guinea-Bissau. An outstanding characteristic of the system is that it contains two subsystems: one based on machine power and one based on human power. The machine-powered system is located in the northeastern part of the nation at Bafata. The human-powered subsystem is centered on Catio in the southern part of the nation. There are reasons to believe that the machine-powered subsystem is growing while the human-powered system is contracting. The machine-powered subsystem is managed by educated manager/farmers with substantial financial and political power. Probably as a result of this power, the machine-powered subsystem is more vertically integrated, from the producer level up, than the human-powered subsystem. The subsystem marketing rice from the South is characterized by many producers and assembly merchants without the resources to vertically integrate and are thus dependent on wholesale merchants. Further, the fact that there are very few wholesale merchants means the system is heavily dependent on a very few individuals.

The milling capacity of the system is more than adequate for current and foreseeable future needs. Transportation also appears to be quite adequate; however, there appears to be under-utilization of public- and private-sector water transportation resources. Water transport is less expensive than truck transport. Road transport is hampered by 60 km of unimproved road connecting Buba and Catio.

SECTION III

THE PROBLEMS ENCOUNTERED IN MARKETING DOMESTIC RICE

This section discusses the problems observed by the study team through:

1. its field work (which surveyed assembly, wholesale merchants, and public officials),

2. its feasibility studies of individual enterprises within the marketing channel, and;

3. an analysis of the system as a whole, based on a linear programming model of the system.

The first subsection presents an overview of the current situation with special focus on the policy environment in which rice marketing takes place. This is followed by a short subsection discussing the main constraints identified by assembly and wholesale merchants. The third subsection discusses feasibility analyses conducted on selected enterprises within the marketing channel. These feasibility analyses are based on costs collected during the field work which included the survey of merchants involved in the marketing of rice. The results of these feasibility studies are used as efficiency benchmarks for comparisons with existing marketing activities. The results are also used in the development of the linear programming model of the rice marketing system which is discussed in the fourth subsection. This section concludes with a summary of findings.

Constraints and Problems Associated with the Policy Environment

The liberalization of the rice market in 1989 and subsequent activities to privatize the parastatal once solely responsible for the marketing of rice in RGB continue to have an important influence on the industry. As the privatization process continues, it creates voids in the marketing channel--that chain of assets and activities that assembles paddy rice from widely dispersed farms, transforms the paddy into polished rice and distributes it to consumers. These voids in the marketing channel are both physical and financial.

For example, as the parastatal ceases (temporarily or permanently) such tasks as storing, transporting, or milling, the assets it was using are often not immediately put back into production or replaced by the private sector. Accordingly, the capability of the system to handle existing supplies is reduced. For example, during the 1990-91 crop year, the parastatal did not operate its large assembly facility near Catio. Its 1,000 ton warehouse was idle as were its motorized barges normally used to transport rice from islands to the Catio warehouse.

The local buying stations of the former parastatal were among the first units of the former marketing system to be privatized. These buying stations represented a key link in the marketing channel. The buying stations were located in rice producing areas and assembled small quantities of rice from surrounding farms into larger lots that could be efficiently transported by truck or boat. By

locating close to the farmer, these buying stations relieved the farmers of the job of marketing their grain, i.e., organizing efficient shipping quantities, transportation services, and buyers. A possible negative consequence of this is that it did not encourage farmers to take an active role in the marketing of their product. Accordingly, they are not well prepared to take over the task of marketing their product.

As rice buying stations were closed or sold to undercapitalized individuals, links were lost in the marketing channel. A major constraint to rebuilding many of these initial links in the marketing channel appears to be the lack of operating capital. Most of the small-scale merchants in the rice producing areas have little capital to self-finance these operating capital intensive businesses. These businesses are considered "operating capital intensive" because the value of the raw material represents the major operating expense of these businesses. The product is not transformed but simply handled. Value added is a small proportion of the product's subsequent selling price.

Those merchants with some of the best experience in buying and selling rice at this first assembly stage are the former employees of the parastatal. In several cases, these former employees have become the owners of the buying stations in which they formerly worked as employees of the parastatal. However, it seems unlikely that these individuals would have accumulated sufficient financial capital as employees to finance the operation of the buying station as its owner. Borrowing the necessary operating capital from a formally organized financial sector is practically impossible since an organized financial sector hardly exists in RGB and has not yet developed a strong presence outside of the capital city.

Compounding the problem is the fact that most small-scale merchants who operate in the small towns and villages in the rice producing areas have very few physical possessions to offer as collateral for a loan with a formally organized financial institution. The Credit Bank of Guinea-Bissau has made an effort to serve the financial needs of these merchants. However, due to prudent considerations relating to loan/collateral ratios, most loans have not exceeded $200, about enough money to purchase about 2 tons of paddy rice. An assembly merchant handling this quantity of paddy and realizing a 20 percent markup on its sale would receive about 275,000 Pesos to pay for his management skill and operating expenses. 275,000 is only about 2.3 times the monthly wage the merchant might pay an employee. Clearly, for a grain assembly business to be profitable, it must handle large quantities of grain and will require large amounts of operating capital for use in purchasing the grain.

The solution of this problem has relied on key, credit-worthy merchants to supply the capital and organizing skills necessary to begin restructuring the assembly stage of the rice marketing system. Due to previous policy, very few merchants had any sort of merchandizing organizations built when the decision to transform the economy was taken. Those that had organizations operated in an informal manner based on trust and verbal contracts. The need for informality may have been prompted by the fact that many of their business activities had been illegal under the centrally-directed economy. Certainly there would not have been much utility in formalizing a contract that would not have been legally enforceable. In spite of their informality, these organizations worked. Naturally, it was

these organizations that were most capable of beginning to take over the task of marketing rice as the State withdrew. These marketing organizations had established business relations in many of the small villages located in the rice growing area and also knew how to lend operating capital on an informal basis.

The State has aided this process by providing loans and loan guarantees to capable merchants. This process is somewhat akin to the former process in which the State provided operating funds to the parastatal. An obvious benefit in such a process is that it reduces the number of transactions between the lending agency and the borrowing agency. The parallel between the former system and the emerging system continues in the fact that the major merchants re-lend the funds to their buying agents. The benefits of this system are that it reduces transactions costs at the bank and enhances control by concentrating responsibility for the repayment of funds in a very limited number of people. The negative consequences of such a system is that it does concentrate control. In doing so, it does not encourage the development of independent businesses and the people that own and manage them.

During the interviews the study team conducted with assembly level merchants, the most often heard complaint was that they were unable to obtain what they felt to be adequate supplies of operating capital. In general, the assembly-level merchants interviewed felt they could have purchased substantially greater amounts of rice during the previous buying season if they had more operating capital. A plausible explanation is that the major merchants were attempting to spread the risk that any given assembly agent might not repay the loan or otherwise not perform as expected.

During January 1992, a nation-wide restriction of credit further dampened the prospects that adequate operating capital would be available to the rice marketing sector. There was a possibility that the lack of credit would again idle the assets controlled by the scaled-down parastatal. The credit constraint also meant that private-sector merchants who had stepped in to assume responsibility for assembling the marketed rice harvest through their informal network of small-scale merchants would have less operating capital. Thus, traditional sources of operating capital for the rice industry appeared to have been reduced substantially.

A potential source of new demand for paddy rice appeared to have been weakened by institutional factors. A privately owned company had installed a new rice mill which had the capacity to mill more than twice the amount of paddy produced and marketed in RGB during recent years. However, the mill management did not have an established network of rice assembly merchants in the growing area. As a result, the mill management was unwilling to risk advancing the necessary operating capital to the assembly merchants. Rather than purchase through the assembly merchants, the mill management decided to deal directly with farmers. This attempt was blocked by court action which enforced a marketing regulation which forbids industrialists, such as rice millers, from purchasing directly from producers.

With traditional sources of rice purchasing capital constrained by a lack of financing and with non-traditional sources constrained by risk considerations, it was predictable that the demand for rice in the major rice producing area of the nation would be lower than normal in the current year. Coupling this information with the expectation of a higher-than-normal crop, due to good rains, implied lower-than-normal prices at the farm level. With idle resources and predicted low farm-level prices, the rice industry appears, at the time of this writing in February, 1992, to be facing a crisis.

Existing marketing regulations appear to discourage market-directed solutions to marketing problems. Marketing regulations which require that middlemen be included in the marketing channel do not encourage the efficiency of direct producer/miller marketing. Such regulations create uncertainties and inequities since the regulations do not appear to be uniformly applied. For example, we found no evidence that producers associations or the former parastatal rice marketing organization, Armazen do Povo, are required to purchase paddy rice only through licensed middlemen. The setting of farm-level prices or guidelines by the Ministry of Commerce and Tourism is another example of marketing regulations that can create uncertainties or inequities and reduce the ability of independent marketers to solve marketing problems. Even though the suggested price is not enforced, the existence of the regulation creates the uncertainty that the regulation will be selectively used as appears to have happened with the regulation on the use of middlemen.

In December, 1991, the Ministry of Commerce and Tourism set minimum, producer-level prices for agricultural products, including paddy rice. The price of paddy rice was set at 650 pesos/kg. In January, 1992, the study team observed rice being purchased from producers at 500 pesos/kg. Since the market price is below the minimum official price, uncertainty is introduced over possible actions local authorities might take. A firm making significantly large purchases at market prices could be taking significant risks should some citizen, perhaps another merchant bruised financially by increased competition, request that local authorities take legal action against the "offending" firm.

Constraints and Problems Mentioned by Marketing Agents

During the study team's survey of people involved in the marketing of rice, the team often spent additional time talking with the merchants, asking about the problems or constraints they faced. Uniformly, both assembly merchants and wholesalers complained about their lack of operating capital and their inability to borrow adequate supplies of this critical business resource. Operating capital or working capital is an especially critical resource for grain businesses since the value added to the product is comparatively low in comparison to the inherent value of the product.

Storing rice, for example, adds value to the product but represents only a fraction of the total worth of the product. Thus, grain marketing enterprises tend to make a small profit on a large volume of product. Without access to borrowed capital to finance the required inventories, merchants' ability to handle the large volumes required to make a business feasible is limited by their accumulated wealth. Putting the problem in a different perspective may assist the reader understand it. As demonstrated above, shipping rice from Catio to Bissau can be a profitable enterprise. However, for a person to make 1,000 dollars as a wholesaler, the person would have to have access to 10,000 dollars.

Problems Revealed by Analyses of Individual Marketing Activities

The two marketing activities analyzed most closely were the rice mill at Bafata and a representative small-scale rice mill located in a representative village in Tombali. A brief analysis was made of a truck-based rice assembly service and of a warehousing service. Both of these last two enterprises are required to assemble paddy rice for resale to wholesalers and millers. These activities are discussed in this section of the report.

Small-Scale Rice Mills. A feasibility analysis was done of a representative .25 ton/hour rice mill to gain an understanding of the economics of these mills.

At Left:

Operator and .25 ton/hour rice mill at Catio.

Below:

Building which houses 2.5 ton/hour rice mill at Bafata.

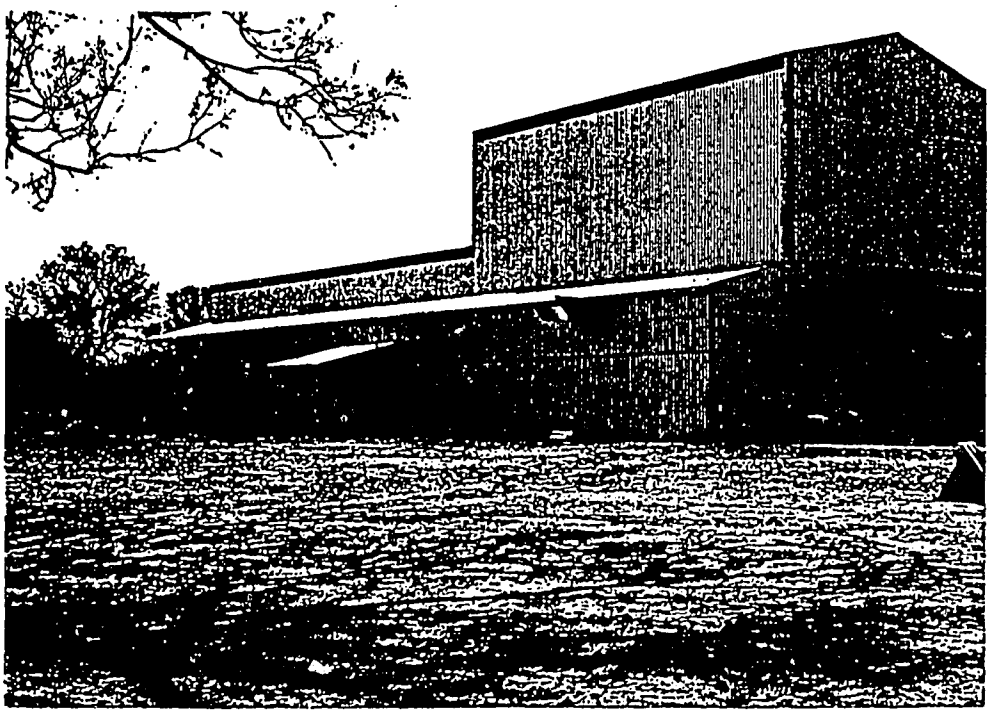


FIGURE 6 . Rice Mills.

These mills have been provided to groups of producers by the Directorate for Agricultural Experimentation and Research (DEPA). DEPA also provided training in the operation of the small machines and in the management of the enterprise. Figure 6 contains a photo of one of these mills. The mills were to operate as service centers providing rice milling services on demand to members of the local community. This type of operating pattern could be an important advantage to these mills in that it does not require the mill to carry an inventory of paddy rice or polished rice. This reduces the demands on the mill management and avoids the large investment in working capital and storage facilities normally associated with a grain milling operation. Unfortunately, it is this aspect of the management of the mills that also limits their profitability since full-capacity operation is difficult to achieve without an inventory of raw material.

The cost of operations as well as repayment of the capital cost of the milling machine was to be obtained from rice milling fees or charges paid by the mill's customers. The recommended milling charge was expressed in two forms: a barter charge of one kilo of polished rice for every 10 kilograms of paddy milled or a cash charge that varied between 50 and 100 Pesos per kilogram of paddy.

This operating scheme severely limits the mill management's control over its revenue. Given a choice between paying with cash or with rice, producers could be expected to pay in cash when the polished rice could be sold for more than the sum of the price of the paddy plus the milling charge divided by the milling yield (paddy price + milling charge)/milling yield. This tends to prevent the mills from earning any extra revenue from the direct marketing of the rice they might receive as payment for milling services. Another restriction on the mill's revenue is competition from the people it is attempting to serve. In areas with little other employment opportunities, local producers may decide to mill their paddy themselves using traditional mortar and pestle. In general, the mill managements are not encouraged to buy rice and mill it for the mill's account. As a result of these restrictions, most of the mills operate at less than full capacity.

If the mills could operate at close to full capacity, it appears that they could be self-sustaining or profitable and could possibly be one of the lowest cost milling operations in Guinea-Bissau. Table 6 demonstrates how this might be possible. The operation described in the table can make a profit while paying a reasonable wage or return to all resources engaged in the operation, including such invested resources as working capital and fixed capital. Note, however, the milling enterprise must work 6 hour days, 20 days a month, 10 months a year to achieve this level of profit. Also note that the "profit" is equal to approximately, 110 US dollars. Figure 7 illustrates the necessity of keeping the mill operating at high capacity in order to achieve profitable levels of production. Losing an hour per day in down-time, time when the mill is not working, puts the enterprise in financial trouble.

Given this information, an obvious recommendation for people concerned with the sustainability of these mills is to organize the flow of paddy to the mill in a manner that assures the mill will process at least 300 tons of paddy per year. This will be difficult since it restricts the producer/owners' marketing flexibility in that they must commit to mill some of their product in the association's mill. Secondly, the milling groups should be encouraged to investigate alternative markets for any polished rice they receive in payment for milling services. Marketing in larger towns can yield increased levels of revenue. During the survey stage of this study, prices for milled rice in villages in Tombali ranged between 1,000 - 1,500 Pesos per kilogram. Milled rice in Bissau was retailing for over 2,000 Pesos per kilogram.

TABLE 6

Illustrative Operating Statement for a .25 Ton/Hour Rice Mill

(1,000 Pesos)

	MONTHLY	9 MONTH YEAR	10 MONTH YEAR
REVENUE:			
Milling Fees			
Tons of Paddy Milled	30	270	300
Milling Fee Per Ton	100	100	100
Total Revenue	3000	27000	30000
EXPENSES:			
Manager's Salary	600	5400	6000
Operator's Salaries (2)	300	2700	3000
Fuel (1.2 liters/hour)	288	2592	2880
Oil (.025 liters/hour)	54	486	540
Lubricant (.008 liters/hour)	17	153	170
Spare Parts	970	8730	9700
Interest @ 5% on Working Capital		354	354
Amortization of Machine		6000	6000
Interest @ 5% on Investment (Machine)		750	750
Totals		27165	29394
Net Revenue		-165	606
Milling Cost Per Kilogram		100.6	98.0
Ignoring Interest:			
Net Revenue		939.0	1710.0
Milling Cost Per Kilogram		96.5	94.3

Working Capital Calculation	
6-month supply of spares	5819.87
1-month supply of fuel & lubricant	359.28
Cash for salaries	900
Total	7079.15
Amortization Calculation	
Cost of Mill	30000
Straight Line Amortization, 5 Years	6000
Interest Calculation	
Average Value of Machine over 5 Year	15000
Interest @ 5% on Average Value	750

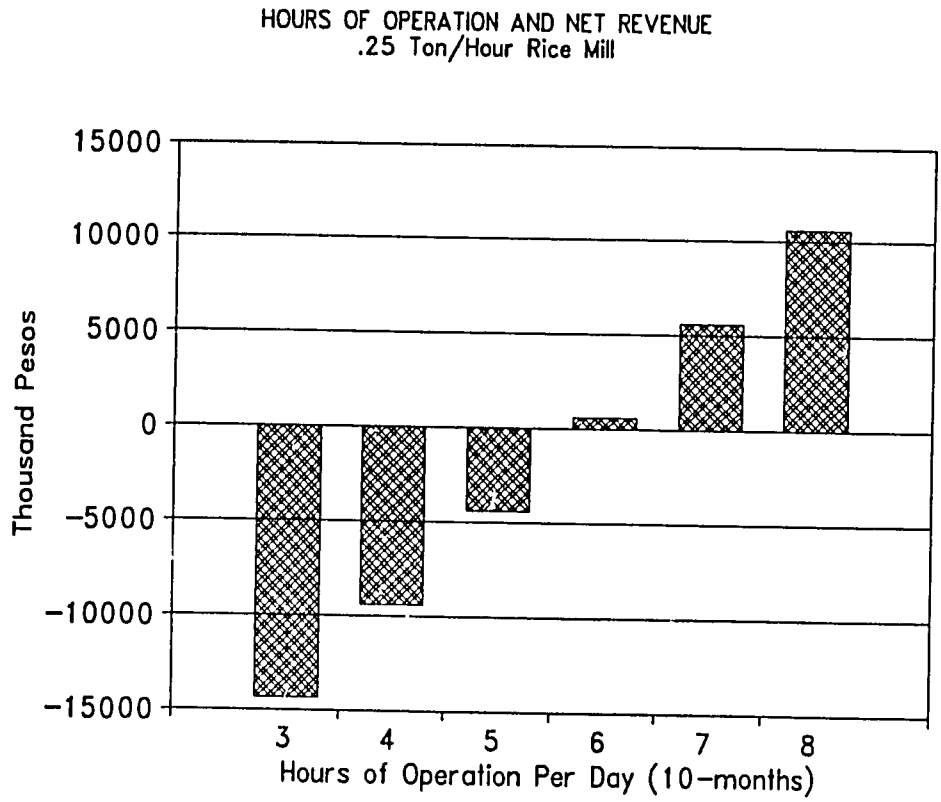


FIGURE 7. Hours of Operation and Net Revenue: .25 Ton/Hour Rice Mill

Feasibility of a Representative .25 Ton/Hour Rice Milling Enterprise. To test the hypothesis that these small-scale rice mills could be profitably operated under a management scheme that assured high capacity operation, the study team conducted a feasibility study of a hypothetical operation. An extended report of this feasibility study is presented in Appendix 1. Just the highlights of that study will be discussed here. Since full-capacity operations require an inventory of raw product, the hypothetical operation includes a warehouse capable of storing 175 tons of paddy. Additionally, since the most practical way of accumulating an inventory of grain is to buy it, the hypothetical operation has a significant investment in inventory working capital.

To prevent downtime due to the absence of spare parts, the mill has an inventory of spare parts and a scheduled program of purchasing replacements. In an attempt to avoid the problems encountered by others with foreign matter in the paddy, the mill has a substantial investment in a paddy rice cleaner. Finally, the revenue envisioned for the hypothetical mill is substantially higher than that achieved by the small mill discussed above. Thus, additional funds for marketing activities have been added to the hypothetical mill's account. With all these additional investments, the total investment cost for the mill is approximately 70,000 US dollars. The investment returns (to owners, lenders, and tax collectors) approximately 20,000 US dollars per year.

Larger-Scale Rice Mills. A feasibility study was conducted of the 2.5 ton/hour rice mill at Bafata that had just begun operations in January 1992. Figure 6 contains a photo of the building housing this mill. The major problem facing this mill is similar to that facing the small-scale mills: under-utilization of the mill's capacity. The mill is designed to process over 10,000 tons of paddy per year. Mill management faces a tremendous challenge in obtaining quantities of this magnitude. Their attempts to purchase rice from the Tombali region had not begun successfully as the field phase of this study ended. Additionally, the mill faces a competitive challenge from the parastatal mill at Bissau. Analyses discussed later in this report indicate that, given the milling charge proposed by the management of the Bafata mill (800 Pesos/kg), it would be more profitable to truck paddy from Bafata to Bissau for milling rather than mill it in Bafata. The Bafata mill also shares with the small-scale mills the problem of not having adequate storage facilities to insure the desired level of production.

The feasibility study, presented in Appendix 3, assumed the mill would add adequate storage and that it could obtain enough paddy to operate at the following capacity levels during its first five years of operation:

Year	1	2	3	4	5
Capacity	25%	35%	50%	75%	100%.

If the mill achieves these goals, the feasibility study estimates that the milling enterprise will be moderately profitable. The total investment is approximately 2 million US dollars and it is expected to return (to owners, lenders, and tax collectors) approximately 610,000 US dollars per year after full capacity has been reached.

The major question is whether or not this growth path shown above is feasible. Rice production in the Bafata area is currently estimated between 2,000 and 4,000

tons. Marketed production in the South is estimated between 5,000 and 7,000 tons. The growth path envisioned above would require a doubling of current production unless rice is diverted from its current uses. Significant change appears to be in store for the Guinean rice industry.

Discussions with the manager of the large mill at Bissau (at Bolola) and a simple financial analysis of its operations indicate that the mill is presently not self-sufficient. The mill presently charges approximately 100 Pesos/kg of paddy for milling rice. Engineering analysis of the mill indicate that with some repairs and continued annual maintenance the mill can continue to operate at a capacity of 2.5 tons/hour or an annual capacity of approximately 10,000 tons per year. However, to cover its costs of operation, the mill would have to charge at least 131 Pesos/kg of paddy.

The mill also operates on a policy of returning to its customers polished rice equivalent to 65% of the weight of the paddy brought for milling. This policy can cause problems if the customer's paddy does not yield rice at the 65% ratio. This could occur if the quality of the customer's paddy is not high enough to yield at such a ratio. The mill has no established, quantitative procedure of determining the quality of the rice and taking that quality into consideration when entering into a milling service contract with a customer.

Paddy Rice Assembly Enterprises. At the present time the weakest components of the rice marketing channel are the enterprises that assemble small quantities of paddy rice from many producers. The importance of this task can be appreciated by considering how much more valuable paddy rice becomes if it is assembled in economically transportable quantities. If the rice were assembled, say at a large warehouse accessible by road or water, arranging to buy and transport the rice to the next marketing activity would be a fairly simple operation because transportation and milling services in Guinea-Bissau can be hired by anyone. The risks of failure would be greatly minimized, since the purchaser would take immediate possession of the rice and would not be involved in financing the assembly process. A buyer would not have to have an established network of assembly agents; thus, many more merchants would be capable of moving rice from the assembly stage forward. It is predictable that the increased value of assembled rice would attract more merchants into the rice marketing industry. With an increase in buyers one expects more competition and thus higher prices reflecting the increased value of the assembled paddy rice at the assembly point.

To begin understanding the cost of the assembly operation, we developed an estimate the cost of an hypothetical operation. We visualize the operation as two distinct types of activities: warehousing and assembly. The warehouse operation is assumed to purchase and resell paddy rice at its 1,000 ton warehouse. Specifically, the warehouse operation does not own trucks or boats with which it can pickup or deliver rice. Instead, it depends on independent assembly merchants to purchase the paddy rice from the village or farm level and resell to the warehouse. Alternatively, producers could become more involved in the marketing process and deliver their paddy rice directly to the warehouse. We discuss the costs of the warehouse operation first and then discuss the costs of a truck-based assembly enterprise. Obviously, the warehouse operation could own and manage (thereby further spreading its management costs) one or more truck-based enterprises such as the one envisioned here. Ownership of the

trucking enterprise was not assumed for the warehouse operation for the purpose of promoting the notion that the assembly operation could be based on several independent enterprises operating under independent managers.

The major points demonstrated with this analysis are:

1. that the unit costs of operating a warehouse are heavily influenced by its fixed costs and the number of units moved through the facility,

2. that one should expect the cost per ton of the assembly operation to be less than 75 Pesos per kilogram,

3. the warehousing operation accounts for approximately 44 Pesos per kilogram of the 75, while the truck-based assembly operation accounts for approximately 30 Pesos per kilogram.

The estimated operating costs for the 1,000 ton warehouse are presented in Table 7. One might visualize the 1,000 ton warehouse owned and operated by Armazens do Povo near Catio as the basis for this warehouse enterprise. Note that the major fixed costs of this hypothetical warehousing enterprise are salaries. Also note that although the salaries are not on a level that would be competitive internationally, they may be slightly high for a warehouse operation in southern Guinea-Bissau. It is possible that one manager could supervise one or more warehouses of this size, thereby, resulting in a lower cost per ton for a larger facility. Alternatively, the warehouse operation could be based on a smaller warehouse, for example, a 500 ton warehouse. With the smaller warehouse, fixed costs would be reduced approximately 20 percent, as would the cost per ton.

This implies that decision makers considering an investment in warehouse space should resist the temptation to build larger facilities than absolutely needed. Building capacity in small units that are fully utilized appears to reduce fixed cost per unit and can enhance decision making flexibility. Such flexibility may be useful, for example, if labor costs are seen as a potential cause of concern. The lack of a large fixed investment in bagged storage (which relies heavily on labor) may allow the consideration of bulk storage systems.

The labor cost for the warehousing operation also appear to be conservative. We assume that the cost for moving bagged grain into or out of the warehouse is 0.60 US dollar per ton or 3300 Pesos. Assuming 50 kg bags of paddy rice, implies a person would be paid 165 Pesos per bag. To make a reasonable daily wage of 15,000 Pesos would require moving about 91 sacks of paddy rice per day. It is expected that laborers would move substantially more than 91 sacks per day and would receive a substantially higher wage. Thus, labor costs appear to be conservatively estimated.

The costs associated with a truck-based assembly service that might be supplying the warehouse are presented in Table 8. The assembly service/enterprise is based on a truck with a 13 ton payload. It is assumed that the truck delivers 26 tons of paddy rice per day from distances that average 25 km from the warehouse (a 50 km round trip is charged). It is assumed that the assembly enterprise operates

TABLE 7

Operating Cost for Bagged Warehouse Assembly Service

(Thousand Pesos)

Annual Tonnage Handled:	1000	
FIXED COSTS	Monthly	Yearly
Manager	700	8400
Buyer/Grader	300	3600
Warehouse Supervisor	300	3600
Bookkeeper	200	2400
Guards (4)	1000	12000
Salaries	2500	30000
Depreciation on Warehouse		21368
Interest on Warehouse		21368
Interest on Working Capital		33500
Miscellaneous (15% of salaries)		4500
TOTAL FIXED COSTS		110735
VARIABLE COSTS		
Warehouse Labor (3300 Pesos/ton)		6600

TOTAL COST PER TON FOR SELECTED ANNUAL TONNAGES

Annual Tonnage	Cost Per Ton
1000	117
2000	62
3000	44

TABLE 8

Operating Cost for a Truck-Based Assembly Service

(Thousand Pesos)

Annual Tonnage Handled:	1872	
FIXED COSTS	Monthly	1/4 Year
Manager	500	1500
Buyer/Grader	300	900
Salaries		2400
Interest on Working Capital		10356
Miscellaneous (15% of Salaries)		360
TOTAL FIXED COSTS		13116
VARIABLE COSTS		
Truck (400 Pesos/ton/km*50*1872)		37440
Labor (3300 Pesos/ton*1872)		6177.6
TOTAL VARIABLE COSTS		43617.6
TOTAL COSTS PER TON		30.3

only 3 months a year. This implies that the trucking enterprise is fully employed elsewhere during the remainder of the year.

An Analysis of the Rice Marketing System as a Single Unit

The foregoing analysis has been designed to aid policy makers develop policies that effect the operation of individual units of the rice marketing channel. To aid public and private policy makers develop policies that impact the way the individual units interact and operate as a unit is the purpose of this section. This is done with the aid of a linear programming model of the rice marketing system. The model incorporates current knowledge of the system, including milling and transportation costs, assembly margins, and the guideline price of paddy at the farm level. Using these values, the model calculates the least-cost pattern of supplying desired quantities of rice where needed throughout the nation. This result is informative for decision makers since it is indicative of the results of a particular set of policies. If the results do not conform to the nation's policy goals, policy makers may wish to have information that will assist them choose policies that will cause the desired policy goal to be achieved. The model can help identify such policies. For example, it may be national policy to reduce dependance on imported rice if this is economically feasible. The model indicates that this goal is unlikely to be achieved under current policies.

Model Results. When the model is run with values representing the existing circumstances in Guinea-Bissau, the model indicates the least-cost way to supply the nation's demand for purchased rice is to rely primarily on imported rice. The important values used to represent the existing situation are that the farm-level price is set at 650 Pesos/kg, the assembly margin is set within the observed range at 35%, and no restrictions are imposed on imports. Domestic rice can hardly compete under these conditions; therefore, the only domestic rice used in the least-cost pattern would be a small quantity used to supply the market around Catio.

This reliance on imports could be reversed if policies were adopted that would cause the assembly margin to be reduced. The model indicates this possibility. When the value of the assembly margin used in the model is reduced from 35% to 15% and the model rerun with all other values remaining as in the first run, domestic rice is used as much as supplies allow. If enough domestic rice is available, domestic rice further replaces imported rice in the least-cost marketing pattern and significantly less imported rice is used. These results imply that two keys to increasing the nation's self-sufficiency in rice are to increase marketing efficiency at the assembly stage and to increase domestic production.

The model indicates other information useful in policy making when used in a testing mode to discover what the results would be if certain other variables were changed. Table 9 displays summary results of 8 such runs of the model. Each of these runs selects a least-cost marketing pattern based on the assumptions used. Each numbered line of the table summarizes the results of a single run of the model. The first data on each line deal with the assumptions on farm-level price, assembly-level marketing margin, and domestic production. Domestic production is often set very high so that the model can choose any level

of domestic production desired. The next data on each line are the actual domestic production (and its production location) called for by the marketing pattern. Next, the location of the milling process is given. The last two items on each line are the level of rice imports selected by the model and the total cost of marketing the rice through the selected pattern.

This discussion of the model results begins with the least-cost marketing pattern associated with the most restrictive set of assumptions. These assumptions are then modified in a logical manner and the least-cost marketing pattern

TABLE 9

Summarized Results: Least-Cost Marketing Patterns

Line Number	Farm Price Pesos	Assembly Margin	Available Production		Production Used		Quantities Milled at			Quantity Imported	Total Costs (million Pesos)
			Catio Tons	Bafata Tons	Catio Tons	Bafata Tons	Catio Tons	Bafata Tons	Bissau Tons	Tons	
1	650	35%	3250	1300	737	0	737	0	0	33132	58128
2	650	35%	3250	1300	0	0	0	0	0	33869	58140
3	650	15%	3250	1300	3250	1300	3250	1300	0	29319	57606
4	550	20%	35000	35000	737	33132	737	12729	20403	0	55745
5	650/585	20%	35000	35000	8295	25574	8295	5930	19644	0	55528
6	650/585	20%	35000	35000	8295	8930	8295	5930	3000	16644	56493
7	650/585	20%	35000	35000	7859	5930	7859	5930	0	20080	55170
8	550/500	15%	35000	35000	1496	15729	1496	12729	3000	16644	48030

recalculated. After an assumption has been modified, it will remain in its modified form in subsequent runs of the model. For example, the first run of the model assumes that traditional mortar and pestle milling services are available for use in the marketing system. This assumption is modified in the second run of the model and remains in its modified form in all subsequent runs of the model. Thus, as we work through the eight runs of the model, we will accumulate modifications to the assumptions underlying the model. Each run of the model illustrates a significant characteristic of the marketing system. Each of these characteristics are important for policy makers to keep in mind as they contemplate policy changes.

First Run: Current Policies. As mentioned above, the least-cost marketing pattern under current policies and production constraints relies primarily on imported rice. Line 1 of Table 9 summarizes this least-cost marketing pattern. Note that the farm-level "guideline" price of 650 Pesos/kg is assumed to hold. The assembly margin is assumed to be 35% and domestic production (in polished rice equivalents) is assumed to be 3,250 tons at Catio and 1,300 tons at Bafata. The only domestic production used in this least-cost pattern is 737 tons produced and processed at Catio to serve the estimated demand for marketed polished rice at Catio. Milling is done by traditional hand-pounding. Imports are 33,132 tons. The cif price of imported rice is assumed to be 260 US$/ton. The total cost of supplying rice through this marketing pattern is 58,071 million Pesos.

This marketing pattern is financially feasible. It requires no investment in milling facilities other than the simple mortars and pestles used in the traditional technology. Note that using the traditional process will more widely distribute (among the workers milling the grain) the returns to the milling

process than would the use of mechanical mills, each owned by a small group of people. The values used here allow 175 Pesos/kg of paddy for milling and transportation services. The individuals hand-pounding the rice would also retain the rice bran by-product worth approximately 50 Pesos/kg of paddy milled. Thus, a person working five hours per day and milling 4 kg of paddy per hour could receive a total return of 4,500 Pesos per day ((175 + 50) X 4 X 5 = 4500 Pesos/per day).

Second Run: Current Policies But No Mortar & Pestle Milling. If traditional milling services were unavailable, the next least-cost marketing pattern (under current policies and production constraints) would include no domestic rice. This pattern and the assumptions relating to it are summarized on Line 2 of Table 9. In the remaining model runs discussed here, we will continue to assume that traditional mortar & pestle milling is unavailable. Obviously, some traditional milling services will be available into the foreseeable future; however, the quantity of these services may be unreliable or impractical to organize. It is clear that, because we have estimated the cost of hand-pounding to be less than the cost of milling in either the .25 ton/hour or the 2.5 ton/hour mills, traditional hand-pounding would be the least cost method of these three. This implies that the traditional method will always be selected to enter the least-cost marketing pattern to the extent the services are available at a cost which is less than the other milling alternatives.

Third Run: Reduced Assembly Margin. If the assembly margin could be reduced (perhaps, through increased competition) to 15 percent, the least-cost marketing pattern would use all available domestic production. This pattern is summarized on Line 3 of Table 9. Note that the assumed production at Catio and Bafata is fully used in the system. The paddy produced at Catio is milled at Catio and that produced at Bafata is milled at Bafata. Most of the rice milled at Catio is transported out of Catio, since the demand for rice in Catio is assumed to be only 737 tons. Imports remain an important factor in this marketing pattern at 29,319 tons. Again, we assume no traditional milling in this run.

This pattern would be feasible with small-scale mills at Catio and Bafata; but would not support the 2.5 ton/per hour existing mill at Bafata.

Fourth Run: Increased Production. The model results from the third run, discussed immediately above, used all available production. The model was prevented from selecting more domestic production because of the constraints we placed on production. See the "Available Production" columns of Line 3 Table 9. This fourth run of the model shows what would occur if we removed those constraints. Accordingly, the production constraints in this run are set to 35,000 tons (paddy equivalent) at both Catio and Bafata. To demonstrate that the result does not depend on the assembly margin being set at 15 percent, the margin is set at 20 percent in this run. The results of the run indicate that if production could be increased to a level that would supply all rice required in the nation, no imported rice would be used in the least-cost marketing pattern. This pattern is summarized on Line 4 of Table 9. Note that this pattern depends heavily on the mill at Bissau.

This pattern would only be feasible if the old mill at Bissau could keep up with the milling demand placed on it. Given the advanced age of the mill at Bissau,

it seems unlikely that this is possible. The possibility of replacing the mill at Bissau also does not appear to be a viable alternative, since a new mill would likely have higher operating costs. Other runs of the model, not discussed here, indicate that any mill installed at Bissau must be capable of operating with a milling charge of less than 180 Pesos/kg to be selected as part of the least-cost marketing pattern.

Note that the quantity of rice the model selects to be milled at Bafata under this marketing pattern would support two mills the size of the existing mill at Bafata. Also, we should point out that, if traditional rice milling services were available at a cost below that of the mill at Bafata, traditional milling services would be used instead of the mill at Bafata. To fully replace the Bafata mill, in this case, would require the full-time services of approximately 3,336 persons. Finally, note also that this marketing pattern favors rice produced at Bafata rather than at Catio. This phenomena is discussed next.

Fifth Run: Pan-Territorial Prices. One reason the marketing pattern discussed immediately above depends so heavily on Bafata production rather that production from Catio is that the same farm-level price is used for both locations. This reflects the government's practice of setting a single farm-level price for the entire nation. Prices so set are termed pan-territorial prices. If farm-level prices were flexible, rice near Catio would sell at a price that would encourage its use. The impact of allowing rice price to differ across geographical space can be demonstrated with the model. In this fifth run of the model, the price of rice at Catio is reduced 10 percent. The two prices--650 Pesos/kg at Bafata and 585 Pesos/kg at Catio--are presented on Line 5 of Table 9. All other values remain as in the fourth run. As seen on Line 5 of Table 9, the use of production from Catio increases substantially over that of the proceeding run of the model in which farm-level prices were assumed to be the same at Bafata and Catio.

The financial feasibility of this marketing pattern (summarized on Line 5 of Table 9) is questionable because of its dependance on the mill at Bissau. Also, the quantity of rice to be milled at Bafata is about 90 percent of the amount required for full operation of the existing mill at Bafata. The amount to be milled at Catio could support a mill the size of the existing mill at Bafata.

Sixth Run: Limited Capacity at Bissau. To test the result if the capacity of the rice mill at Bissau were constrained, we set a constraint on the capacity of the mill to 3,000 tons of polished rice and reran the model. The results are summarized on Line 6 of Table 9. The rice mill at Bissau is used to the maximum extent allowed (3,000 tons of polished rice) and imports increase to replace the rice not produced by the Bissau mill. This demonstrates the importance of the mill at Bissau in reducing imports--when domestic production is sufficient and the operating cost of the mill is approximately 131 Pesos/kg of paddy.

The marketing pattern discovered in this sixth run appears to be physically feasible since it does not rely heavily on the mill at Bissau. The quantities to be milled at Bafata and Catio are not optimal for the size of mills we have studied here. Thus, a financially feasible pattern would probably shift somewhat the quantities to be milled and quantities to be imported.

Seventh Run: Reduced Importation Fees. If the cost of imported rice is reduced from the situation just described, the first impact is a reduction in the quantity of rice milled at Bissau. This reduced use of domestic production is compensated with increased imports. This least-cost marketing pattern is summarized on Line 7 of Table 9. In this example, the importation fees have been reduced by approximately 50%, from 10.3% to 5% of the cif value. Also, all other assumptions employed in the sixth run of the model (including the constraint on milling capacity at Bissau) remain the same in this run. Note that the farm-level prices were assumed to remain as they were in the sixth run of the model. With fixed farm-level prices, a reduction in the cost of imported rice will be expected to cause imports to increase and the use of domestic rice to be reduced. In the face of competition from lower priced imports, farmers may be willing to accept a lower price rather than retain rice designated for marketing. Legally, this is only possible if the government does not set prices. This illustrates one of the problems associated with administratively fixed prices, namely, that it reduces the marketing system's ability to deal with unanticipated price changes.

Eighth Run: Is Domestic Rice Competitive with Imports? A major question is under what conditions the domestic industry could continue to compete with imported rice if the protection provided by the import fees was removed. An indication of what would result is provided by this eighth run of the model. In this run the import fee was reduced to zero. The assembly margin was reduced to 15 percent. Farm level prices were reduced to 550 Pesos/kg in Bafata and to 500 Pesos/kg in Catio. Finally, the cif price of imported rice was reduced from 260 US$/ton to 240 US$/ton. As can be seen on Line 8 of Table 9, the use of domestic product is increased over that indicated in the previous run. The amount of domestic production called for by this marketing pattern is about 3 times the current level of marketed production (about 5,000 tons). An additional run of the model with the cif price of rice set at 230 US$/ton indicated only a small reduction in the use of domestic rice in the least-cost marketing pattern. Clearly, further reducing the assembly margin would enhance the competitiveness of domestic production.

The average cif price of imported rice during Oct 1990 to Oct 1991 was 276 US$/ton. In 1989 the average cif price of imported rice was approximately 280 US$/ton. In 1988, it was approximately 250 US$/ton. During the study team's field work, we observed rice being purchased by assembly merchants at 500 Pesos/kg.

Thus, it appears that the domestic rice industry has the ability to compete with imported rice without tariff protection if the efficiency of the assembly-level stage can be improved. It is clear that this ability can be enhanced if producers and marketers have the freedom to adjust their prices to market conditions. However, it is also clear from the linear programming analysis that domestic rice cannot totally replace all imports of rice unless a mill or mills of adequate capacity to produce approximately 20,000 tons of polished rice and with milling costs of approximately 180 Pesos/kg of paddy can be installed.

The following material provides a detailed discussion of the model. This is followed by a discussion of ways in which the model can be used in policy making.

The Model. The model discovers the least costly method of purchasing, transporting, milling, and distributing domestic and imported rice such that demand for rice in all regions of the nation is satisfied. Paddy rice is grown and purchased in two areas of the nation: the Southern Region of Tombali and Quinara and the Region of Bafata. The paddy rice can be milled in either of three locations: Catio, Bafata, or Bissau. The Catio location represents the existing small rice mills distributed throughout the region or traditional hand-pounding with mortar and pestle. Alternatively, the Catio location can be seen to represent a larger-scale mill located in Catio. The Bafata location represents the newly installed rice mill at Bafata, while the Bissau location represents the large, old mill at Bissau. Imported rice enters the system at Bissau. The demand (annual quantity demanded in tons) for polished rice in selected towns of the 9 regions of the nation is developed in Table 1.

The model is a set of equations that describe the cost of milling rice at the various milling locations and the cost of transporting rice between various points. The model also contains equations that express constrains in the system. For example, one constraint in the system is the amount of paddy rice available at Catio. Other constraints express the quantities of rice needed at various locations, e.g., the demands for polished rice. The model is limited in that it considers an operating year as a single time period. A more complicated model would break the year down into shorter periods of time. This would allow for analysis of storage decisions, i.e., whether to store paddy or polished rice for use in a later period or to use it immediately. The linear programming model used in the first run of the model is presented in Table 10.

The values used in the first run of the model are shown in Table 11. The first section of Table 11 presents the cost of marketing domestic rice through available marketing channels or paths. For example, the first column, entitled, CMC, presents the cost of assembling, milling and selling rice produced near Catio in Catio. The letters, CMC, refer to "Catio rice Milled in Catio." Under the CMC heading, one finds that the assumed 35% assembly margin is 350 Pesos per kilogram, the milling charge (for traditional hand-pounding) is 175 Pesos per kilogram of paddy. The cost of the rice reflects a 65 percent milling yield. Thus, (650 + 350 + 175)/.65 = 1808. The value of the by-product, rice bran, is subtracted to obtain the cost of the polished rice when mechanical milling is used since it is assumed that this reduces the marketing agent's costs. However, in the case of hand-pounded rice, the value of the rice bran is not subtracted since the marketing agent does not own the brain. The milling charge includes packaging costs.

The final column in the first section of Table 11 refers to imported rice delivered to a warehouse in Bissau. This price reflects a c.i.f. price of 260 US dollars per ton plus port costs of 4.8 US dollars per ton plus port fees and taxes equal to 10.3 percent of the c.i.f. cost plus cost of delivery into the warehouse of 5.33 US dollars per ton. Note that the cost of milling at Bissau is substantially lower than at Catio or Bafata.

The second section of Table 11 presents the transportation costs used and the quantities of polished rice demanded in each region of the country. The total quantity of polished rice demanded is 33,869 tons. The terms "Supply Point" and "Demand Point" refer, respectively, to the locations where rice is produced and

TABLE 10

The Linear Programming Model

MINIMIZE

1808CMC + 2192CMBF + 1994CMBS + 2049BFMC + 1951BFMBF + 1863BFMBS + 023MCC

+ 157MCBF + 215MCBS + 157MBFC + 023MBFBF + 130MBFBS + 215MBSC + 130MBSBF
+ 029MBSBS + 1662IBS + 1763IBF + 1848IC + 1803IGA + 1670IBI + 1690ICA
+ 1694IOI + 1761IBO + 1677IQU + 170MBSGA + 037MBSBI + 057MBSCA + 061MBSOI

+ 128MBSBO + 044MBSQU + 162MCGA + 251MCBI + 255MCCA + 183MCOI + 133MCBO
+ 079MCQU + 047MBFGA + 156MBFBI + 152MBFCA + 077MBFOI + 134MBFBO + 137MBFQU

SUBJECT TO

Paddy Rice Supply from Catio Constraint
CMC + CMBF + CMBS < 3250

Paddy Rice Supply from Bafata Constraint
BFMC + BFMBF + BFMBS < 1300

Imports at Bissau Constraint
IBS + IBF + IC + IGA + IBI + ICA + IOI + IBO + IQU < 40000

Equality Constraint on shipments to and from Catio Mills
-CMC - BFMC + MCC + MCBF + MCBS + MCGA + MCBI + MCCA + MCOI + MCBO
+ MCQU = 0

Equality Constraint on shipments to and from Bafata Mill
-CMBF - BFMBF + MBFC + MBFBF + MBFBS + MBFGA + MBFBI + MBFCA + MBFOI + MBFBO
+ MBFQU = 0

Equality Constraint on shipments to and from Bissau Mill
-CMBS - BFMBS + MBSC + MBSBF + MBSBS + MBSGA + MBSBI + MBSCA + MBSOI + MBSBO

+ MBSQU = 0

Demand at Catio	MCC + MBFC + MBSC + IC > 737
Demand at Bafata	MCBF + MBFBF + MBSBF + IBF > 5930
Demand at Bissau	MCBS + MBFBS + MBSBS + IBS > 14846
Demand at Gabu	MCGA + MBFGA + MBSGA + IGA > 6799
Demand at Biombo	MCBI + MBFBI + MBSBI + IBI > 1338
Demand at Cacheu	MCCA + MBFCA + MBSCA + ICA > 1112
Demand at Oio	MCOI + MBFOI + MBSOI + IOI > 2348
Demand at Bolama	MCBO + MBFBO + MBSBO + IBO > 323
Demand at Quinara	MCQU + MBFQU + MBSQU + IQU > 436

TABLE 11

Values Used in the Linear Programming Model

Cost of Rice Through Selected Market Channels (Thousand Pesos per Ton)

	CMC	CMBF	CMBS	BFMC	BFMBF	BFMBS	IBS	
Farm Price	650	650	650	650	650	650	CIF Price US$	260
Assembly Margin	350	350	350	350	350	350	Port Cost US$	4.8
Transport		157	215	157		130	Customs US$	26.78
Milling Charge	175	318	131	175	318	131	Delivery US$	5.33
Less Bran Value	0	50	50	0	50	50	Total US$	297
Cost of Rice	1808	2192	1994	2049	1951	1863	Total Pesos	1633

CMC = Catio rice Milled at Catio
CMBF = Catio rice Milled at Bafata
CMBS = Catio rice Milled at Bissau

BFMC = Bafata rice milled at Catio
BFMBF = Bafata rice Milled at Bafata
BFMBS = Bafata rice Milled at Bissau
IBS = Imports at Bissau

Transportation Costs

Supply Point	Demand Point	Town	Km	Transport Cost	Load Unload Cost	Total Transportation Cost	Tons of Polished Rice Demanded
Bissau	Bissau	Bissau	In-town	18	11	29	14846
Bissau	Gabu	Gabu	200	161	9	170	6799
Bissau	Biombo	Quinhamel	35	28	9	37	1338
Bissau	Cacheu	Pelundo	60	48	9	57	1112
Bissau	Oio	Mansoa	65	52	9	61	2348
Bissau	Bolama	Bolama	Boat	110	18	128	323
Bissau	Quinara	Fulacunda	44	35	9	44	436
Bissau	Bafata	Bafata	150	121	9	130	
Bissau	Tombali	Catio	Boat	144	71	215	
Catio	Catio	Catio	In-town	16.5	6.6	23	737
Catio	Gabu	Gabu	192	155	7	161	
Catio	Biombo	Quinhamel	Boat	244	7	251	
Catio	Cacheu	Pelundo	308	248	7	255	
Catio	Oio	Mansoa	219	176	7	183	
Catio	Bolama	Bolama	Boat	120	13	133	
Catio	Quinara	Fulacunda	89	72	7	78	
Bafata	Bafata	Bafata	In-town	16.5	6.6	23	5930
Bafata	Gabu	Gabu	50	40	7	47	
Bafata	Biombo	Quinhamel	185	149	7	156	
Bafata	Cacheu	Pelundo	180	145	7	151	
Bafata	Oio	Mansoa	87	70	7	77	
Bafata	Bolama	Bolama	150	121	13	134	
Bafata	Quinara	Fulacunda	161	130	7	136	
		Total Tonnage of Polished Rice Demanded					33869

Constraints on Production and Imports

	Values Used in Various Runs of Model: First Group	Second Group
Available (Marketed) Paddy Rice at Catio	5000	53846
Available (Marketed) Paddy Rice at Bafata	2000	53846
Imports at Bissau	40000	40000

where it is sold to consumers. The transportation costs reported in the table refer to the round-trip distance between towns multiplied by the Pesos/ton/km value developed in Table 3. The value resulting from this multiplication is then increased by 17 percent as a charge for the trucking enterprise overhead. The cost of either loading or unloading a truck is assumed to be a standard 3.3 Pesos per kilogram in all towns except Bissau, where labor wages are assumed to be higher than elsewhere. The charge in Bissau, 5.5 Pesos per kilogram, is based on survey results which indicate the cost of both loading and unloading a 15 ton truck is 30 US dollars or about 11,000 Pesos per ton. As an example of the transportation cost calculation, the transportation cost between Bissau and Bafata includes the cost of loading in Bissau (5.5 Pesos/kg) plus the cost of the transportation service (round-trip to Bafata is (300 km x .344) x 1.17) plus the cost of unloading in Bafata (3.3 Pesos/kg). In-town delivery, that is, delivery from a mill to a warehouse within the same town, is the sum of a truck rental charge and labor costs for loading and unloading.

The third section of Table 11 presents the constraints imposed on the system. The constraints used in the first run of the model are that only 5,000 tons of paddy rice are annually available at Catio and only 2,000 tons are annually available at Bafata. In the model, the annual tonnage figures are expressed in terms of polished rice. Thus, the actual figures become 3,250 tons for Catio and 1,300 tons for Bafata. These constraints on available paddy rice are relaxed in some runs of the model to 35,000 tons of polished-rice equivalent paddy. The constraint on imported rice is set at 40,000 tons. However, the constraint is not effective since the total quantity of rice demanded is 33,896 tons. There are 9 other constraints that relate to the demand for rice in each region of the nation. These constraints are not listed in the lower portion of Table 10 and are also listed in the second section of Table 11 as the quantities demanded in the 9 regions of the nation. These constraints imply that at least the amount of rice indicated must be supplied by the system for the solution to be feasible.

When operated or "run," the model tries various distribution patterns (combinations of quantities milled at various locations or imported and then transported to the locations needing rice). A plausible solution is found when all demands are satisfied without exceeding any of the constraints built into the model. Using the processing and marketing costs inserted into the model, the computer program then calculates the total cost of satisfying the demand with a given distribution pattern. The computer program then attempts to change the distribution pattern in a way that will result in a reduction in the total cost of achieving the desired distribution of polished rice. The program continues searching until it can find no other distribution pattern that reduces total cost. The distribution pattern with the lowest total cost is considered the optimal solution or least-cost manner of satisfying the expressed demand for polished rice.

Use of Model Results. The least-cost distribution pattern identifies what quantities of paddy should be milled at which location and transported to which demand point in order to satisfy demand at the lowest total cost. Use of the model for public or private policy making purposes assumes that the freely operating marketing system will tend to duplicate the pattern discovered by the linear programming model. This is based on the assumption that the lowest cost

pattern of rice marketing will dominate higher cost patterns through the action of competition. A marketing agent supplying rice in the lowest-cost pattern can supply rice at a lower cost than marketers who are not using the lowest-cost pattern. With other things being equal, lower costs imply higher profits. Thus, the lower cost marketers will tend to remain in business while their higher cost competitors do not.

Knowledge of the least-cost pattern can help businesses modify their operations to conform with the least-cost pattern. These modifications would include changes in prices if the least-cost pattern revealed that such a change might shift the flow of product in a desired direction. For example, the management of a rice mill might find that reducing the price it charges for milling services by a small fraction would cause more paddy rice to be directed to their mill. Alternatively, the model can indicate to the mill management that increasing or lowering its milling costs within a range of values will not cause a change in the expected marketing pattern.

A more specific example involves the rice mills at Bafata and Bissau. The rice mill at Bafata can expect that a great deal of effort will be expended by independent producers to avoid using the mill unless the price it charges for milling services (or a similarly related price it will pay for paddy rice) lies below a critical level. Alternatively, the rice mill at Bissau can expect to win customers from the Bafata mill even if its raises it milling charge, as long as the milling charge at Bissau remains below a certain level.

Government officials can use knowledge of the least cost distribution pattern to alter policies in a way that would be expected to change the distribution pattern in a desired direction. Clearly, increasing the cost of importing rice through taxes or port fees will encourage increased use of domestic rice. More subtle, perhaps, is the impact of the cost of domestic transportation on the use of domestically produced rice. For example, reducing port fees for domestic shipping or the cost of unloading domestic vessels would tend to cause more paddy to be moved from Catio to Bissau for processing.

The total distribution cost associated with any pattern of distribution can also be used as a guide to decision making. This may be especially useful for governmental decision makers who tend to be more concerned with the total cost (and the distribution of those costs as revenue to various businesses) of supplying the rice demanded by consumers. A given change in the critical values under the control of government will be associated with an associated change in estimated total distribution cost. Thus, the cost or benefit of the change can be evaluated. If the benefits clearly outweigh the costs, government has stronger justification for making the change.

Section Summary

The important findings reported in this section include the following:

1. The partial privatization of the former rice marketing parastatal has predictably disrupted the assembly of rice from producers in the South.

2. Private sector efforts to replace this assembly system are hampered by lack of access to financial and physical resources.

3. Analysis of the assembly process indicates that the assembly margin could be reduced from approximately 35 percent to approximately 10 percent.

4. Government/bank policy appears to allocate credit based on conservative loan-to-collateral ratios. This means that most credit flows through two or three wholesale merchants. This system favors the concentration of economic power and does not foster the development of economic power among producers and assembly merchants.

5. Existing market regulations require that wholesalers purchase rice only through licensed assembly merchants. Assembly merchant licenses carry limitations which restrict the area within which a merchant can operate.

6. A pan-territorial floor price for rice at the farm level was announced but not enforced.

7. Port fees, leveed on the cif value of imported rice, have recently been increased such that they now amount to 10.3% of the cif value of imported rice.

8. The small .25 ton/hour rice mills distributed and subsidized by governmental organizations are operating at capacity levels which limit their ability to be self-sufficient. A portion of this problem relates to the operating strategy used by the mill's ownership and promoted by the government.

9. The new rice mill at Bafata will have difficulty becoming self-sufficient unless it can purchase substantially increased quantities of paddy rice than have been marketed in recent years. The mill will need to add storage capacity to allow it to operate throughout the year. Given the existence of milling alternatives, the mill at Bafata will have to lower the price it was planning to charge for milling rice if it wishes to attract a substantial group of customers for its milling services.

10. The old rice mill at Bissau is not self-sufficient because it is not charging a milling fee that covers its costs. It is also having difficulty because of its policy of providing it milling customers with polished rice at an assumed but untested milling yield.

11. The major findings from the linear programming analysis of the system as a whole include the following:

    1. Under current policies and assuming the farm-level minimum price was strictly enforced, the least-cost method of supplying the national demand for purchased rice would be to rely primarily on imported rice. The only domestic rice used would be a small amount produced and milled in the South to satisfy the demand for marketed rice in that area.

2. Improving the efficiency of the assembly process and/or allowing farm-level prices to be market-determined should result in a greater dependence on domestic rice. Pan-territorial pricing, namely, setting one price for an entire geographic region, discriminates against producers distant from major markets. When a single farm-level price is used in the model, production from Bafata is preferred over production from Catio. With improved assembly-level marketing efficiency and/or liberalized prices, the only constraint to increased national self-sufficiency in rice is the lack of domestic production.

3. Traditional milling (hand-pounding with mortar and pestle) may be a viable alternative to mechanized milling in locations distant from established mills and other employment opportunities.

4. Under current policies, the first impact of an decrease in importation fees or cif prices for imported rice is an increase in imports used in the northern portion of the nation. However, if farm-level prices and marketing margins were downwardly flexible, the increase in imports would not occur unless domestic supplies were unavailable.

SECTION IV

FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

Findings Relating to Milling Capacity

Together the 35 small mills located in the southern portion of the nation have the capability of processing about 10,000 tons of paddy per year. The other two operating mills in the nation (at Bafata and Bissau) could annually process more than 20,000 tons. Since sales of paddy into the rice marketing channel have not amounted to more than 10,000 tons in recent years, the existing, operational capacity exceeds industry needs. The small .25 ton/hour rice mills distributed and subsidized by governmental organizations are operating at capacity levels which constrain their ability to be self-sufficient. A portion of this problem relates to the operating strategy used by the mill's ownership and promoted by the government.

The new rice mill at Bafata will have difficulty becoming self-sufficient unless it can purchase substantially increased quantities of paddy rice than have been marketed in recent years. The mill will need to add storage capacity to allow it to operate throughout the year. Given the existence of milling alternatives, the mill at Bafata will have to lower the price it was planning to charge for milling rice if it wishes to attract a substantial group of customers for its milling services.

The old rice mill at Bissau is presently not self-sufficient due to the low price it charges for milling services and due to its practice of attempting to return to milling customers a certain quantity of milled rice regardless of the quality of the paddy rice milled.

Conclusions Relating to Milling Capacity

The milling capacity of the system is more than adequate for current and foreseeable future needs. The management strategy for the approximately 35 small mills in the southern portion of the nations must be changed to enable these mills to become self-sufficient. The rice mill at Bafata will not become self-sufficient unless it can purchase substantially larger quantities of paddy rice for processing than are presently available. Alternatively, the rice mill at Bafata could rely more heavily on the provision of milling services to independent rice marketers.

The old rice mill at Bissau could become self-sufficient by charging a price that covers its costs of operations and instituting a rice grading procedure to establish the yield to return to each customer.

Recommendations Relating to Milling Capacity

The government or donor community should not subsidize the installation of additional rice milling capacity. The government should recognize that the subsidy of any one type of mill results in unfair competition for other types of milling. The government and donor community should recognize that subsidized

mills in the South compete with traditional milling services provided primarily by women. The government should consider whether the subsidization of these mills is the most appropriate method of achieving its goals. If the goal is to provide appropriate technology employment opportunities to village women, perhaps, the most available solution is to stop subsidizing the small mills.

Findings and Conclusions Relating to Small-Scale Rice Mills

The admirable efforts of the government to assist producers capture additional revenue by milling their rice in small rice mills prior to sale has not produced anticipated benefits. The cause of this failure is primarily due to the management advice given to the producers' associations by governmental organizations. The small mills are under-utilized and poorly supplied with spare parts. Additionally, the producers' associations do not appear to have been well advised on how their products should be marketed to obtain accessible and higher levels of revenue. Additional findings and recommendations relating to small-scale rice mills can be found in the Appendix containing the feasibility study of a representative mill.

Recommendations Relating to Small-Scale Rice Mills

Governmental and private-sector organizations working with these groups should consider revising the management advice given to these groups. The revised advice should emphasize the necessity of operating the mills at full capacity. They should also consider the possibility of recapitalizing the mills as profit oriented marketing enterprises as outlined in the feasibility study discussed in Section III of this report. This would require a substantial amount of training: of the members of the producers' association, of the association's board of directors, and of the manager of the facility.

Findings and Conclusions Relating to Large-Scale Rice Mills

The existing large-scale rice mills at Bissau and Bafata are more than sufficient to mill the present and predictable production of rice in Guinea-Bissau. The new rice mill at Bafata will have difficulty becoming self-sufficient unless it can purchase substantially increased quantities of paddy rice than have been marketed in recent years. The mill will need to add storage capacity to allow it to operate throughout the year. Given the existence of milling alternatives, the mill at Bafata will have to lower the price it was planning to charge for milling rice if it wishes to attract a substantial group of customers for its milling services.

The old rice mill at Bissau is not self-sufficient because it is not charging a milling fee that covers its costs. It is also having difficulty because of its policy of providing it milling customers with polished rice at an assumed but untested milling yield. This mill could play an important role in reducing the nation's dependence on imported rice, if it can continue to mill paddy rice at less than 180 Pesos/kg. It is the possibility of continuing to operate at this relatively low level of milling charge that makes this mill important. Given this milling charge and adequate domestic production, each ton of rice milled in this mill reduces the need for imported rice. Further, it appears that, under

conditions of adequate domestic production, increases in tonnage milled at Bissau do not imply a related reduction of tonnage milled at Bafata.

Recommendations Relating to Large-Scale Rice Mills

The managements of both mills should consider very carefully the entire package of services they offer and the prices they charge. The linear programming analysis discussed in Section III points out that relatively small changes in prices or costs can divert rice from one mill to the other. Prices have to be competitive and service has to be reliable or independent producers will find other markets for their paddy rice. This is especially true in the case of the new manager-farmers who operate the mechanized farms near Bafata. If existing mills refuse to mill their paddy at competitive prices, these manager-farmers are quite capable of putting in additional rice mills.

The management of the mill at Bafata should find beneficial a detailed study of the feasibility study conducted on the mill and discussed in Section III of this report. The managements of both mills should gain some insight as to how to price their services by studying both the Bafata rice mill feasibility study, provided as an appendix to this report, and the results of the linear programming analysis presented in this report. Both mills should institute the practice of buying or accepting rice for milling based on a test of the quality of the paddy.

Given the potential importance of the mill at Bissau, its operation should be thoroughly studied to develop recommendations relating to the feasibility of maintaining and enhancing its performance.

Findings and Conclusions Relating to Transportation

Transportation within the rice marketing system appears to be quite adequate; however, there appears to be under-utilization of public- and private-sector water transportation resources. Water transport is less expensive than truck transport. Fees paid for unloading boats at Bissau may be excessive. Road transport is hampered by 60 km of unimproved road connecting Buba and Catio.

Recommendations Relating to Transportation

The government should institute policies that encourage efficiency in the handling of domestic freight at all domestic ports in the nation. The government should consider making the road between Buba and Catio an all weather road.

Findings Relating to the Assembly Stage of the Marketing System

1. The partial privatization of the former rice marketing parastatal has predictably disrupted the assembly of rice from producers in the South.

2. Private sector efforts to replace this assembly system are hampered by lack of access to financial and physical resources.

3. Government/bank policy appears to allocate credit based on conservative loan-to-collateral ratios. This means that most credit flows through two or three wholesale merchants. This system does probably favors the concentration of economic power and probably does not foster the development of economic power among producers and assembly merchants.

4. Existing market regulations require that wholesalers purchase rice only through licensed assembly merchants. Assembly merchant licenses carry limitations which restrict the area within which a merchant can operate.

5. A pan-territorial floor price for rice at the farm level was announced but not enforced.

6. The assembly stage marketing margin reported by assembly merchants averaged approximately 35 percent. The average quantity of paddy rice handled by assembly merchants was 60 tons.

Conclusions Relating to the Assembly Stage of the Marketing System

The void left by the privatization of the parastatal rice marketing organization is being filled by the private sector. However, extremely limited access to credit has tended to concentrate economic power and discourages individual efforts to reorganize the assembly system. Small merchants or producers who may wish to participate in the assembly process as independent agents often cannot obtain the required operating capital to develop feasible enterprises.

Major constraints to small-scale merchant's access to credit appear to be their lack of readily marketable property for use as collateral and their isolated business locations.

Marketing regulations which require that middlemen be included in the marketing channel do not encourage the efficiency of direct producer/miller marketing relations which carry potential benefits for both farmers and consumers. The practice of setting official minimum prices for paddy rice does not encourage production efficiency and may hamper marketers' efforts to market domestically produced rice in competition with imported rice.

Recommendations Relating to the Assembly Stage of the Marketing System

The problems relating to assembly merchants' access to credit and their lack of collateral could be largely solved if a bonded warehouse were established at Catio. Such a warehouse would also be the major component of a decentralized assembly system: a system in which economic power tends to be equally distributed.

A bonded warehouse acts as a bank in accepting deposits of grain for the personal accounts of independent businesses. When the grain is deposited in the bonded warehouse, the warehouse gives the depositor a receipt which acknowledges that the depositor has a certain quantity of grain on deposit at the warehouse. The

depositor can sell the warehouse receipt and thereby transfer ownership of the grain to someone else.

Alternatively, the warehouse receipt can be used as collateral for a loan. The loan can be used for any purpose, but, may be used to finance the purchase of additional grain which is also deposited into the warehouse in return for a warehouse receipt. The cycle of borrowing, buying grain, depositing it in the warehouse, and borrowing more money can be repeated a number of times that depends on the percentage of the value of the grain in storage that can be borrowed and the amount of equity capital the business can invest in the process. Regardless of the amount of equity capital a business owns, this process can allow the business to finance and control a greater amount of grain that it could without the process.

The central location and need for the depositors to travel to the warehouse to deposit their grain also reduces the cost a bank or other lending agency would have in making inventory loans to businesses at their locations. Lending agents could handle many loans from a single location near the warehouse.

An additional benefit of a centralized, bonded warehouse is that it becomes the center of an assembly system which depends on many independent assembly agents (some of whom may producers) rather than a few centrally-directed assembly organizations. The assembled grain will attract merchants and millers who will attempt to purchase the warehouse receipts. As a result, a market will be created in which the small quantities assembled by small-scale merchants or producers will have almost the same unit value as a large quantity of grain accumulated with the much larger financial resources of a major merchant.

It is recommended that the government encourage the creation of a bonded warehouse at Catio. The creation of such an institution may require the enactment of a bonded warehouse law which details the rights and responsibilities of the institution(s) and sets forth governmental rights and responsibilities required to insure the integrity of the institution(s) and the safety of the stored grain. A bank or other lending agency should be associated with the warehouse to make loans based on grain stored at the warehouse.

The government should discontinue the practice of setting minimum farm-level prices primarily because it places marketing firms in an uncertain legal standing and exposes them to the possibility of selective enforcement when the market price drops below the official price. A more preferred method of assuring that producers receive the highest price economically possible is to encourage competition among the buyers of farm products. Policies to encourage competition are discussed below.

Findings Relating to the Operation of the System as a Whole

Theses findings flow mainly from the linear programming analysis of the domestic rice marketing system.

When the rice marketing system is constrained with fixed prices at the farm level and inefficiency at the assembly stage, the least-cost method of supplying the nation's demand for marketed rice is to rely mainly on imported rice. In other

words, under these constraints, domestic rice cannot compete with imported rice except in isolated areas distant from the port at Bissau.

When these constraints are relaxed, that is, when assembly level efficiency is assumed to increase and when farm-level prices are market-determined, domestic rice can be marketed less expensively in many areas of the country than can imported rice. Under conditions of enhanced marketing efficiency, the factor that prevents domestic rice from replacing significant quantities of imported rice in the marketing system is the lack of sufficient quantities of domestic rice.

When a single farm-level price is set for the nation, there is a tendency for rice from distant areas not to be included in the least-cost marketing pattern if supplies are available from areas closer to major markets.

Anything that changes the ratio of the domestic cost of imported rice to the cost of domestically produced rice tends to change the quantity of rice imported. For example, a decrease in the cif price of imported rice or a decrease in importation fees tends to cause an increase in imports if the costs of domestic rice remain fixed. Alternatively, any change that causes a decrease in the cost of domestic rice tends to reduce the amount of rice imported if the cost of imported rice remains fixed.

Conclusions Relating to the Operation of the System as a Whole

Given adequate financial resources and a liberalized internal policy environment, the rice marketing system can compete with imported rice. Protection from imported rice, in the form of importation fees or tariffs are not needed for domestic rice to compete successfully with imported rice. However, it appears unlikely that domestic production can totally replace imports. Since marketing costs increase the cost of domestic rice, any measure that increases the efficiency of domestic rice marketing tends to increase the capability of domestic rice to compete with imported rice. The setting of a single farm-level price for the nation discriminates against rice grown in the South in favor of rice grown in the North.

Recommendations Relating to the Operation of the System as a Whole

If the national goal is to increase the nation's self-sufficiency in rice while maintaining a liberalized economy, the government should encourage competition within the rice marketing channel. Increased competition can be encouraged through policies (such as the policy relating to a bonded warehouse described above) that allow wider access to the resources, especially financial resources, required to operate rice marketing enterprises. Increased competition and marketing efficiency is also enhanced by policies that allow marketers the flexibility to develop alternative marketing methods. This implies that government should not impose marketing patterns such as the current regulation requiring millers to buy from assembly merchants. Increased competition should result in enhanced marketing efficiency and should tend to increase the share of the total cost of domestic rice flowing to producers in the form of higher farm-level prices. The higher farm-level prices should encourage producers to increase production thereby raising the nation's self-sufficiency in rice.

The government should not set farm-level prices for agricultural commodities. Instead, these prices should be "set" or discovered through the interaction of buyers and sellers in the market. This allows both buyers and sellers to reach pricing agreements that compensate for differences in important characteristics (such as location) of the commodities involved.

In setting customs fees that increase the cost of imported rice, the government may wish to use a linear programming model such as presented here to:

- determine at what level of an international price an increase in importation fees is required to protect domestic producers and

- estimate the benefits to producers and the government treasury and costs to consumers of various levels of customs fees.

To the extent that a substantial proportion of increases in rice production may be produced on mechanized farms, increased customs fees will transfer wealth from consumers to the manager-farmers involved in mechanized rice production. A variable port fee or tariff that became larger as the international price of rice fell and smaller as the international price rose could provide desired levels of income protection to domestic farmers and tax revenue to the government without unnecessarily taxing consumers when international prices were high or domestic supplies exhausted. In the interest of maintaining a market-oriented economy, the government should avoid instituting importation fees for the purpose of protecting domestic producers. A more market-oriented approach to assisting farmers is to enhance the efficiency and competitiveness of the domestic rice marketing system.

Governmental and private-sector organizations concerned with the development of the rice industry should also consider offering training in marketing to producers and merchants involved in the rice industry. Such training should cover basic marketing skills as simple price analysis (when and where are the best markets), assembly of economically shippable lots of grain, arranging transportation, arranging financing, and essential legal skills. The former grain marketing parastatal of Mali has recently presented such courses to marketers in Mali.

The existence of wide differences in prices at similar levels of the market, such as the study team observed between Catio and Bissau during the field phase of this study, are probably related to the credit constraint; however, it seems unlikely that such a differential would exist very long if more people knew about it. If it does not do so already, the government should encourage the news media to regularly report the prices (at various locations within the nation) of agricultural commodities of interest to the general public. Mali again has experience than could, perhaps, be applied in Guinea-Bissau.

Since domestically produced rice is most competitive with imported rice in areas away from port cities due to the transportation advantage. The government may be able to assist the industry exploit this advantage by the development of trading treaties, allowing preferential treatment of domestically produced grain, with neighboring nations.

Observations Relating to Rice Production in Guinea-Bissau

Comments by a leader in mechanized rice production indicate that mechanized rice production is quite profitable under current conditions. These conditions, coupled with the managerial capability of the people involved in mechanized rice production, suggest that mechanized rice production will increase substantially in the next five years. Note that these observations rely on the comments of a leader in mechanized production and not on an analysis of its economics.

The prospects for human-powered rice production do not appear very bright. Marketed rice from human-powered production systems appears to be centered around Catio. Given that rice was marketed from human-powered farms in other regions of the nation in the past, this may indicate reduced interest in this enterprise. Unless the productivity of labor in human-powered rice culture can be increased, it is predictable that more labor will be attracted away from this form of rice culture as higher paying employment opportunities increase in other sectors of the economy. A present, productivity in Balanta rice production is estimated at approximately 19 kg of paddy per day. Multiplying this figure by 600 Pesos per kilogram results in a gross daily wage of 11,000 Pesos. Currently, this wage is still competitive with other alternatives in many parts of Guinea-Bissau. Predictably, human-powered rice culture will have to change to survive.

Conclusions Relating to Rice Production in Guinea-Bissau

The differences in the total cost of marketing patterns using or not using imported rice (from the linear programming analysis) indicate that the nation could expect savings in the total cost of supplying its rice needs by significantly increasing domestic production. However, these results are based on imported rice at 260 US dollars per ton and a significant charge for port services and customs duties. Based on comments about the profitability of mechanized rice production, one could expect that rice from mechanized farms could remain competitive with imported rice even if the world price of rice declined somewhat. Even the more productive human-powered farmers could continue to make competitive wages if farm-level prices declined to 500 Pesos per kilogram. Thus, it appears, from the perspective of the analysis in this study, that the government of the RGB and the international donor community should encourage increased rice production in Guinea-Bissau. However, the role the government should play in encouraging domestic rice production should be the subject of additional analysis that documents the economics of mechanized rice production and considers alternative uses for the resources employed in rice production. A study, supported by USAID/Bissau, addressing these topics is currently being finalized.

SECTION V

BRIEFLY STATED RECOMMENDATIONS OF THE STUDY

Recommendations Relating to Milling Capacity

* The government or donor community should not subsidize the installation of additional rice milling capacity.

Recommendations Relating to Small-Scale Rice Mills

* Governmental and private-sector organizations working with these groups should consider revising the management advice given to these groups. The revised advice should emphasize the necessity of operating the mills at full capacity.

* They should also consider the possibility of recapitalizing the mills as profit oriented marketing enterprises as outlined in the feasibility study discussed in Section III of this report.

Recommendations Relating to Large-Scale Rice Mills

* The managements of mills at Bafata and Bissau should consider very carefully the entire package of services they offer and the prices they charge.

* Both mills should institute the practice of buying or accepting rice for milling based on a test of the quality of the paddy.

* Given the potential importance of the mill at Bissau, its operation should be thoroughly studied to develop recommendations relating to the feasibility of maintaining and enhancing its performance.

Recommendations Relating to Transportation

* The government should institute policies that encourage efficiency in the handling of domestic freight at all domestic ports in the nation.

* The government should consider making the road between Buba and Catio an all weather road.

Recommendations Relating to the Assembly Stage of the Marketing System

* The government encourage the creation of a bonded warehouse at Catio.

* The creation of such an institution may require the enactment of a bonded warehouse law which details the rights and responsibilities of the institution(s) and sets forth governmental rights and responsibilities required to insure the integrity of the institution(s) and the safety of the stored grain.

* A bank or other lending agency should be associated with the warehouse to make loans based on grain stored at the warehouse.

Recommendations Relating to the Operation of the System as a Whole

* The government should encourage competition within the rice marketing channel through policies (such as the policy relating to a bonded warehouse described above) that allow wider access to the resources, especially financial resources, required to operate rice marketing enterprises.

* The government should not impose marketing patterns such as the current regulation requiring millers to buy from assembly merchants.

* The government should not set farm-level prices for agricultural commodities. Instead, these prices should be "set" or discovered through the interaction of buyers and sellers in the market.

* In setting customs fees that increase the cost of imported rice, the government may wish to use a linear programming model such as presented here to:

  - determine at what level of an international price an increase in importation fees is required to protect domestic producers and

  - estimate the benefits to producers and the government treasury and costs to consumers of various levels of customs fees.

* The government should consider a variable port fee or tariff that becomes larger as the international price of rice falls and smaller as the international price rises to provide desired levels of income protection to domestic farmers and tax revenue to the government without unnecessarily taxing consumers when international prices were high or domestic supplies exhausted.

* In the interest of maintaining a market-oriented economy, the government should avoid instituting importation fees for the purpose of protecting domestic producers. A more market-oriented approach to assisting farmers is to enhance the efficiency and competitiveness of the domestic rice marketing system.

* Governmental and private-sector organizations concerned with the development of the rice industry should also consider offering training in marketing to producers and merchants involved in the rice industry. Such training should cover basic marketing skills as simple price analysis (when and where are the best markets), assembly of economically shippable lots of grain, arranging transportation, arranging financing, and essential legal skills. The former grain marketing parastatal of Mali has recently presented such courses to marketers in Mali.

* The government should encourage the news media to regularly report the prices (at various locations within the nation) of agricultural commodities of interest to the general public. Mali again has experience than could, perhaps, be applied in Guinea-Bissau.

* Since domestically produced rice is most competitive with imported rice in areas away from port cities due to the transportation advantage, the government may be able to assist the industry exploit this advantage by the development of trading treaties with neighboring nations.

Recommendations Relating to Rice Production in Guinea-Bissau

* The role the government should play in encouraging domestic rice production should be the subject of additional analysis that documents the economics of mechanized rice production and considers alternative uses for the resources employed in rice production.

SECTION VI

REFERENCES

I.R.A.M. Plan Cerealier de la Guineé Bissau, Phase I: Diagnostic -Bilan. I.R.A.M., Paris, June 1991.

Lea, J. D. (Zach), C. Hugo, and C. R. Ribeiro. Rice Production and Marketing in Guinea-Bissau: A Contribution for Policy Dialogue. Report submitted to the United States Agency for International Development, Guinea-Bissau, January, 1990.

Pearson, S. R., J. D. Stryker, and C. P. Humphreys. Rice in West Africa: Policy and Economics. Stanford University Press, Stanford, California, 1981.

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APPENDIX 1

FEASIBILITY ANALYSIS OF A .25 TON/HOUR RICE MILL IN SOUTHERN GUINEA-BISSAU

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EXECUTIVE SUMMARY

Under current conditions, it appears that a small rice mill installed in southern Guinea-Bissau could be quite profitable. We calculate the earning power of the total investment in a prototypic .25 ton per hour rice mill to be approximately 37 percent per year. This relatively high result provides a measure of confidence that our general evaluation is correct even if some values have been inaccurately represented. The total investment (both fixed investment and working capital) envisioned here is approximately 70,000 US Dollars. The investment returns approximately 20,000 US Dollars per year.

The major assumption upon which our result relies is that the mill is managed as a milling and marketing enterprise which buys, mills, and markets rice for its own account rather than as a subsidized service organization providing milling services on demand. This requires that the mill be operated at close to its capacity throughout its assumed 10-month operating year. Achieving this level of operation requires that the mill own or rent a warehouse and purchase and store sufficient paddy rice to allow for continuous operation. We have assumed the mill will own the warehouse. Finally, profitable operation demands efficient purchasing of raw material, spare parts, operating supplies and efficient marketing of the finished products, rice and bran. Thus, competent management is an important determinant of the success of these small mills.

Factors which tend to support our evaluation of the mill include the reasonable prices we have used for both raw material and finished products. We have also attempted to be conservative in estimating the cost of spare parts for the mill. Spare parts are a major expense associated with these small mills. Additionally, we have assumed that all employees of the mill will be adequately paid.

One uncertainty we could not address is the investment and operating cost for a rice paddy cleaning machine. Since the cost of this machine was not available at report time, we have estimated its investment cost as being equal to that of the rice polishing machine. We have not included an estimate of the operating cost of the rice paddy cleaning machine. Adding this expense would tend to lower the earning power of the mill; however, tests made to evaluate increasing fuel costs by 50% do not materially change our evaluation of the feasibility of the mill.

Our findings must be evaluated in light of the many assumptions we used in our calculations. Thus, a major portion of this report is devoted to revealing and discussing these assumptions. We also report the results of tests made to determine the sensitivity of changes in our assumptions on the feasibility of the mill.

We request that readers communicate to us any concerns they may have relating to the appropriateness of the assumptions. By incorporating corrections identified by readers, we can approach an evaluation of this type of rice mill that most accurately reflects reality.

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INTRODUCTION

This is a feasibility analysis of small rice milling enterprises based on machines that decorticate (dehull) and polish rice at a rate of .25 tons of paddy (non-decorticated rice) per hour. Presently, there are approximately 40 of these machines in Southern Guinea-Bissau. Most of these existing milling operations are not economically viable because they operate as service providers, providing milling services to local villagers. This often results in the mills being idle for extended periods of time, since the mills must wait for customers.

This feasibility analysis assumes a different mode of operation. It assumes that the mill does not wait for customers to bring paddy for processing, but, instead, purchases the paddy it processes. This provides the mill with enough control over its operations to operate as long and as continuously as desired. This mode of operation appears to be profitable as shown by our calculated measure of earning power. It is more profitable and thus economically sustainable than the currently used mode of operation. However, it does require more investment and a higher level of management than usually employed in existing mills of this size. Acknowledging and planning for this fact should aid users of this analysis in decision making.

Because no financial structure has been assumed for the prototype enterprise analyzed here, the results reflect the earning power of the enterprise before consideration of its financial structure or taxes on earnings. Financial structure describes how the investment and any profit is shared among different classes of investors. Significantly, neither depreciation nor interest paid are considered in this analysis, since they are dependant on the financial structure of the enterprise and the application of tax regulations. To include depreciation would require detailed knowledge of the manner in which applicable taxation rules and regulations are applied to this enterprise. To include interest paid would require detailed knowledge of the financial structure of the enterprise, i.e., the proportions of total capital borrowed from banks, invested by bond holders, or invested by junior classes of stockholders. At this initial stage of feasibility analysis, these details are not needed to achieve our objective in conducting the feasibility analysis, namely, to determine if the enterprise appears feasible under any financial structure.

The Calculated IRR for the Prototype Village Mill

The measure of feasibility developed under these limitations is called the internal rate of return (IRR). An enterprise is considered feasible if its IRR is greater than the investors' cost of capital. For example, if an investor could obtain financial capital at an interest rate of 10% per annum, the investor would consider feasible investments which have IRRs greater than 10%. The other investment opportunities available to the investor also influence the investor's decision. A rational investor would consider the IRRs of all investment opportunities and chose to analyze more closely those with the highest IRRs.

Given a favorable IRR, an investor group will normally proceed to a second stage of feasibility analysis which attempts to develop a financial structure that optimizes the return to the principal owners of the enterprise while assuring outside investors of the safety of their investments and expected earnings. This

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type of feasibility analysis develops a measure called the financial rate of return (FRR). A financial rate of return analysis is beyond the scope of this report; however, such an analysis would be a simple extension of the work already accomplished in the present analysis.

In the present circumstance, the IRR determined for a prototype rice mill located in a rice growing area of Southern Guinea-Bissau should provide public and private citizens concerned with the development of the rice industry in Guinea-Bissau with information that will be helpful in understanding the situation and in making decisions to respond to the situation.

The calculated internal rate of return for the prototype rice mill is approximately 37 percent. This is a real rate of return with the effects of inflation removed. To obtain an idea of the nominal rate of return, one should add the rate of inflation to this calculated rate. If the rate of inflation were 36 percent per annum, the inflation-adjusted IRR for the mill would be on the order of 70 percent. The IRR and alternative measures of the earning power of the mill, such as its net present value, are discussed in below in the subsection entitled "A Discussion of Tables 16 thru 19".

The effects of inflation are handled by assuming that the relation between all prices used in the analysis will remain the same over time. The effect of inflation, under this assumption, would be to increase all values at the same rate. An appropriate rate of inflation could then be used to adjust the values used in future years. This would provide a measure of the earning power of the enterprise that included inflation. However, it raises the problem of choosing an appropriate inflation rate. We avoid the problem by using the same values for all years; in effect, treating the values as having been deflated to the current year. As a result, we obtain a measure of earning power with inflation effects removed.

Assumptions Used in the Analysis

It is important to remember that the calculated IRR is totally dependant on the assumptions that underlie the analysis. If the assumptions are infeasible, implausible, or incorrect; the calculated IRR is misleading. To gain a better understanding of the influence of each major assumption on the calculated IRR, we change the value of the assumption and recalculate the IRR.

Perhaps, the most important assumption relates to the availability of capable management to direct the operations of the mill. Unfortunately, this assumption is not amenable to quantitative analysis. We must simply assume adequate management exists. Less than adequate management will result lower levels of profitability. However, given the high estimated level of earning power for these prototype operations, it seem possible that adequate management could be obtained. Further, it seems possible that such enterprises could be feasible (although not as profitable) with less than ideal management.

The other major assumptions used in the analysis are presented in outline form in Table 12 and constitute a brief description of the enterprise. Included are assumptions relating to the raw material and finished product markets, operating schedule, yield of products, transition to full-capacity operation, seasonal

patterns in raw material purchases, and prices for raw material and finished product prices. The transition pattern, presented in Item 14 of Table 12, assumes that the mill will achieve full capacity production in its first operating season.

It is envisioned that the machinery will be ordered and installed during the six months (in the Fall of the year) prior to the first operating season. Further, it is envisioned that the warehouse will be built during the first five months of the first operating season. This means the warehouse will be complete before the rainy season begins. The seasonal pattern in paddy rice purchases, Item 15, describes the assumed flow of paddy into storage at the mill during a typical year. The monthly revenue and cost of raw material data, Item 15, also relate to full-capacity operating years.

The more critical of these assumptions and tests to determine the impacts on the IRR of changes in the assumptions are discussed individually in the text following Table 12. A summary of the sensitivity test results are presented in Table 13.

TABLE 12

A Description of the Rice Milling Enterprise: Small Mill

1.	Proposed Project:	.25 ton/hour Village Rice Mill
2.	Location:	Village in Southern Guinea-Bissau
3.	Production Market:	Sold to Retailers at Mill or in Bissau
4.	Input Supply:	Farmers near Mill
5.	Specific Goals:	Mill rice for own account
6.	Processing Capacity:	300 tons per year (.25 tons/hour, 6 hours/day, 20 days/month, 10 months/year)
7.	Processing Yield:	65% Mill-Run Rice, 10% Mill-Run Rice Bran/Flour
8.	Storage Capacity:	
	Raw Material:	175 tons of Paddy Rice
	Finished Products:	
	Rice:	20 tons of Finished Rice
	Bran:	3 tons Bran
9.	Annual Throughput:	300 tons
10.	Product Output:	
	Rice:	195 tons of Mill-Run (Unsorted) Rice
	Bran:	30 tons of Mill-Run Bran/Flour Mix
11.	Economic Horizon:	12 years based on 2 accounting period per year
12.	Type of Evaluation:	Evaluated as new enterprise
13.	Monetary Unit:	Million Pesos
14.	Monetary Exchange Rate:	5500 Pesos per US Dollar, 40 Pesos per Portuguese Escudo
15.	Quantity Unit:	Tons
16.	Quantity Unit Multiple:	1

17. Transition Pattern:

Time to complete construction:	5 months
Years to reach planned scale of operation:	1 year

Mill will begin operating in second month of first year as construction is completed on warehouse.

18. Seasonal pattern in annual throughput of paddy rice purchases and rice sales:

Months	Purchases	Sales
1 Jan	0%	0%
2 Feb	15%	10%
3 Mar	35%	10%
4 Apr	35%	10%
5 May	10%	10%
6 June	5%	10%
7 July	0%	10%
8 Aug	0%	10%
9 Sept	0%	10%
10 Oct	0%	10%
11 Nov	0%	10%
12 Dec	0%	0%
Total	100%	100%

TABLE 12

A Description of the Rice Milling Enterprise: Small Mill (cont.)

19. Monthly operating pattern for Periods 2 & 3: Monetary Units = Million Pesos

	Raw Material				Products Marketed			Byproducts Marketed		
Month	Volume	Price	Value	Volume Milled	Volume	Price	Value	Volume	Price	Value
1st Jan	0.00	0.650	0.00	0	0	1.650	0.000	0	0.500	0.000
2nd Feb	45.00	0.650	29.25	30	19.5	1.700	33.150	3	0.500	1.500
3rd Mar	105.00	0.700	73.50	30	19.5	1.400	27.300	3	0.500	1.500
4th Apr	105.00	0.750	78.75	30	19.5	1.650	32.175	3	0.500	1.500
5th May	30.00	0.800	24.00	30	19.5	1.600	31.200	3	0.500	1.500
6th Jun	15.00	0.850	12.75	30	19.5	1.650	32.175	3	0.500	1.500
7th Jul	0.00	0.900	0.00	30	19.5	2.250	43.875	3	0.500	1.500
8th Aug	0.00	0.900	0.00	30	19.5	2.450	47.775	3	0.500	1.500
9th Sep	0.00	0.900	0.00	30	19.5	2.500	48.750	3	0.500	1.500
10th Oct	0.00	0.900	0.00	30	19.5	2.350	45.825	3	0.500	1.500
11th Nov	0.00	0.900	0.00	30	19.5	1.950	38.025	3	0.500	1.500
12th Dec	0.00	0.900	0.00	0	0	2.000	0.000	0	0.500	0.000
TOTAL	300		218.25	300	195.0		380	30		15.00
AVERAGE	25	0.728	18.19	25.00	16.25	1.93	31.69	2.50	0.50	1.25

	Sales Rice	Sales Bran	Sales Total	Raw Material Value	Gross Income	Total Expenses	Net Income
1st Jan	0	0	0.00	0.00	0	1.32	-1.32
2nd Feb	33.15	1.5	34.65	21.83	12.825	4.37	8.45
3rd Mar	27.30	1.5	28.80	21.83	6.975	4.37	2.60
4th Apr	32.18	1.5	33.68	21.83	11.85	4.37	7.48
5th May	31.20	1.5	32.70	21.83	10.875	4.37	6.50
6th Jun	32.18	1.5	33.68	109.13	11.85	4.37	7.48
Six-Month Total	156.00	7.50	163.50	21.83	54.37	23.18	31.20
7th Jul	43.88	1.5	45.38	21.83	23.55	4.37	19.18
8th Aug	47.78	1.5	49.28	21.83	27.45	4.37	23.08
9th Sep	48.75	1.5	50.25	21.83	28.425	4.37	24.05
10th Oct	45.83	1.5	47.33	21.83	25.5	4.37	21.13
11th Nov	38.03	1.5	39.53	21.83	17.7	4.37	13.33
12th Dec	0.00	0	0.00	0.00	0	1.32	-1.32
Six-Month Total	224.25	7.50	231.75	109.13	122.63	23.18	99.45
Total for Year	380.25	15.00	395.25	218.25	177.00	46.35	130.65

The Assumptions Relating to Paddy Rice Supply to the Mill

The analysis assumes that the rice mill will process 300 tons of paddy per year. This level of throughput is considered to be full capacity, requiring that the mill operate 6 hours per day, 20 days per month, 10 months per year. It is assumed that the mill can reach full capacity during the initial operating season. It is also assumed that the mill can purchase its grain directly from farmers who can arrange to transport the rice to the mill. During the peak purchasing months, the mill will have to purchase approximately 100 tons of paddy per month (3-5 tons per day). If the rice is brought in 30 kg baskets as is typical in the area, the mill must be ready to receive 167 sellers per day or one every 3.75 minutes. Clearly, the mill should be located in a rice-growing area that produces enough rice to easily supply the mill with the rice it requires.

The Assumptions Relating to the Prices Paid and Received

Prices have an obvious impact on the profitability of an enterprise. However, they are difficult to predict; especially, in an economy without a long experience with open market policies. Thus, it is important to scrutinize the prices used in a feasibility analysis to gage their plausibility. Further, it is helpful to understand how sensitive the IRR is to changes in the prices used in the analysis. The results of these sensitivity analyses can be useful not only in managing the rice mill but also in attempts to favorably influence government policies affecting the rice industry. The prices used for paddy and for finished rice and rice bran are presented in Table 12.

Paddy Prices. We feel the paddy prices we have used (displayed in Table 12) are conservative in that they are higher than observed prices. The price we used for January 1992 is 650 Pesos/kg; however, we observed paddy being purchased in the South in January 1992 at 500 Pesos/kg, delivered to the buyer. This could be interpreted to mean that our prices are higher than would have to be paid and, therefore, would imply that the mill could be more profitable than we have calculated.

However, there is some uncertainty concerning the legality of a rice mill buying paddy directly from producers. It is possible that the Government of Guinea-Bissau will require that all rice millers buy paddy through assembly merchants. If this occurs, the prices used here will not be accurate and must be increased by the assembly merchant's margin of approximately 20 percent. The impact of adding 20 percent to the purchase price of the raw material was tested by changing the price and recalculating the IRR. The recalculated IRR was approximately 22 percent--a reduction in earning power of 15 percent. Note that all other factors, costs, and prices were assumed to remain the same during this test.

We assume also that the paddy prices used have been adjusted to allow for a reasonable amount of foreign matter--dirt, straw, etc.--in the purchased paddy. Maintaining control over the cost of paddy will require that some method be used to test incoming grain to ascertain its foreign matter content. Reductions in price or refusal to buy grain containing excessive foreign matter have proven to be effective means of discouraging the adulteration of purchased grain.

TABLE 13

Recalculated IRRs Associated with Changes in Expenses or Investments

Item Changed	Percent Change from Base Case*	Resulting IRR
Prices of Polished Rice	13 % decrease	19.8%
Prices of Paddy Rice	20 % increase	21.6%
Cost of Warehouse	200% increase	29.6%
Plant Spare Parts	50 % increase	35.0%
Fuel Expense	200% increase	35.1%
Fixed Admin. Wages & Salaries	50 % decrease	13.7%

* Base Case IRR: 36.9%

Polished Rice Prices. The prices used to represent the prices the mill will receive for polished rice also reflect current prices and our understanding of seasonal changes in these prices. We should mention that no pattern in seasonal prices has been established since the RGB deregulated prices in 1989. See Figure 7 for a visual confirmation of this statement.

The polished rice prices used in the analysis were estimated as follows. Reported monthly prices for the five years encompassing 1987 and 1991 were deflated to real prices. This was done to remove the effect of intra-year inflation. Then a series of monthly price indices was developed for the 12 monthly prices in each year. These indices measure the difference between a given monthly price and the average of the 12 monthly prices for the same year. The average of the five series relating to the five years encompassing 1987 and 1991 was selected to estimate the monthly prices used in the analysis.

Unfortunately, not a great deal of confidence can be placed in this approach, since it is not based on strong quantitative analysis. However, the existing data do not allow the type of quantitative analysis one would hope for. As can be seen in Figure 7, there is a great deal of difference in the seasonal patterns of price. Because we cannot rely on a long history of prices from periods relatively similar to the recent past, we cannot determine which (if any of these patterns) is most representative of what can be expected to happen in the future. This made it difficult to select a seasonal pattern to use in predicting future seasonal prices. In the end, the average of the five seasonal indices was used to estimate the monthly prices used in the analysis. This strengthens the advisability of testing the sensitivity of the IRR to changes in prices.

Once the monthly indices were selected, a price for January 1992 was developed. An observed retail price, 2200 Pesos/kg, was selected as a base. From this base, a 15 percent retailer's margin and 225 pesos transportation cost were subtracted to arrive at the delivered price for January used in the analysis. The other 11 monthly indices were then used to develop the monthly prices used in the analysis and presented in Table 12. Note that this assumes that the mill will capture any wholesaler's margin, since the mill will sell directly to retailers.

The prices for polished rice used in this study are considered to include the cost of loading the rice onto trucks at the mill. Thus, it is assumed that the mill manager can arrange for a merchant in Bissau to take delivery of the rice at the mill. This will require some marketing efforts on the part of the mill manager. For example, the manager may find that regular trips to Bissau are helpful in finding buyers. The marketing process may also require regular telephone calls to Bissau. Estimated costs for these and other marketing activities have been included in this analysis. (See Table 25.)

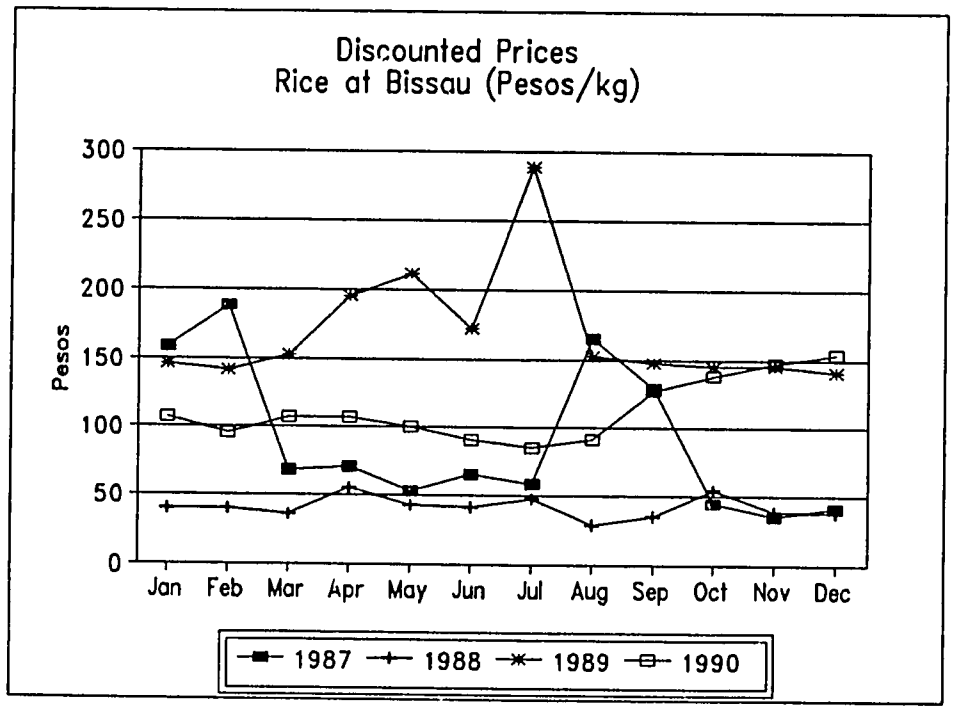

FIGURE 8. Discounted Prices

In studying the schedule of prices used to calculate the IRR for the base case we report here, one is prompted to wonder what would be the effect on the IRR if the polished rice prices did not fluctuate as indicated. The fluctuations are based on only 5 years in a rapidly changing economic environment. What if market forces caused these seasonal fluctuations to be reduced. In an extreme case, there would be no fluctuations. To test what would happen to the IRR in this case, we selected one price, 1700 Pesos/kg, as the price the mill could expect to receive in every month of the year and recalculated the IRR based on this price. Reducing the fluctuations, reduces sales revenue to the mill by 13 percent. As a result the IRR drops to approximately 20 percent. This is a significant drop; yet, the enterprise retains a favorable IRR.

Assumptions Relating to Grain Storage Facilities and Total Investment Values

Grain Storage Facilities. Most existing mills of this size have no storage facilities. Because storage facilities are necessary to insure that the mill can operate at full capacity, this feasibility study included the estimated cost of

constructing the needed facilities. The components of the total fixed investment in the rice mill are presented in Table 14. Working capital requirements are presented in Table 27. The grain storage facility envisioned here is a common warehouse designed to hold sacked grain. The warehouse is designed to hold 175 tons of sacked paddy, 20 tons of sacked polished rice and 3 tons of sacked bran.

It is quite possible that the mill could install bulk storage facilities to store the grain rather than use the warehouse envisioned here. Bulk storage in silos has several advantages over the warehouse. With bulk storage the grain receiving process can be speeded-up, labor and labor management costs are reduced, and the investment costs are comparable. No sacks are required. The grain can be treated for insect infestation more efficiently. The negative aspect of bulk storage is that it requires machinery and the management capability to operate and maintain the machinery.

Although the mill is to process 300 tons of paddy per year, the capacity requirements for an adequate storage facility are substantially below 300 tons. This is due to the assumed rate at which rice flows into and out of the mill as shown in Item 18 of Table 12. Table 18 is a copy of the electronic spreadsheet used to determine the required storage capacity.

Clearly, the cost of the warehouse represents a major component of the total fixed investment in the milling enterprise. This raises concerns that the assumed cost of the warehouse is accurate. We used a relatively low price of 175 US Dollars per square meter as the cost of construction. This price was given to us by a local contractor, who envisioned a concrete block structure with a wooden roof structure, metal roofing, and an height at the roof edge of 3 meters. More elaborate structures would probably cost much more. The effect on the calculated IRR of a doubling of the cost of the warehouse was tested. With the cost of the warehouse doubled and all other factors remaining as in the base case, the IRR was recalculated as approximately 30 percent. Thus, if the cost of the warehouse is the only major change required to implement this enterprise, it is likely that the enterprise will be profitable.

TABLE 14

Summary of Capital Outlay for Facilities

1.	Proposed Project:	Village Rice Mill			
2.	Location:	Village in Southern Guinea-Bissau			
3.	Unit of Measure:	1000 Pesos			
		Organization			Total
4.	Preconstruction:	0			0
		Acquisition			
5.	Land and Site:	300			300
6.	BUILDINGS	Capacity Tons	Area Required	Cost per Sq. Meter	
	Warehouse				
	Paddy	175	141.41		
	Finished Rice	20	12.13		
	Store		15.00		
	Warehouse Total		168.54	962.5	162220.6
	Milling Shed		30.00	55	1650
	Subtotal for Buildings				
7.	EQUIPMENT	Purchase	Delivery	Installation	
	Platform Scale	1750	500	0	2,250
	Cleaning Machine	29,071	500	0	29,571
	Milling Machine	29,071	500	0	29,571
	Maintenance	275	0	0	275
	Subtotal for Equipment				
8.	Other Capital Outlay:				
	_____	_____			
	_____	_____			
	_____	_____			
9.	SUBTOTAL				225,838
10.	Contingency				33,876
11.	TOTAL ESTIMATED CAPITAL OUTLAY				
		Period 0	Period 1		Total
12.	Outlay by period	70,918	188,796		259,714

Assumptions Relating to Operating Costs

The costs of operating the rice mill were developed from information provided by personnel working with the Rural Incentives Program and the Ministry of Rural Development and Agriculture, Directorate for Agricultural Experimentation and Research (DEPA). The details of these costs are presented in Tables 16-28. A summary of these details is presented in Table 15. Since spare parts represent such a major operating expense, a separate table, Table 28, presents the assumptions relating to the costs and useful life of the most important spare parts. Reviewing the values presented in Table 15, the major expenses naturally attract attention and raise the familiar question of how the IRR would be effected by changes in the major expense items. Doubling fuel expense causes total variable expenses to increase by 16 percent and results in an IRR of approximately 35 percent. Increasing the spare parts expense by 50 percent causes total variable expenses to increase by 17 percent and results in an IRR of approximately 35 percent.

TABLE 15

Projected Annual Variable and Fixed Operating Costs

1. Proposed Project: Village Rice Mill
2. Location: Village in Souther Guinea-Bissau
3. Monetary Unit: 1000
4. Volume Unit: Tons
5. Projected Base: 1992
6. Period Length: 12 Months

	Receiving & Conditioning	Material Storage	Material Processing	Handling, Marketing	Office & Administ.	All Functions
7. Units of throughput	300	175	300	195 30		
Type of Expense						
8. VARIABLE COSTS:						
Wages and salaries	300	330	2,492	0	0	3,152
Employee benefits	46	46	349	0	0	441
Fuel and power costs	0	0	2,400	0	0	2,400
Spare parts	0	0	10,087	0	0	10,087
Repairs & maintenance	0	0	110	0	0	110
Supplies & materials	0	825	8,872	0	0	9,697
Handling shrinkage	0	65	0	1,157	0	1,222
Contents insurance	0	3,430	0	0	0	3,430
Materials taxes	0	0	0	0	0	0
Misc. operating expenses	0	0	0	0	0	0
Other variable cost	0	0	0	0	0	0
SUBTOTAL w/o interest	376	4,695	24,309	1,157	0	30,538
Short-term interest	0	0	0	0	0	0
TOTAL VARIABLE COST	376	4,695	24,309	1,157	0	30,538
VARIABLE COST PER UNIT	1.2540	26.8314	81.0311	0.0028		102
9. FIXED COSTS:						
Administration	1,989	1,989	1,989	3,967	691	10,625
Fringe benefits	278	278	278	555	97	1,487
General utilities	0	0	0	0	0	0
Office forms, supplies	0	0	0	0	0	0
Maintenance & services	0	0	75	0	0	75
Insurance premiums	0	0	0	0	0	0
Licenses, dues & fee	0	0	100	0	0	100
Communications	550	0	303	1,815	660	3,328
Business taxes	0	0	0	0	0	0
Misc. fixed expense	0	0	100	0	0	100
Other fixed cost	0	0	100	0	0	100
SUBTOTAL w/o interest	2,817	2,267	2,944	6,337	1,447	15,814
Fixed interest expense	0	0	0	0	0	0
Depreciation expense	0	0	0	0	0	0
TOTAL FIXED COST	2,817	2,267	2,944	6,337	1,447	15,814
FIXED COST PER UNIT OF INPUT						53

A DISCUSSION OF TABLES 16 THRU 19

Table 16 presents the calculated IRR along with several alternative ways of expressing this result. This is done to aid reviewers who may prefer using an alternative feasibility measure. The lower section of the table presents benefit/cost ratios for the enterprise. These benefit/cost ratios are calculated at interest rates, defined by the analyst, ranging from 20 percent to 45 percent per annum. The benefit/cost ratio approaches 1/1 as the defined interest rate approaches the internal rate of return. The net present values of the enterprise at these analyst-defined interest rates are also presented. The net present value of the enterprise approaches zero (net present value of revenue equals that of outlay) as the defined interest rate approaches the IRR. Thus, the IRR is the interest rate that results in a benefit/cost ratio of 1/1 and net present value of zero.

The number of years required to "payback" the initial investment can be calculated by cumulatively adding the values in the "Net Revenue" column under the central "OPERATING" section of the upper portion of the table. This analysis indicates the initial investment in facilities could be "paid back" in 5 6-month operating periods or 2.5 years.

The upper left portion of Table 16 presents the expected annual flow of investments into the enterprise, under the column entitled "INVESTMENT". These investments are divided into those for facilities and those for working capital. The investments for working capital reflect the expected changes in investment in raw material investories between the two 6-month period of a typical operating year. Raw material inventories are built up during the first 6-month period of the year (January-June) during the harvest/marketing season. These inventories are steadily reduced during the following 6-month period (July to December) when no raw material is purchased and the mill must rely on its inventory of grain to keep the mill operating. The 6-month operating period was selected as a basis of computation in order to reflect this distinct seasonality in operations.

The center column of the table presents expected revenues, expenses, and the resulting net revenue per 6-month period.

The upper right column of the table presents present value factors and values for total investment and net revenue. Note that the total net present values for investment and net revenue are equal, producing a net present value of zero. The present value factors are calculated from the IRR value after the computerized software has selected an interest rate (the IRR) that results in total net present value being equal to zero.

Table 17 displays the analysis used to develop the amount of storage capacity needed for the mill to operate at full capacity for ten months. It shows how the raw material will flow into and out of storage.

Table 18 summarizes working capital requirements. Table 19 summarizes the expected usage of spare parts.

TABLE 16

2.5 Ton/Hour Rice Mill at Bafata, Guinea-Bissau
(in Million Pesos)

INTERNAL RETURN ON TOTAL CAPITAL 36.887 PERCENT

PERIOD NO.	PERIOD IDENT.	INVESTMENT (M. Pesos) FACILITIES	WORKING CAPITAL	TOTAL	OPERATING (M. Pesos) TOTAL REVENUE	OPERATING EXPENSES**	NET REVENUE	PRESENT VALUE FACTOR	PRESENT VALUE TOTAL INVESTMENT	PRESENT VALUE NET REVENUE
0	291	71	128	200	0	8	-8	1	200	-8
1	192	188	-37	151	55	23	32	0.8547	129	27
2	292	0	33	33	123	23	100	0.7305	24	73
3	193	0	-33	-33	55	23	32	0.6244	-21	20
4	293	0	33	33	123	23	100	0.5337	18	53
5	194	0	-33	-33	55	23	32	0.4561	-15	14
6	294	0	33	33	123	23	100	0.3899	13	39
7	195	0	-33	-33	55	23	32	0.3332	-11	11
8	295	0	33	33	123	23	100	0.2848	9	28
9	196	0	-33	-33	55	23	32	0.2434	-8	8
10	296	71	33	104	123	23	100	0.2081	22	21
11	197	0	-33	-33	55	23	32	0.1778	-6	6
12	297	0	33	33	123	23	100	0.152	5	15
13	198	0	-33	-33	55	23	32	0.1299	-4	4
14	298	0	33	33	123	23	100	0.111	4	11
15	199	0	-33	-33	55	23	32	0.0949	-3	3
16	299	0	33	33	123	23	100	0.0811	3	8
17	100	0	-33	-33	55	23	32	0.0693	-2	2
18	200	0	33	33	123	23	100	0.0593	2	6
19	101	0	-33	-33	55	23	32	0.0506	-2	2
20	201	71	33	104	123	23	100	0.0433	4	4
21	102	0	-33	-33	55	23	32	0.037	-1	1
22	202	0	33	33	123	23	100	0.0316	1	3
23	103	0	-33	-33	55	23	32	0.027	-1	1
24	203	0	33	33	123	23	100	0.0231	1	2
25	104	-177	-124	-301	0	0	0	0.0197	-6	0
	TOTAL	225	0	225	2127	558	1569		354	354

INTEREST PER CENT	BENEFIT/COST RATIO	PRESENT VALUE IN M. Pesos REVENUE	OUTLAY	BALANCE
20	1.621	589	363	226
25	1.367	495	362	133
30	1.183	425	360	66
35	1.044	371	356	16
40	0.935	329	352	-23
45	0.848	295	348	-53

*EXCLUDING DEPRECIATION, INTEREST, AND INCOME TAX

ALTERNATIVE:
2.5 Ton/Hour Rice Mill in Guinea-Bissau. One Peso equals 1/40 Escudos or 1/5500 US Dollars.

TABLE 17

Worksheet for Determining Working Capital Needs

Project: Village Rice Mill
Monthly Balance: PADDY INVENTORY
Unit of Measure: 1 ton
Storage Capacity: 175 tons
Annual Purchases: 300 tons

Conversion Rate: 65.00%
Conversion Cost: 0.0%
Price Unit: Million Pesos/ton

Account: RAW MATERIAL INVENTORY

Month	Volume In	Volume Out	Start Stock	1ST Stock	2ND Stock	3RD Stock	Later Stock	Ending Balnce	Capcty Used-%	Age (Mon)	Unit Value	Stock Value	Acq. Value
	xxx	xxx						0		8.0	0.650	0.00	
1 Jan	0	0	0	0	0	0	0	0	0.0	0.0	0.650	0.00	0.00
2 Feb	45	30	0	15	0	0	0	15	8.6	0.5	0.650	9.75	29.25
3 Mar	105	30	0	0	90	0	0	90	51.4	1.5	0.700	63.00	73.50
4 Apr	105	30	0	0	60	105	0	165	94.3	2.5	0.750	120.75	78.75
5 May	30	30	0	0	30	105	30	165	94.3	-3.0	0.800	123.75	24.00
6 Jun	15	30	0	0	0	105	45	150	85.7	0.5	0.850	115.50	12.75
7 Jul	0	30	0	0	0	75	45	120	68.6	3.0	0.900	93.00	0.00
8 Aug	0	30	0	0	0	45	45	90	51.4	5.5	0.900	70.50	0.00
9 Sep	0	30	0	0	0	15	45	60	34.3	6.5	0.900	48.00	0.00
10 Oct	0	30	0	0	0	0	30	30	17.1	6.5	0.900	24.75	0.00
11 Nov	0	30	0	0	0	0	0	0	0.0	0.0	0.900	0.00	0.00
12 Dec	0	0	0	0	0	0	0	0	0.0	0.0	0.900	0.00	0.00
Total	300	300						885					218.25
Ave.	25.00	25.00	0.00	1.25	15.00	37.50	20.00	73.75	42.14	1.86	0.728	72.13	18.19
												39.38	

Inventory by month of entry to stocks:

Month	Start	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
START	0												
1 Jan	0	0											
2 Feb	0	0	15										
3 Mar	0	0	0	90									
4 Apr	0	0	0	60	105								
5 May	0	0	0	30	105	30							
6 Jun	0	0	0	0	105	30	15						
7 Jul	0	0	0	0	75	30	15	0					
8 Aug	0	0	0	0	45	30	15	0	0				
9 Sep	0	0	0	0	15	30	15	0	0	0			
10 Oct	0	0	0	0	0	15	15	0	0	0	0		
11 Nov	0	0	0	0	0	0	0	0	0	0	0	0	
12 Dec	0	0	0	0	0	0	0	0	0	0	0	0	0
Total													
Ave.	0.00	0.00	1.36	18.00	50.00	17.50	10.71	0.00	0.00	0.00	0.00	0.00	0.00

Code = 2

TABLE 18

Summary Of Working Capital Requirements

Project:	Village Rice Mill		Million Pesos			
Location:	Southern Guinea-Bissau					
Output Transition:	Period 1: 100%		Period 4: 100%			
	Period 2: 100%		Period 5: 100%			
	Period 3: 100%		Period 6: 100%			
Account	Final Balance	Balance 192	Balance 292	Balance 193	Balance 294	Balance 195
VARIABLE ACCOUNTS:	(Throughput dependent					
1. Cash working account	8.2	8	8	8	8	8
2. Raw Material Inventory	72.1	72.10	39.38	72.10	39.38	72.10
3. Plant Supplies Inventory	[illegible].6	1.60	1.60	1.60	1.60	1.60
4. Spare Parts Inventory	2.9	2.90	2.90	2.90	2.90	2.90
5. Final Products Inventory	38.2	38.20	38.20	38.20	38.20	38.20
6. Byproducts Inventory	0.5	0.50	0.50	0.50	0.50	0.50
Subtotal	124	123.53	90.81	123.53	90.81	123.53
Variable WC Entry by Period:		124.00	-33.00	33.00	-33.00	33.00
Recovery Value in Final Period:						124
FIXED ACCOUNTS:	(Independent of throughput)					
1. Prepaid Ins. Premiums	0.3	0	0	0	0	0
2. Miscellaneous	4	0	0	0	0	0
Subtotal	4.33	0.33	0.33	0.33	0.33	0.33
Fixed WC Entry by Period:		0.33	0.00	0.00	0.00	0.00
Recovery Value in Final Period:						0

TABLE 19

Worksheet for Computing Spare Parts Expense

(Per Ton)

Spare Parts for ISEKI .25 ton/hour Rice Mill

Name	Yen	CIF Cost Dollars	Pesos	Tons of Paddy Milled	Cost Per Ton Dollars	Cost Per Ton Pesos
Veio branquador descasca Roll, resistance, polishing	13,750	91	503,500	150	0.61	3,357
Rosca elevador Roll, feed	14,375	99	546,250	450	0.22	1,214
Rolo borracha (2) Rubber roller	13,250	91	503,500	30	3.05	16,783
Pineria (2) Screen, bran	15,000	103	570,000	60	1.72	9,500
Anilha	2,500	17	95,000	300	0.06	317
Belt, v/sa-40	704	5	26,752	450	0.01	59
Belt, v/sb-73	2,062	14	78,356	450	0.03	174
Belt, v/b-176	2,125	15	80,750	225	0.07	359
Engine spares	14,989	103	569,595	1,000	0.10	570
Subtotal for spare parts per ton					5.87	32,333
Expressed in thousands					0.01	32

APPENDIX 3

FEASIBILITY ANALYSIS OF THE RICE MILL AT BAFATA, GUINEA-BISSAU

by

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February 1992

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EXECUTIVE SUMMARY

The rice mill at Bafata appears to be economically feasible but not spectacularly profitable. We calculate the earning power of the total investment to be approximately 12 percent per year. In monetary terms, the mill represents a fixed investment of approximately 2 million US Dollars with an additional 474,000 US Dollars in working capital. The annual monetary return to this investment (after full capacity output has been reached in Year 5) amounts to approximately 610,000 US Dollars. This suggests the need for additional action by the mill owners to insure that economic conditions relating to the supply of raw material and the market for finished products are favorable to the success of the mill.

A factor which tends to confirm our evaluation of the mill is the optimistic assumption regarding the availability of paddy (non-decorticated rice) for processing in the mill. We assume that enough rice can be purchased by the to enable it to reach full capacity production within five years. This may not occur without assistance or encouragement from the mill owners.

A factor which suggests that the earning power of the mill is higher than we have calculated is the high cost of the plant equipment used in this analysis. The figures given to us by the mill management appear to be quite high when compared to similar capacity mills in the Americas.

Our findings must be evaluated in light of the many assumptions we used in our calculations. Thus, a major portion of this report is devoted to revealing and discussing the critical assumptions underlying our evaluation. We also report the results of tests made to determine the sensitivity of changes in our assumptions on the feasibility of the mill. Not surprisingly, these tests revealed that changes in the total value of the investment in the mill and changes in assumed output product prices have the greatest impact on the feasibility of the mill. This underscores the need for the mill owners to check the validity of the figures used to represent the total investment in the mill.

We request that readers communicate to us any concerns they may have relating to the appropriateness of the assumptions. By incorporating corrections identified by readers, we can approach an evaluation of the rice mill that most accurately reflects reality. We appreciate your assistance.

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INTRODUCTION

This is a feasibility analysis of the rice mill at Bafata, Guinea-Bissau under its current configuration and economic operating environment. Please note that, because the financial structure of the enterprise was not available for inclusion into this analysis, the results will reflect the earning power of the enterprise before consideration of its financial structure or taxes on earnings.

Significantly, neither depreciation nor interest paid are considered in this analysis, since they are dependant on the financial structure of the enterprise and the application of tax regulations. To include depreciation would require detailed knowledge of the manner in which applicable taxation rules and regulations are applied to this enterprise. To include interest paid would require detailed knowledge of the financial structure of the enterprise, i.e., the proportions of total capital borrowed from banks, invested by bond holders, or invested by junior classes of stockholders. At this initial stage of feasibility analysis, these details are not needed to achieve our objective in conducting the feasibility analysis, namely, to determine if the enterprise appears feasible under any financial structure.

The measure of feasibility developed under these limitations is called the internal rate of return (IRR). An enterprise is considered feasible if its IRR is greater than the investors' cost of capital. For example, if an investor could obtain financial capital at an interest rate of 10% per annum, the investor would consider feasible investments which have IRRs greater than 10%. The other investment opportunities available to the investor also influence the investor's decision. A rational investor would consider the IRRs of all investment opportunities and chose to analyze more closely those with the highest IRRs.

Given a favorable IRR, the investor group will normally proceed to a second stage of feasibility analysis which attempts to develop a financial structure that optimizes the return to the principal owners of the enterprise while assuring outside investors of the safety of their investments and expected earnings. This type of feasibility analysis develops a measure called the financial rate of return (FRR). A financial rate of return analysis is beyond the scope of this report; however, such an analysis would be a simple extension of the work already accomplished in the present analysis.

In the present circumstance, the IRR determined for the rice mill at Bafata should provide public and private citizens concerned with the development of the rice industry in Guinea-Bissau with information that will be helpful in understanding the situation and in making decisions to respond to the situation.

The Calculated IRR for the Rice Mill at Bafata

The calculated internal rate of return for the rice mill at Bafata is approximately 12 percent. This is a real rate of return with the effects of inflation removed. To obtain an idea of the nominal rate of return, one should add the rate of inflation to this calculated rate. If the rate of inflation were 36 percent per annum, the inflation-adjusted IRR for the mill would be on the order of 48 percent. The IRR and alternative measures of the earning power of the mill, such as its net present value, are discussed in A Discussion of Table 26.

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The effects of inflation are handled by assuming that the relation between all prices used in the analysis will remain the same over time. The effect of inflation, under this assumption, would be to increase all values at the same rate. An appropriate rate of inflation could then be used to adjust the values used in future years. This would provide a measure of the earning power of the enterprise that included inflation. However, it raises the problem of choosing an appropriate inflation rate. We avoid the problem by using the same values for all years; in effect, treating the values as having been deflated to the current year. As a result, we obtain a measure of earning power with inflation effects removed.

Assumptions Used in the Analysis

It is important to remember that the calculated IRR is totally dependant on the assumptions that underlie the analysis. If the assumptions are infeasible, implausible, or incorrect; the calculated IRR is misleading. Perhaps, the most important assumption relates to the availability of paddy rice for processing in the mill. Even if the assumptions used in this analysis appear plausible, determined efforts will be needed to insure that the assumptions are realized, that the paddy will be produced. If the assumptions used appear to be overly optimistic, even more drastic action will be called for. Thus, it is important to examine closely the assumptions used and attempt to understand how sensitive is the calculated IRR to changes in the assumptions.

The major assumptions used in the analysis are presented in outline form in Table 20 and constitute a brief description of the enterprise. Included are assumptions relating to the raw material and finished product markets, operating schedule, yield of products, transition to full-capacity operation, seasonal patterns in raw material purchases, raw material and finished product prices. The transition pattern, presented in Item 14 of Table 20, describes the assumed annual increase in production from start-up until full-capacity production is reached in Year 5. The seasonal pattern in paddy rice purchases, Item 15, describes the assumed flow of paddy into storage at the mill during a typical year after full-capacity has been reached. The monthly revenue and cost of raw material data, Item 15, also relate to full-capacity operating years. The more critical of these assumptions are discussed individually in the text following Table 20.

TABLE 20

A Description of the Rice Milling Enterprise: Large Mill

1. Proposed project: 2.5 ton/hour Rice Mill
2. Location: Bafata
3. Product Market: Sold to Retailers in Bissau
4. Input Supply: Farmers near Bafata and Assembly Market at Catio
5. Specific Goals: Mill rice for mill account only
6. Processing Capacity: 10,000 tons/year
7. Processing Yield: 65% Mill-Run Rice
   10% Mill-Run Rice Bran
8. Storage Capacity:
   Raw Material: 4,000 tons of Paddy Rice
   Polished Rice: 140 tons
   Bran: 2 tons
9. Annual Throughput: 10,000 tons (16 hours/day, 5 days/week, 50 weeks/year)
10. Product Output:
    Rice: 6,500 tons of Mill-Run (Unsorted) Rice
    Bran: 1000 tons of Mill-Run Bran/Flour Mix
11. Economic Horizon: 12 years based on 12 accounting periods per year
12. Monetary Unit: Million Pesos
13. Quantity Unit: Tons
14. Transition pattern:
    Time to complete construction: 1 year
    Years to reach planned scale of operation: 5 years
    Five-year transition pattern:

Years:	1	2	3	4	5
Percent:	25%	35%	50%	75%	100%

15. Paddy rice purchases, prices and revenue by month at full-capacity:

	Raw Material			Volume	Products Marketed			Byproducts Marketed		
Month	Volume	Price	Value	Milled	Volume	Price	Value	Volume	Price	Value
1st Jan	2000	0.765	1530.61	870	565.5	1.900	1074.5	87	0.500	43.5
2nd Feb	0	0.816	0.00	870	565.5	1.950	1102.7	87	0.500	43.5
3rd Mar	500	0.867	433.67	870	565.5	1.600	904.8	87	0.500	43.5
4th Apr	2000	0.867	1734.69	870	565.5	1.900	1074.5	87	0.500	43.5
5th May	2500	0.867	2168.37	870	565.5	1.850	1046.2	87	0.500	43.5
6th Jun	1000	0.918	918.37	870	565.5	1.900	1074.5	87	0.500	43.5
7th Jul	0	0.918	0.00	870	565.5	2.550	1442.0	87	0.500	43.5
8th Aug	0	0.918	0.00	870	565.5	2.750	1555.1	87	0.500	43.5
9th Sep	0	0.867	0.00	870	565.5	2.800	1583.4	87	0.500	43.5
10th Oct	0	0.867	0.00	870	565.5	2.650	1498.6	87	0.500	43.5
11th Nov	1000	0.867	867.35	870	565.5	2.250	1272.4	87	0.500	43.5
12th Dec	1000	0.867	867.35	430	279.5	2.300	642.9	43	0.500	21.5
TOTAL	10000		8520.41	10000	6500		14363.8	1000	.500	500.0
AVERAGE		.852		833.3		2.210		83.33		

The Assumptions Relating to Paddy Rice Supply to the Mill

The analysis assumes that the rice mill will process 10,000 tons of paddy per year in Year 5. This level of throughput is considered to be full capacity. The transition pattern from start-up in Year 1 to full capacity in Year 5 is an assumption based on an understanding of the present rice production and marketing situation in Guinea-Bissau. It is also assumed that this pattern of increased rice production will not automatically occur. Thus, it is important that this assumption be clearly stated to encourage due consideration of its implications.

The percentages in the transition pattern relate to the assumed production level at full-capacity. Accordingly, it is assumed that the mill will process the percentages of full capacity tonnage, shown in Table 21, during the four years of transition to full-capacity production.

TABLE 21

Tonnage of Paddy Processed During Transition Phase

	Percent of Capacity	Tonnage Processed
Year 0, 1991	0%	0
Year 1, 1992	25%	2,500
Year 2, 1993	35%	3,500
Year 3, 1994	50%	5,000
Year 4, 1995	75%	7,500
Year 5, 1996	100%	10,000

Without considerable expansion of marketable rice production in the area around Catio and in the area around Bafata achieving these levels of throughput will be difficult. ("Throughput" is tonnage of paddy processed or "put through" the mill per year.) Current levels of marketed production from these two areas are estimated to be 5,000 - 7,000 tons from Catio and 2,000 tons from Bafata. Competition with other buyers will influence the actual tonnages that can be purchased from these areas. To obtain the desired quantities from the Southern Region only in Years 1 and 2 would require that the Bafata mill be able to purchase approximately one-half of the paddy offered for sale during 1992. This market share would have to increase in 1993 unless marketed production increased. Obtaining this level of market dominance (a 50% share) will be time consuming and expensive, given current levels of competition.

Obtaining the desired levels of paddy rice supplied to the mill after Year 2 may require efforts on the part of the mill management to increase production in both the south and in the area around Bafata. Perhaps, the area around Bafata holds the greatest potential to increase production quickly enough, since the farms around Bafata are mechanized and are, possibly, more responsive to monetary incentives. Certainly, it is plausible that production in Bafata can be increased dramatically through the application of technical and financial resources. This is the assumption embedded in the values used in the analysis.

One method of increasing the marketed production is to increase the yields per hectare on existing farms. Present yields are approximately 2 tons per hectare. Yields in other parts of the world regularly surpass 4 tons per hectare. Thus, the estimated 2,000 hectares now under production near Bafata could produce 8,000 tons for the market. Another option to is to produce multiple crops on the same land. This has the potential of doubling again, to 16,000 tons, the paddy produced for the market. A third option is to bring more land under cultivation. This option appears also to hold great potential. One of the leaders of the major organization of commercial farmers from the Bafata area estimates that the area under production near Bafata could be expanded to 10,000 hectares.

The relatively low IRR calculated in this analysis relies very heavily on the assumption that production can be drastically increased within five years; and, that a significant proportion of that production will be milled in the Bafata mill. Thus, it suggests that the owners of the Bafata mill should consider developing and implementing a program that will cause production to increase sufficiently. Of course, the mill at Bafata could count on processing only some fraction of this total. The size of this fraction would be determined by the price the mill is willing to pay for the paddy or charge individual customers for custom milling services. Under the second option, the mill would not take title to the paddy but would simply provide milling services.

To determine the impact of changes in these critical assumptions on the calculated IRR, changes were made and the IRR recalculated. Note that only the assumptions relating to the quantities milled per year were changed. Everything else remained as in the initial calculation. Table 22 presents the results of these sensitivity tests.

TABLE 22

Selected Annual Throughput Scenarios and Associated IRRs

Period-Year	Scenario 1*		Scenario 2		Scenario 3	
	Percent of Capacity	Tonnage Milled Per Year	Percent of Capacity	Tonnage Milled Per Year	Percent of Capacity	Tonnage Milled Per Year
0-1991	0%	0	0%	0	0%	0
1-1992	25%	2,500	25%	2,500	25%	2,500
2-1993	35%	3,500	35%	3,500	50%	5,000
3-1994	50%	5,000	50%	5,000	75%	7,500
4-1995	75%	7,500	60%	6,000	100%	10,000
5-1996	100%	10,000	60%	6,000		
6-1997			100%	10,000		

Associated IRRs

Scenario 1	Scenario 2	Scenario 3
11.8%	10.2%	14.0%

* Scenario 1 is the base case

As seen in Table 22, the changes in the pattern of transition to full capacity have an effect on the calculated IRR. As one might expect, the earning power of the enterprise increases with an acceleration in the transition to full capacity. When full capacity is achieved in Year 4, the IRR is 14.5%. When the transition to full capacity is delayed until Year 6, the IRR is 10.4%. Again, this analysis emphasizes the desirability of a rapid transition pattern and suggests that some additional resources could be invested in achieving a shortening of the transition period.

The Assumptions Relating to the Prices Paid and Received

Prices have an obvious impact on the profitability of an enterprise. However, they are difficult to predict; especially, in an economy without a long experience with open market policies. Thus, it is important to scrutinize the prices used in a feasibility analysis to gage their plausibility. Further, it is helpful to understand how sensitive the IRR is to changes in the prices used in the analysis. The results of these sensitivity analyses can be useful not only in managing the rice mill but also in attempts to favorably influence government policies affecting the rice industry. The prices used for paddy and for finished rice and rice bran are presented in Table 29.

Paddy Prices. The prices paid for paddy reflect our understanding of the existing market for paddy. For example, the price listed for January is 765 Pesos/kg. This was calculated by beginning with a farm level price of 600 Pesos/kg and adding a "markup" of 20% to reflect the assembler merchant's margin (600/.8=750). Next the assembler merchants price of 750 Pesos/kg was adjusted to reflect an expected 2 percent foreign material content in the purchased paddy. The purchaser actually buys a mixture of paddy and foreign material such as dirt, rocks, and straw. If this foreign matter content is assumed to be 2 percent, each kilogram purchased only contains 980 grams of paddy. To reflect this fact, the price of the purchased material is divided by .98. In this case, this adjustment yielded a price of 765 Pesos/kg. Similar adjustments were made to the estimated farm-level prices selected for use in the other months of the year. These selected prices also reflect observed changes in prices over the season.

In the present case, these prices do not reflect the cost of transportation to the mill. They are prices at the assembly points, either in Catio or on farms near Bafata. The cost of transporting the grain to the mill is included in the cost of operating the mill (included as raw material receiving costs). The development of these trucking costs is detailed in Table 27. Given these facts, it is interesting to note that the calculated IRR of 11.8 percent does not require a sacrifice on the part of farmer or assemblers. It appears feasible for farmers and assemblers to receive an attractive price for their grain and assembly services.

In a more efficiently organized marketing system, the 20 percent assembler's margin could be substantially reduced. To understand what incentive the rice mill would have in reducing this margin to 10 percent, the prices paid for paddy were reduced by 10 percent and the IRR recalculated. When the cost of raw material is reduced by 10 percent and all other prices and expenses remain the same, the calculated IRR becomes 16.3 percent, an increase of 4.5 percentage points over the base case. If raw material prices are increased 10 percent and all other factors remain the same, the IRR becomes 6.7 percent.

Polished Rice Prices. The prices used to represent the prices the mill will receive for polished rice also reflect current prices and our understanding of seasonal changes in these prices. We should mention that no pattern in seasonal prices has been established since the RGB deregulated prices in 1989. See Figure 8 for a visual confirmation of this statement. The prices for polished rice used in this study are considered to be delivered-goods prices. That is, they include the cost of delivering the rice from Bafata to a warehouse in Bissau. The trucking cost included in the cost of operating the mill covered the cost of transporting 5,000 tons of rice to Bissau.

The polished rice prices used in the analysis were estimated as follows. Reported monthly prices for the five years encompassing 1987 and 1991 were deflated to real prices. This was done to remove the effect of intra-year inflation. Then a series of monthly price indices was developed for the 12 monthly prices in each year. These indices measure the difference between a given monthly price and the average of the 12 monthly prices for the same year. The average of the five series relating to the five years encompassing 1987 and 1991 was selected to estimate the monthly prices used in the analysis.

Unfortunately, not a great deal of confidence can be placed in this approach, since it is not based on strong quantitative analysis. However, the existing data do not allow the type of quantitative analysis one would hope for. As can be seen in Figure 8, there is a great deal of difference in the seasonal patterns of price. Because we cannot rely on a long history of prices from periods relatively similar to the recent past, we cannot determine which (if any of these patterns) is most representative of what can be expected to happen in the future. This made it difficult to select a seasonal pattern to use in predicting future seasonal prices. In the end, the average of the five seasonal indices was used to estimate the monthly prices used in the analysis. This strengthens the advisability of testing the sensitivity of the IRR to changes in prices.

Once the monthly indices were selected, a price for January 1992 was developed. An observed retail price, 2200 Pesos/kg, was selected as a base. From this base, a 15 percent retailer's margin was subtracted to arrive at the delivered price for January used in the analysis. The other 11 monthly indices were then used to develop the monthly prices used in the analysis and presented in Table 29. Note that this assumes that the rice mill will pay the cost of delivering the rice to Bissau. It also assumes that the mill will capture any wholesaler's margin, since the mill will sell directly to retailers.

To test the sensitivity of the IRR to the level of prices used, two tests were made. In the first, the prices received were reduced by 5 percent. The resulting IRR was 7.6 percent. In the second test, the prices were increased by 5 percent. The resulting IRR was 15.6. Clearly, these results can be used in policy discussions dealing with rice import/export policy. A small, real decline in rice prices (caused, perhaps, by foreign nations "dumping" rice on the international market) at the wholesale level can have a significant negative effect on the rice mill's profitability.

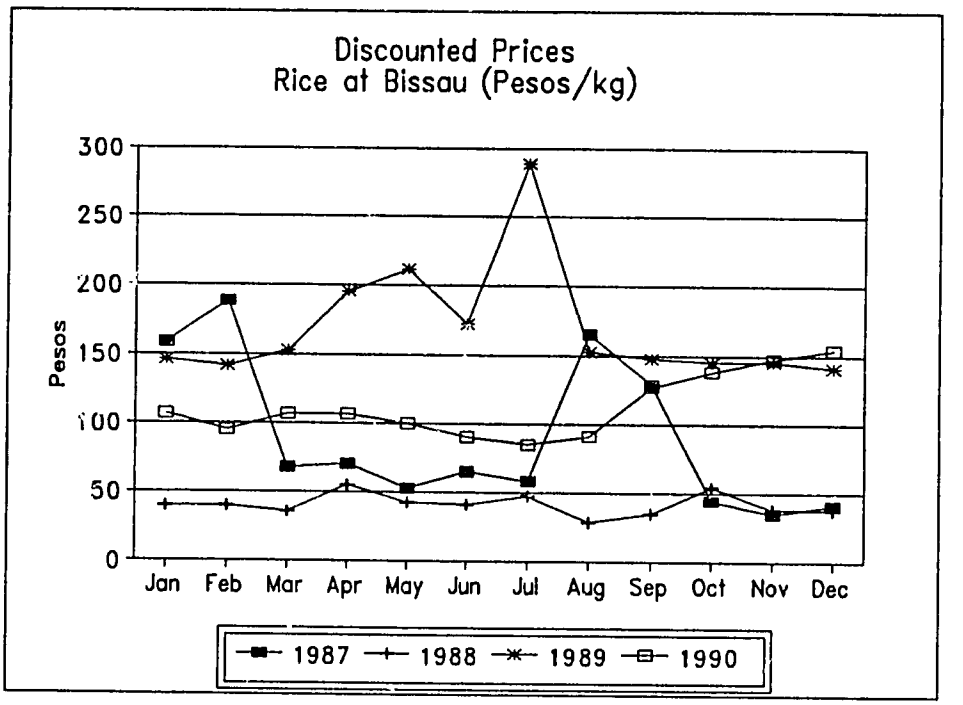

FIGURE 9. Discounted Prices Rice at Bissau

Assumptions Relating to Grain Storage Facilities and Total Investment Values

Grain Storage Facilities. The existing mill does not have facilities for storing grain at the mill. Because storage facilities are necessary to insure that the mill can operate at full capacity, this feasibility study included the estimated cost of constructing the needed facilities. Although initial assessments by the mill owners and this analyst assumed that facilities to store 8,000 tons of paddy were required, further analysis has shown that it is possible to reduce the capacity needed to 4,000 tons. Accordingly, the estimated cost of constructing a 4,000 ton capacity grain storage facility was added to the total investment for the rice mill. The base case feasibility scenario (which produced a calculated IRR of 11.8 percent) includes this additional investment. The components of the total investment in the rice mill are presented in Table 23. The grain storage facility envisioned here includes 4 silos, each containing 1,000 tons each and the associated grain conveyors to connect the silos to the mill.

The analysis which suggested the size of the grain storage facility could be substantially reduced from earlier estimates of its size is dependent on an off season crop of rice. Clearly, if the crop can be divided into two seasons, the amount of storage needed to run the mill throughout the year can also be cut in half. Essentially, the reduction in storage facility size depends on the ability of the rice mill to buy paddy at certain times of the year and in certain quantities.

The analysis here envisioned that the mill could (after Year 4 of its life) purchase its paddy on the pattern shown in Item 15 of Table 20. This pattern

assumes that 40 percent of annual needs can be purchased during the months of November, December and January. The rice available for purchase during these months should come from mechanized farms near Bafata. Once these farms are harvested, they can be replanted to rice and will supply a major proportion of the rice purchased in April, May and June. Not only will this reduce the mill's dependence on Southern rice (for which substantial competition exists) but will also provide paddy for processing during the Summer months. Table 28 is a copy of the electronic spreadsheet used to determine the required storage capacity.

TABLE 23

Summary of Capital Outlay for the Rice Mill

Item	Capital Outlay	Period Acquired	Life (Years)
LAND:			
Acquisition	33	1991	
Contingency	2	1991	
Subtotal	35		
BUILDINGS:			
Processing	869.0	1991	40
Site Development	151.25	1991	40
Contingency	51	1991	40
Subtotal	1,071		
EQUIPMENT:			
Grain Silos	1320.0	1991	15
Processing	6132.5	1991	15
Generator motors	453.8	1991	5
Trucks	1516	1991	4
Contingency	472	1991	15
Subtotal	9,894		
TOTAL OUTLAY	11,000	Million Pesos or	
	275	Million Escudos	

Total Fixed Investment. The values of the investments in site, plant buildings and equipment were developed from information provided by the mill management. These values are presented in Table 23. (The investment in working capital is presented in Table 29.) Since a 10 percent change in investment translates into a 1.5 percent change in the calculated IRR, it is important that the mill owners check the figures use here for accuracy before using the results of this feasibility study. Because the figures relating to the cost of equipment appear quite high in comparison with the cost of similar rice mills in Central America, this analyst would appreciate very much receiving confirmation or suggestions for changing any of these figures.

Two of the values presented in Table 23 need further clarification. The acquisition cost of the land also includes 27.5 million Pesos as an estimate of pre-investment organizational expenses. The investment for site development includes the cost of constructing the road to the mill.

Assumptions Relating to Operating Costs

The costs of operating the rice mill were developed from information provided by the mill management. The details of these costs are presented in Tables 30-34. A summary of these details is presented in Table 25. Reviewing the values presented in Table 25, the major expenses naturally attract attention and raise the familiar question of how the IRR would be effected by changes in the major expense items. The following table (Table 24) presents the results of selected tests.

TABLE 24

Recalculated IRRs Associated with Changes in Major Expense Items

Expense Item Changed	Percent Change from Base Case*	Resulting IRR
Variable Wages & Salaries	50 % increase	11.5%
Plant and Truck Spare Parts	50 % increase	10.1%
Variable Fuel & Power	50 % increase	11.1%
Fixed Admin. Wages & Salaries	50 % decrease	13.4%

* Base Case IRR: 11.8%

TABLE 25

Projected Variable and Fixed Operating Costs in Year 5

	Receiving & Conditioning	Material Storage	Material Processing	Handling, Marketing	Office & Administ.	All Functions
1. Units of throughput	10,000	20,000	10,000	6,500 1,000		
Type of Expense						
2. VARIABLE COSTS:						
Wages and salaries	76,698	1,250	8,248	11,870	30,938	129,004
Employee benefits	9,204	150	990	1,424	3,713	15,481
Fuel and power costs	68,912	0	320,000	42,784	0	431,696
Spare parts	265,333	0	512,678	191,736	10,560	980,307
Repairs & maintenance	14,644	0	19,584	9,092	3,536	46,855
Supplies and materials	0	10,400	0	703,938	0	714,338
Handling shrinkage	0	8,771	0	44,500	0	53,271
Contents insurance	0	0	0	0	0	0
Materials taxes	0	0	0	0	0	0
SUBTOTAL w/o interest	434,791	20,571	861,500	1,005,344	48,747	2,370,952
Short-term interest	0	0	0	0	0	0
TOTAL VARIABLE COST	434,791	20,571	861,500	1,005,344	48,747	2,370,952
VARIABLE COST PER KG						237.10
3. FIXED COSTS:						
Administration	7,680	0	144,000	164,160	63,600	379,440
Fringe benefits	922	0	17,280	19,699	7,632	45,533
General utilities	3,600	3,600	3,600	0	3,600	14,400
Office forms, supplies	0	0	0	0	6,000	6,000
Maintenance & services	3,000	0	9,000	0	0	12,000
Insurance premiums	361	0	0	221	0	582
Licenses, dues and fee	3,020	0	0	1,024	7,000	11,044
Communications	0	0	0	0	24,000	24,000
Business taxes	0	0	0	0	0	0
Misc. fixed expense	0	0	0	0	27,500	27,500
Other fixed cost	0	0	0	0	0	0
SUBTOTAL w/o interest	18,582	3,600	173,880	185,105	139,332	520,499
Fixed interest expense						0
Depreciation expense						0
TOTAL FIXED COST	18,582	3,600	173,880	185,105	139,332	520,499
FIXED COST PER KG OF PADDY						52.05

A DISCUSSION OF TABLE 26

Table 26 presents the calculated IRR along with several alternative ways of expressing this result. This is done to aid reviewers who may prefer using an alternative feasibility measure. The lower section of the table presents benefit/cost ratios for the enterprise. These benefit/cost ratios are calculated at interest rates, defined by the analyst, ranging from 9 percent to 15 percent per annum. The benefit/cost ratio approaches 1/1 as the defined interest rate approaches the internal rate of return. The net present values of the enterprise at these analyst-defined interest rates are also presented. The net present value of the enterprise approaches zero (net present value of revenue equals that of outlay) as the defined interest rate approaches the IRR. Thus, the IRR is the interest rate that results in a benefit/cost ratio of 1/1 and net present value of zero.

The number of years required to "payback" the initial investment can be calculated by cumulatively adding the values in the "Net Revenue" column under the central "OPERATING" section of the upper portion of the table. This analysis indicates the initial investment in facilities could be "paid back" in 6 years.

The upper left portion of Table 26 presents the expected annual flow of investments into the enterprise, under the column entitled "INVESTMENT". These investments are divided into those for facilities and those for working capital. The investments for working capital reflect the expected growth in rice processing over a five year period. As more rice is processed each year, additional working capital investments are required.

The center column of the table presents expected revenues, expenses, and the resulting net revenue per year. Again, these figures reflect the expected growth pattern in rice processing through year 5.

The upper right column of the table presents present value factors and values for total investment and net revenue. Note that the total net present values for investment and net revenue are equal, producing a net present value of zero. The present value factors are calculated from the IRR value after the computerized software has selected an interest rate (the IRR) that results in total net present value being equal to zero.

TABLE 26

Internal Rate of Return and Associated Data

2.5 Ton/Hour Rice Mill at Bafata, Guinea-Bissau
(in Million Pesos)

INTERNAL RETURN ON TOTAL CAPITAL 11.8 PERCENT

PERIOD		INVESTMENT (M. Pesos)			OPERATING (M. Pesos)			PRESENT VALUE FACTOR	PRESENT VALUE	
NO.	IDENT.	FACILITIES	WORKING CAPITAL	TOTAL	TOTAL REVENUE	OPERATING EXPENSES**	NET REVENUE		TOTAL INVESTMENT	NET REVENUE
0	1991	11020.	0.	11020.	0.	0.	0.	1.	11020.	0.
1	1992	0.	661.	661.	1563.	1115.	448.	0.8948	591.	401.
2	1993	0.	261.	261.	2188.	1353.	835.	0.8006	209.	669.
3	1994	0.	392.	392.	3126.	1709.	1417.	0.7164	281.	1015.
4	1995	1516.	653.	2169.	4689.	2301.	2388.	0.641	1390.	1531.
5	1996	454.	653.	1107.	6251.	2894.	3357.	0.5736	635.	1925.
6	1997	0	0.	0.	6251.	2894.	3357.	0.5132	0.	1723.
7	1998	0.	0.	0.	6251.	2894.	3357.	0.4592	0.	1542.
8	1999	1516.	0.	1516.	6251.	2894.	3357.	0.4109	623.	1379.
9	2000	0.	0.	0.	6251.	2894.	3357.	0.3676	0.	1234.
10	2001	454.	0.	454.	6251.	2894.	3357.	0.329	149.	1104.
11	2002	0.	0.	0.	6251.	2891.	3357.	0.2943	0.	989.
12	2003	-2646.	-2620.	-5266.	0.	0.	0.	0.2634	-1387.	0.
		12314.	0.	12314.	55323.	26733.	28590.		13512.	13512.

INTEREST PER CENT	BENEFIT/COST RATIO	PRESENT VALUE IN M. Pesos		
		REVENUE	OUTLAY	BALANCE
9.000	1.177	15870.	13485.	2385.
10.000	1.108	14957.	13504.	1452.
11.000	1.044	14112.	13512.	600.
12.000	0.987	13329.	13511.	-181.
13.000	0.934	12604.	13501.	-898.
15.000	0.840	11304.	13464.	-2160

**EXCLUDING DEPRECIATION, INTEREST, AND INCOME TAX

ALTERNATIVE:
2.5 Ton/Hour Rice Mill in Guinea-Bissau. One Peso equals 1/40 Escudos or 1/5500 US Dollars.
Base Case.

TABLE 27

Form to Calculate Trucking Expenses

Cost Item		25 ton Truck with Trailer Price/ Unit	Km Useful Life/ Unit	Use @ Factor	Cost/Km	2 ton Truck Price/ Unit	Km Useful Life/ Unit	Use @ Factor	Cost/Km
Truck @	$83,333	500000	200000	3.75E-06	1.875	132000	150000	5E-06	0.660
Trailer	$20,000	120000	300000	2.5E-06	0.300				
1st Driver's annual salary		6000	64610	1.55E-05	0.093	6000	10400	9.615E-05	0.577
1st Driver's salary benefit		840	64610	1.55E-05	0.013	840	10400	9.615E-05	0.081
2nd Driver's annual salary		6000	64610	1.55E-05	0.093				
2nd Driver's salary benefit		840	64610	1.55E-05	0.013				
Diesel		2	2.5	0.4	0.800	2	2.5	0.4	0.800
Oil		18	150	0.006667	0.120	18	150	0.0066667	0.120
Lubrication		110	5000	0.0002	0.022	110	5000	0.0002	0.022
Maintenance		275	10000	0.0001	0.028	275	10000	0.0001	0.028
Tires (10+(8*.5))	$800	79200	30000	3.33E-05	2.640	4400	30000	3.333E-05	0.147
Parts (5% of truck value)		25000	30000	3.33E-05	0.333	6600	30000	3.333E-05	0.220
Insurance: Drivers		720	64610	1.55E-05	0.011	360	10400	9.615E-05	0.035
Insurance: Truck		194	64610	1.55E-05	0.003	194	10400	9.615E-05	0.019
Licenses and Fees		2114	64610	1.55E-05	0.033	1057	10400	9.615E-05	0.102
Interest @	0.25	53125	64610	1.16E-05	0.675	12375	10400	7.212E-05	0.892
Total Cost Per Kilometer					7.551				3.701
Total Cost per Ton per Km					0.252				2.056
Cost/Ton from Catio					93.634		Cost/ton at Catio		41.12434

@ Use Factor = 1/(Km Useful Life per Unit)
Example: 1 liter of fuel has useful life of 2.5 km.
Its Use Factor is 1/2.5 = .4
Cost/Km = Price per Unit X Use Factor
@ Truck use factor: (1 - salvage percentage)/(km life)

Assumptions Used to Calculate Trucking Expenses

I. Vehicle Types, Costs, Capacities, etc.:

Item	Vehicle Type 25 ton Escudos	Pesos	Trailer Escudos	Pesos	Truck/ Trailer	2 ton Escudos	Pesos
Acquisition Cost	12500	500000	3000	120000	620000	3300	132000
Loading Capacity	20		20		30	1.8	
Salvage Percentage	0.25		0.25			0.25	
Number of Trucks Owned	2		1			1	

NOTE: Assumptions treat the 2 trucks and 1 trailer as 2 units of 1 truck plus 1/2 trailer.

II. Transportation Distances and Times

Type of Trip	Distance One Way Km	R'nd Trip Km	Time Loading Hours	Travel Hours	Total Hours
Bafata-Catio-Bafata	186	372	3	13	16
Around Bafata	20	40	4	2	6
Bafata-Bissau-Bafata	140	280	3	5	8
Around Catio	10	20	2	1	3

TABLE 27

Form to Calculate Trucking Expenses (Cont.)

III. Tonnage Delivered and Kilometers Run:

Type of Trip	Truck Type	Number Trucks	Time Frame Days	Trips/ Day	Number Trips	Total Km	Tonnage Delivered	Trucks Required	---Total Hours--- Required	Available
Bafata-Catio-Bafata	25+ tons	2	103	1.80	185	68820	5550	1.8	2960	6000
Around Bafata	25+ tons	2	48	3.60	173	6920	5190	3.6	1038	
Bafata-Bissau-Bafata	25+ tons	2	106	1.80	191	53480	5730	1.8	1528	
Total for 25 ton truck/trailer unit			257			129220	16470		5528	
Around Catio	2 tons	1	130	4	520	10400	936	1		
Total for all trucks						139620	17406			

TABLE 28

Worksheet for Determining Working Capital Needs for Paddy Inventory

Project: 2.5 ton/hour Rice Mill
Unit of Measure: 1 tons
Storage Capacity: 4,000 tons
Annual Purchases: 10,000 tons

Conversion Rate: 65.00%
Price Unit: Million Pesos/ton

Account: RAW MATERIAL INVENTORY

Month	Volume In	Volume Out	Start Stock	1ST Stock	2ND Stock	3RD Stock	Later Stock	Ending Balnce	Capcty Used-%	Age (Mon)	Unit Value	Stock Value	Acq. Value
	xxx	xxx						1000		1.0	0.650	650.00	
1 Jan	2000	870	130	2000	0	0	0	2130	53.3	2.00	0.765	1615.11	1530.61
2 Feb	0	870	0	1260	0	0	0	1260	31.5	2.00	0.816	964.29	0.00
3 Mar	500	870	0	390	0	500	0	890	22.3	3.00	0.867	732.14	433.67
4 Apr	2000	870	0	0	0	20	2000	2020	50.5	2.00	0.867	1752.04	1734.69
5 May	2500	870	0	0	0	0	3650	3650	91.3	2.00	0.867	3165.82	2168.37
6 Jun	1000	870	0	0	0	0	3780	3780	94.5	3.00	0.918	3329.59	918.37
7 Jul	0	870	0	0	0	0	2910	2910	72.8	3.00	0.918	2575.00	0.00
8 Aug	0	870	0	0	0	0	2040	2040	51.0	4.00	0.918	1820.41	0.00
9 Sep	0	870	0	0	0	0	1170	1170	29.3	5.00	0.867	1065.82	0.00
10 Oct	0	870	0	0	0	0	300	300	7.5	5.00	0.867	275.51	0.00
11 Nov	1000	870	0	0	0	0	430	430	10.8	0.43	0.867	372.96	867.35
12 Dec	1000	430	0	0	0	0	1000	1000	25.0	1.00	0.867	867.35	867.35
Total	10000	10000						21580					8520.41
Ave.	833.33	833.33	10.83	304	0.00	43.33	1440	1798	44.96	2.70	0.852	1544.67	710.03

Month	Start	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Age at end of entry month:													
	1	1.00	0.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.43	1.00
Inventory by month of entry to stocks:												Code =	1
1 Jan	130	2000											
2 Feb	0	1260	0										
3 Mar	0	390	0	500									
4 Apr	0	0	0	20	2000								
5 May	0	0	0	0	1150	2500							
6 Jun	0	0	0	0	280	2500	1000						
7 Jul	0	0	0	0	0	1910	1000	0					
8 Aug	0	0	0	0	0	1040	1000	0	0				
9 Sep	0	0	0	0	0	170	1000	0	0	0			
10 Oct	0	0	0	0	0	0	300	0	0	0	0		
11 Nov	0	0	0	0	0	0	0	0	0	0	0	430	
12 Dec	0	0	0	0	0	0	0	0	0	0	0	0	1000
Total													
Ave.	10.8	304.2	0.0	52.0	381.1	1015.0	614.3	0.0	0.0	0.0	0.0	215.0	1000.0

TABLE 29

Total Working Capital Investment

Project:	2.5 ton/hour Rice Mill	Monetary Unit:	Million Pesos
Location:	Bafata, Guinea-Bissau		
Output Transition:	Period 1: 25%	Period 4:	75.0%
	Period 2: 35%	Period 5:	100.0%
	Period 3: 50%	Period 6:	100.0%

Account	Final Balance	Balance 1992	Balance 1993	Balance 1994	Balance 1995	Balance 1996
VARIABLE ACCOUNTS:	(Throughput dependent)					
1. Cash working account	500.0	125	175	250	375	500
2. Raw Matr'l Inventory	1544.7	386	541	772	1,159	1,545
3. Plant Supplies Inv.	223.9	56	78	112	168	224
4. Spare Parts Inventory	296.2	74	104	148	222	296
5. Goods in Process Inv.	0.0	0	0	0	0	0
6. Final Products Inv.	33.0	8	12	17	25	33
7. Byproducts Inventory	7.5	2	3	4	6	8
			0	0	0	0
12. Accts. Rec., Retail	0.0	0	0	0	0	0
13. Accts. Rec., Wholesal	0.0	0	0	0	0	0
14. Accts. Rec., Byproduc	0.0	0	0	0	0	0
15. Miscellaneous	5.0	1	2	3	4	5
Subtotal	2,610	653	914	1,305	1,958	2,610
Variable WC Entry by Period:		653	261	392	653	653
Recovery Value in Final Period:						2,610
FIXED ACCOUNTS:	(Independent of throughput)					
8. Office supplies inv.	2.0	2	2	2	2	2
9. Prepaid Ins. Premiums	0.2	0	0	0	0	0
10. Prepaid dues & fees	3.0	3	3	3	3	3
11. Amortized Org. Expens	3	3	3	3	3	3
16. Other _____	0	0	0	0	0	0
Subtotal	8	8	8	8	8	8
Fixed WC Entry by Period:		8	0	0	0	0
Recovery Value in Final Period:						8

TABLE 30

Worksheet for Computing Variable Wages and Salaries

Employee Benefit 12.00% Work Week: 40 hours

Employment Classification	Receiving & Conditioning	Material Storage	Material Processing	Handling, Marketing	Office & Administ.	All Functions
A. PERSON WEEKS/YEAR:						
1. Supervisory-1	0	0	0	0	10	10
2. Skilled-1	16	0	0	0	0	16
3. Skilled-2	0	0	0	0	15	15
4. Semiskilled-1	16	0	0	50	0	66
5. Semiskilled-2	25	25	100	0	0	150
6. Unskilled-1	16	0	0	0	25	41
7. Unskilled-2	100	0	100	250	0	450
8. Sack Handlers	192	0	0	0	0	192
9. Casuals-2	0	0	0	0	7	7
B. WAGE RATE PER HOUR:						
1. Supervisory-1	75.00	75.00	75.00	75.00	75.00	
2. Skilled-1	50.00	50.00	50.00	50.00	50.00	
3. Skilled-2	0.00	0.00	0.00	0.00	0.00	
4. Semiskilled-1	1.88	1.88	1.88	1.88	1.88	
5. Semiskilled-2	1.25	1.25	1.25	1.25	1.25	
6. Unskilled-1	0.94	0.94	0.94	0.94	0.94	
7. Unskilled-2	0.81	0.81	0.81	0.61	0.81	
8. Sack Handlers	5.00	0.00	0.00	0.00	0.00	
9. Casuals-2	0.00	0.00	0.00	0.00	0.00	
C. EARNINGS PER PERIOD:						
1. Supervisory-1	0	0	0	0	30,000	30,000
2. Skilled-1	32,000	0	0	0	0	32,000
3. Skilled-2	0	0	0	0	0	0
4. Semiskilled-1	1,200	0	0	3,750	0	4,950
5. Semiskilled-2	1,250	1,250	5,000	0	0	7,500
6. Unskilled-1	600	0	0	0	938	1,538
7. Unskilled-2	3,248	0	3,248	8,120	0	14,616
8. Sack Handlers	38,400	0	0	0	0	38,400
9. Casuals-2	0	0	0	0	0	0
TOTAL WAGES & SALARIES	76,698	1,250	8,248	11,870	30,938	129,004
D. EMPLOYEE BENEFITS:						
1. Supervisory-1	0	0	0	0	3,600	3,600
2. Skilled-1	3,840	0	0	0	0	3,840
3. Skilled-2	0	0	0	0	0	0
4. Semiskilled-1	144	0	0	450	0	594
5. Semiskilled-2	150	150	600	0	0	900
6. Unskilled-1	72	0	0	0	113	185
7. Unskilled-2	390	0	390	974	0	1,754
8. Casuals-1	4,608	0	0	0	0	4,608
9. Casuals-2	0	0	0	0	0	0
TOTAL EMPLOYEE BENEFITS	9,204	150	990	1,424	3,713	15,481

TABLE 31

Worksheet for Computing Fixed Administrative and Office Salaries

Fringe Benefit: 12.00% Work Weeks per Year 50

Employment Classification	Receiving & Conditioning	Material Storage	Material Processing	Handling, Marketing	Office & Administ.	All Functions
A. PERSON WEEKS/YEAR:						
1. Managerial-1	0.00	0.00	50.00	0.00	0.00	50.00
2. Managerial-2	0.00	0.00	0.00	25.00	25.00	50.00
3. Professional	0.00	0.00	0.00	50.00	0.00	50.00
4. Supervisory-1	0.00	0.00	0.00	0.00	0.00	0.00
5. Supervisory-2	0.00	0.00	0.00	0.00	0.00	0.00
6. Bookkeeping	0.00	0.00	0.00	0.00	100.00	100.00
7. Truck Drivers	64.00	0.00	0.00	68.00	0.00	132.00
B. ANNUAL BASE SALARY:						
1. Managerial-1	144,000	144,000	144,000	144,000	144,000	
2. Managerial-2	120,000	120,000	120,000	120,000	120,000	
3. Professional	96,000	96,000	96,000	96,000	96,000	
4. Supervisory-1	0	0	0	0	0	
5. Supervisory-2	0	0	0	0	0	
6. Bookkeeping	1,800	1,800	1,800	1,800	1,800	
7. Truck Drivers	6,000	0	0	6,000	0	
C. EARNINGS PER PERIOD:						
1. Managerial-1	0	0	144,000	0	0	144,000
2. Managerial-2	0	0	0	60,000	60,000	120,000
3. Professional	0	0	0	96,000	0	96,000
4. Supervisory-1	0	0	0	0	0	0
5. Supervisory-2	0	0	0	0	0	0
6. Bookkeeping	0	0	0	0	3,600	3,600
7. Truck Drivers	7,680	0	0	8,160	0	15,840
TOTAL ADM. PAYROLL	7,680	0	144,000	164,160	63,600	379,440
D. FRINGE BENEFITS:						
1. Managerial-1	0	0	17,280	0	0	17,280
2. Managerial-2	0	0	0	7,200	7,200	14,400
3. Professional	0	0	0	11,520	0	11,520
4. Supervisory-1	0	0	0	0	0	0
5. Supervisory-2	0	0	0	0	0	0
6. Bookkeeping	0	0	0	0	432	432
7. Truck Drivers	922	0	0	979	0	1,901
TOTAL FRINGE BENEFIT	922	0	17,280	19,699	7,632	45,533

TABLE 32

Worksheet for Computing Energy Use and Variable Cost

Level-off Period: 5 Months in Period: 12

Source of Energy	Receiving & Conditioning	Material Storage	Material Processing	Handling, Marketing	Office & Administ.	All Functions
A. ENERGY USE PER HOUR OR KM:						
1. Fuel, Generators	40.0	0.0	40.0	0.0	0.0	80.0
2. Fuel, Lg. Trucks	0.4	0.0	0.0	0.4	0.0	0.8
3. Fuel, Sm. Truck	0.4	0.0	0.0	0.4	0.0	0.8
B. HOURS OR KM OF USE PER PERIOD:						
1. Fuel, Generators	0	0	4,000	0	0	4,000
2. Fuel, Lg. Trucks	75,740	0	0	53,480	0	129,220
3. Fuel, Sm. Truck	10,400	0	0	0	0	10,400
C. COST PER UNIT:						
1. Fuel, Generators	2.000	2.000	2.000	2.000	2.000	
2. Fuel, Lg. Trucks	2.000	2.000	2.000	2.000	2.000	
3. Fuel, Sm. Truck	2.000	2.000	2.000	2.000	2.000	
D. TOTAL COST PER PERIOD:						
1. Fuel, Generators	0	0	320,000	0	0	320,000
2. Fuel, Lg. Trucks	60,592	0	0	42,784	0	103,376
3. Fuel, Sm. Truck	8,320	0	0	0	0	8,320
TOTAL ENERGY COST	88,912	0	320,000	42,784	0	431,696

TABLE 33

Worksheet for Computing Costs of Plant Supplies and Materials

Level-off Period: 5 Months in Period: 12

Type of Supply	Receiving & Conditioning	Material Storage	Material Processing	Handling, Marketing	Office & Administ.	All Functions
A. QUANTITIES OF PLANT SUPPLIES PER PERIOD:						
1. Packaging (000s)	0.0	0.0	0.0	6500.0	0.0	6500.0
2. Tags & labels (000s	0.0	0.0	0.0	0.0	0.0	0.0
3. Stitching (spools)	0.0	0.0	0.0	25.0	0.0	25.0
4. Sacks for bran	0.0	0.0	0.0	20000.0	0.0	20000.0
5. Fumigations	0.0	2.0	0.0	0.0	0.0	2.0
6. Insecticides (lbs)	0.0	0.0	0.0	0.0	0.0	0.0
7. Cleaners (boxes)	0.0	0.0	0.0	0.0	0.0	0.0
8. Tissues (gross)	0.0	0.0	0.0	0.0	0.0	0.0
9. Brooms & mops (doz)	0.0	0.0	0.0	0.0	0.0	0.0
10. Lubricants (kg)	0.0	0.0	0.0	250.0	0.0	250.0
11. Other _____	0.0	0.0	0.0	0.0	0.0	0.0
B. COST PER UNIT FOR PLANT SUPPLIES:						
1. Packaging (000s)	0.0	0.0	0.0	100.0	0.0	
2. Tags & labels (000s	0.0	0.0	0.0	0.0	0.0	
3. Stitching (spools)	0.0	0.0	0.0	27.5	0.0	
4. Sacks for bran	0.0	0.0	0.0	2.5	0.0	
5. Fumigations	0.0	5200.0	0.0	0.0	0.0	
6. Insecticides (lbs)	0.0	0.0	0.0	0.0	0.0	
7. Cleaners (boxes)	0.0	0.0	0.0	0.0	0.0	
8. Tissues (gross)	0.0	0.0	0.0	0.0	0.0	
9. Brooms & mops (doz)	0.0	0.0	0.0	0.0	0.0	
10. Lubricants (kg)	0.0	0.0	0.0	13.0	0.0	
11. Other _____	0.0	0.0	0.0	0.0	0.0	
C. PROJECTED COSTS PER PERIOD:						
1. Packaging (000s)	0	0	0	650,000	0	650,000
2. Tags & labels (000s	0	0	0	0	0	0
3. Stitching (spools)	0	0	0	688	0	688
4. Sacks for bran	0	0	0	50,000	0	50,000
5. Fumigations	0	10,400	0	0	0	10,400
6. Insecticides (lbs)	0	0	0	0	0	0
7. Cleaners (boxes)	0	0	0	0	0	0
8. Tissues (gross)	0	0	0	0	0	0
9. Brooms & mops (doz)	0	0	0	0	0	0
10. Lubricants (kg)	0	0	0	3,250	0	3,250
11. Other _____	0	0	0	0	0	0
PLANT SUPPLIES COST	0	10,400	0	703,938	0	714,338

TABLE 34

Worksheet for Computing Variable Cost for Spare Parts

Level-off Period: 5 Months in Period: 12

Type of Part	Receiving & Conditioning	Material Storage	Material Processing	Handling, Marketing	Office & Administ.	All Functions
A. QUANTITIES OF PARTS PER PERIOD:						
1. Belting (meters)	0.0	0.0	32.0	0.0	0.0	32.0
2. Chains (meters)	0.0	0.0	160.0	0.0	0.0	160.0
3. Polishing stone set	0.0	0.0	3.0	0.0	0.0	3.0
4. Rubber rollers	0.0	0.0	400.0	0.0	0.0	400.0
5. Values (grain flow)	0.0	0.0	14.7	0.0	0.0	14.7
6. Truck, 25 ton	63091.4	0.0	0.0	44548.8	0.0	107640.3
7. Tires, 25 ton	199953.6	0.0	0.0	141187.2	0.0	341140.8
8. Truck, 2 ton	2288.0	0.0	0.0	0.0	0.0	2288.0
9. Trucks, adminst.	0.0	0.0	0.0	0.0	10560.0	10560.0
10. Electrical (sets)	0.0	0.0	3.0	0.0	0.0	3.0
11. Bagger part	0.0	0.0	0.0	150.0	0.0	150.0
B. COST PER UNIT FOR PARTS:						
1. Belting (meters)	0.00	0.00	30.00	0.00	0.00	
2. Chains (meters)	0.00	0.00	24.00	0.00	0.00	
3. Polishing stone set	0.00	0.00	8000.00	0.00	0.00	
4. Rubber rollers	0.00	0.00	1200.00	0.00	0.00	
5. Values (grain flow)	0.00	0.00	240.00	0.00	0.00	
6. Truck, 25 ton	1.00	0.00	0.00	1.00	0.00	
7. Tires, 25 ton	1.00	0.00	0.00	1.00	0.00	
8. Truck, 2 ton	1.00	0.00	0.00	0.00	0.00	
9. Trucks, adminst.	0.00	0.00	0.00	0.00	1.00	
10. Electrical (sets)	0.00	0.00	120.00	0.00	0.00	
11. Bagger part	0.00	0.00	0.00	40.00	0.00	
C. PROJECTED COSTS PER PERIOD:						
1. Belting (meters)	0	0	960	0	0	960
2. Chains (meters)	0	0	3,840	0	0	3,840
3. Polishing stone set	0	0	24,000	0	0	24,000
4. Rubber rollers	0	0	480,000	0	0	480,000
5. Values (grain flow)	0	0	3,518	0	0	3,518
6. Truck, 25 ton	63,091	0	0	44,549	0	107,640
7. Tires, 25 ton	199,954	0	0	141,187	0	341,141
8. Truck, 2 ton	2,288	0	0	0	0	2,288
9. Trucks, adminst.	0	0	0	0	10,560	10,560
10. Electrical (sets)	0	0	360	0	0	360
11. Bagger part	0	0	0	6,000	0	6,000
TOTAL PARTS COST	265,333	0	512,678	191,736	10,560	980,307