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SRI LANKAN RICE INDUSTRY

Prospects and Opportunities

International Markets for Rice and the Export Potential for Sri Lankan Rice

Processing of Rice and Rice By-Products: Improvements and Possibilities

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

A. The World Rice Trade Outlook

Only 12 million tons, 5% of the world's milled rice, enters world trade. The world rice market is a thin, segmented, imperfect market in which governments are the key actors. Of the 11.6 million tons traded in 1982, 64% of the imports and 41% of the exports were done by governments. There are very distinct markets based on different rice types, qualities and methods of processing which preclude perfect substitution. Consumer preferences are so strong in some countries that consumers would refuse to eat rice other than that to which they are accustomed. If they change, they change only to variations within the preferred quality and type.

The major rices traded in world markets are of the "Japonica" and the "Indica" varieties. The former is found in Japan, Korea, Taiwan, parts of China, Australia, the Mediterranean, Brazil and California. Its demand is basically restricted to Korea and Indonesia. "Indica" varieties are the most important of the rices traded in parboiled or regular milled form, and the market is segmented as follows:

1) High quality parboiled rices are sold by the U.S. and Thailand, with the principal markets being Saudi Arabia and Nigeria.
2) Low quality parboiled rice is mostly exported by Pakistan and Burma, and there are just three markets: Bangladesh, Sri Lanka and Liberia.

3) High quality regular milled rice is sold principally by the U.S. and Thailand, to markets in Europe and West Asia. Basmati is a unique aromatic "Indica" rice, grown only in the Punjab, and sold at a premium to high quality long grain regular rice.

4) Medium quality long grain regular rice is principally exported by the U.S., Thailand and Pakistan, to markets in Indonesia, USSR, Brazil and Southeast Asia.

5) Low quality long grain regular rice is sold principally by Thailand, Burma and Pakistan, and the major markets are in West Africa.

Since the 1973/76 "world food crises," Asian countries have made determined efforts to achieve self-sufficiency in rice. They have been remarkably successful, and Asian imports of rice have gone down. The main elements of this increase in the production have been the accelerated dissemination of high yielding varieties (HYV), investment in water control, research, extension, credit, etc., but above all, in guaranteed and relatively high producer prices. In many countries, these producer prices are set above fob levels, to provide highly remunerative incentives for farmers to increase their marketable production. For obvious political and economic reasons, these prices are not amenable to downward movements.

The traditional importing countries have put more emphasis on raising rice production than have the traditional

rice exporters. India has moved from being the major importer to a major exporter. Korea and Indonesia are almost self-sufficient in years of good production, while Bangladesh is expected to achieve self-sufficiency in 1984/85 and Sri Lanka within a few years. In the meanwhile, Asian exporters have stepped up their export capacities: Thailand has doubled its exports in the past decade, to 3-3.5 million tons; Pakistan, Burma, China, Taiwan and India have exported about 1 million tons each. Taiwan, like Japan, exports at a loss, since domestic prices are 2-3 times the world levels, and these high prices are the basis of its rural development and urban-rural income equalization policies.

The success of the Asian countries' production policies was tested in 1982-83, when monsoon Asia sufferred its worst weather in a decade. Despite a fall in production, a 24% rise in imports, and shipment of 3 million tons to the new past 1973 markets emerging in West Asia and West Africa, international rice prices dropped. Currently, Thai 5% is selling for less than $260 fob, and cheap rice (25% - 35% brokens) is quoted c & f for the same price per ton as wheat.

The rice trade is a highly competitive business, and likely to get even more intense in the coming decade as exportable surpluses increase in monsoon Asia. The trade is tightly controlled by a small group of well-established traders, with close connections to the major importing and

exporting countries' governments. Entry costs to a new supplier are extremely high, and there is immense competition from existing exporters.

If Sri Lanka ever finds itself in a position of having consistent surpluses, over and above buffer and emergency stocks, she will not be able to export this rice at remunerative prices. She is a high cost producer of non-exportable quality rice. To develop varieties that are of export grade will take many years, and there is no assured market for the farmer to grow this rice, unless they are heavily subsidized. Even if the varieties are forthcoming, the milling industry has to be vastly improved, and major investments will be needed for an export oriented infrastructure.

During the course of this decade, even as Sri Lanka approaches self-sufficiency and investments flow into better milling and marketing infrastructure, the established exporting nations will be moving ahead and tightening their hold on the world market, which in total volume has remained stagnant for the past five years, and shows little sign of growth. In particular Pakistan and Burma would be Sri Lanka's competition, and the comparative advantage in rice production lies with them. While the current guaranteed price for paddy in Sri Lanka is Rs. 62.50 per bu, Burmese mills pay an equivalent of Rs 25.00 per bu. While the average Sri Lankan paddy is about the lowest quality grade in Asia, the Burmese paddy is the well known Emata type, of export

quality, and processed by mills that have their own docks and have been in the export business for years. Similarly, in Pakistan, the Rice Export Corporation buys average quality rice for export at an equivalent of Rs. 3.80 per kg, compared to Rs. 5.41 per kg for the cheapest rice on the Colombo wholesale market in September 1983, for parboiled Grade II. Despite these low prices, Burmese and Pakistani farmers still find them profitable, and rice production in both countries is expanding faster than consumption. While Sri Lanka has to spend up to Rs. 200,000 per ha to develop new land, in Burma and Pakistan there is much under-utilized irrigated land, and increases in production in these countries can come from greater use of HYV, which costs very little in economic terms relative to investment in additional irrigation.

Sri Lanka will not be able to export its rice in the foreseable future - it has neither the right varieties nor the natural endowment for economic production. Production should not exceed self-sufficiency levels, and this balance can be maintained by both expanding domestic consumption and by reducing the area under rice. Sri Lanka's per capita rice consumption is very low by Asian standards (e.g. about 100 Kg, against 155 Kgs in Bangladesh), so there is considerable potential for domestic consumption to increase, particularly if consumers had access to more rice of better quality at prevailing prices through a general upgrading of

domestic output. If production still gets ahead of consumption growth, well-drained irrigated land under paddy should be allowed to move to other more renumerative crops.

b. Improvements in Rice Processing

When paddy is milled, the highest value product is whole grain white rice. All other products and by-products, such as brokens, husk and bran, have lower value, in terms of Rs per ton.

Sri Lanka's milling sector can be described as a low quality, low technology industry, operating with a great deal of waste. Because it is just emerging from decades of control that encouraged the lowest standards of milling, the industry needs investment and technology to enhance value added and reduce waste. The prerequisite to the needed investment flow are better milling margins, and open operation of market forces. Currently, many mills depend on quota milling for the PMB, whose charges for the private sector are much lower than its own actual costs, and this unfairly suppresses milling margins.

Those millers not depending on milling for the PMB (Paddy Marketi Board) are responding to market forces, and want to improve the quality of their milled products. They can increase quality, and revenue, by pre-cleaning paddy before milling, and by proper attention to fundamental principles to avoid discoloration and over-cooking in parboiling. The investment needed per mill can be recovered within a season.

Husk is a very useful fuel, but not fully utilized in Sri Lanka. Large parboiling mills use husk to fuel their single-pass boilers, but these produce only 1 Kg of steam from 3 Kgs of husk. Modern triple-pass boilers are nine times as efficient, generating 3 Kgs of steam per one Kg of husk, i.e., one ton of husk gives the same amount of usable steam energy as 328 liters of fuel oil, that is worth Rs. 1,575. Larger water-tube boilers can also produce electricity in addition to steam, with one Kg of husk producing 0.5 kwh of electricity and up to 5 Kgs of steam. The ash from these boilers is also exportable, currently valued at Rs. 5000 per ton c & f European steel mills. It is used as an insulator for molten steel in continuous casting mills. The investment costs in modern husk-fired equipment, to produce process steam and electricity, is recoverable in less than a year, assuming continuous operation.

Good quality bran from parboiling mills is currently sold to poultry operations for Rs 2 per Kg; this is its highest value. Bran, which is 16% oil, can also be processed in solvent extraction plants to yield edible oil. However, the costs of processing probably exceed the returns. Much bran, particularly from raw millers, sells for a lower value, Rs. 1 per Kg, because it is not stabilized (treated with moist heat for a while, like parboiling), and thus goes rancid rapidly, which makes it good only for soap making. Also,

half the total bran is completely lost, as half the country's paddy is milled in old hullers, which mix the bran and husk completely, producing a mix that is it unfit for any commercial use.

Brokens, which sell for 70% of the value of whole grain rice, can be used for poultry rations if not sold for human consumption. In feed value they are almost as good as maize. The only other use, 2000 tons or so at most, is as by-product for beer and potable alcohol production.

C. Recommendations

Export Prospects

For the forseable future, i.e., for the next ten years, there are just no prospects of Sri Lanka being even a minor rice exporter, able to ship even one or two 10,000-ton shiploads. Local rice varieties are not suitable for export, and the milling industry is not technologically capable of producing rice that meets the minimum acceptable quality demanded by the international trade. It will take at least a decade for the rice breeders to develop suitable varieties, for the farmers to grow sufficient volumes and the best millers to upgrade their techniques sufficiently.

Furthermore, the international rice trade is expected to remain stagnant, while countries already in the exporting trade are projected to increase their exportable surpluses. With the exception of the city state, all Asian rice importers are likely to achieve technical self-sufficiency before or at the same time as Sri Lanka. In the meanwhile,

the major rice exporter will be able to mill and sell their rice at fob prices well below those prevailing for non-export grades of rice in the Colombo wholesale market. The medium term option for the Sri Lanka rice industry is to increase domestic consumption and improve its milling technology to maximize value added and profitability.

Rice Processing

To improve milling, it is recommended that PMB raise its payments to private mills engaged in local milling to equal the true milling costs incurred by the PMB itself. Government, through its existing industrial development programs, should make more credit available to millers to invest in new equipment, much of it already locally manufactured, that will produce better quality rice. To help millers improve their mill-level technology, it is recommended that GOSL consider engaging an experienced miller, with previous high-level agro-industry management experience, on a long-term assignment to advise the PMB and private mills.

Government can also accelerate the economic use of husk by encouraging decentralized generation of electricity by the private sector, using modern boiler technology. Here, CEB (Ceylon Electricity Board) involvement is essential, as a purchaser of power at reasonable prices that would reflect its avoided cost. In this way, CEB will be utilizing domestic renewable energy in place of imported oil without incurring much capital investment on its own account.

SECTION 1

I. THE INTERNATIONAL MARKET FOR RICE [1/]

A. Market Overview

The world rice market is a thin, segmented, imperfect market in which governments are the key actors. Most of the rice moving in world commerce is normally fully milled and bagged. Total annual world rice production in recent years has exceeded 400 million tons paddy, 90% of which is grown in monsoon Asia. However, only about 12 million tons of rice, 5% of milled production, is traded internationally. Because rice is grown as a subsistence crop in most countries, production shortfalls or surpluses are somewhat tempered by changes in on-farm consumption. In addition, changes in stocking levels at both the farm and the national levels absorb some of the variations in production.

With such a relatively small amount of rice entering world channels, a significant production variation in one or two important countries had a substantial impact on world demand and consequently on world prices up to 1982.

Most of the rice traded in the international market is done in ship lots of about 10,000 tons each and through direct negotiations, rather than tenders. In addition, most export sales of rice are done on an fob basis. As is the

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1/ This section to page 13 is taken almost in its entirety from an unpublished and undated paper written by Dr. Tom Slayton, the USDA's rice expert, titled "The World Rice Market; A Primer on its Structure and Workings." Slight changes have been made in the order of some paragraphs. Dr. Slayton's permission to use his paper is greatly appreciated.

case in the domestic markets, on the international level the pervasive role of government trading is apparent. Of the estimated 11.6 million tons of rice traded in 1982, 7.4 million tons or 64% were imported by governments. Other imports and exports are also subject to licensing, quotas and other forms of government control. In addition, there is a growing usage of government-to-government contracts.

B. Market Segmentation

While approximately 12 million tons are traded annually, there are very distinct markets based on different rice types, qualities, and methods of processing which preclude perfect subtitution. In fact, consumer preferences are so strong in some countries that consumers would refuse to eat rice other than that to which they are accustomed. This phenomenon results in rice prices of different types/qualities moving somewhat independently of each other, based on the supply-demand factors for the individual market segment.

In the world market, considerable emphasis is placed on grain length (long, medium, and short) and on the percentage of broken kernels as criteria of quality. In addition, the kernel shape (length/breadth, e.g. slender, medium, bold, and short), the chalkiness, and translucency are considered. The absence of chalkiness and high translucency in the rice endosperm are quality characteristics associated with good grain appearance. Uniformity of quality is important to rice traders and buyers.

C. Types of Rice and Trade Flows

Only small amounts of paddy are traded internationally because the relative value of the rice hulls does not make it economical to ship long distances in this form.[2/] While accurate data is not available, only about 1.0-1.5 million tons of brown rice are traded annually, usually in bulk form. The principal brown rice markets are South Korea, Portugal, the European Community, Canada and South Africa. The latter three markets import principally parboiled brown rice.

There are basically four types of rice: glutinous, aromatic, Japonica, and Indica. The tenderness and stickiness of cooked rice are inversely correlated with the amylose content of the starch.

"Glutinous" rice (also known as waxy or sweet rice) has very low amylose content. When cooked it forms a gelatine-like mass without distinct grain separation. Most rice consuming areas in Asia produce small amounts of glutinous rice for use in desserts, ceremonial foods and sweet dishes. In northeast Thailand and Laos, however, it is the staple food. Usually less than 100,000 tons of glutinous rice is traded (principally by Thailand). It is usually sold at a

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2/ This may change in the future as new technology permits efficient conversion of husk into energy, with 3 kgs. of husk giving the same energy as 1 kg. of oil in special steam boilers. Larger shipments of paddy can then be transported in bulk, which is cheaper than shipping milled rice in bags.

discount to non-glutinous rice with the same amount of brokens. Indonesia, Laos, Japan and China are the principal importers of glutinous rice.

Most scented or "aromatic" rice is grown in the Punjab area of Central Pakistan and Northern India and is called basmati rice. (Small quantities of aromatic or "fragrant" rice are also grown in Thailand and sold principally to Hong Kong and Singapore.) The volume traded is limited to about 300-400,000 tons annually and this rice is sold at prices roughly double that of high quality long grain rice. When cooked, basmati rice grains elongate to about twice their original size and remain completely separate.

"Japonica" type rice, having a fairly low amylose content, is semi-sticky and moist when cooked. Japonica type rice is a round shaped grain which is found in Japan, the Koreas, Taiwan, part of China, Australia, the Mediterranean area, Brazil and California. Because of its cooking characteristics, the demand for this type of rice is relatively limited, with Indonesia and South Korea the principal importers. A significant quantity of Japonica rice must usually be exported to what are normally Indica markets. As a result, it normally sells at a discount to Indica rice. The amount of Japonica rice trade internationally has varied widely in recent years, but has averaged about 1.5 million tons annually.

"Indica" type rice is the long grain rice that dominates world trade. It is grown principally in China, South and

Southeast Asia, and the Southern U.S. With an intermediate to high amylose content, Indica type rice cooks fluffy, and shows high volume expansion and grain separation. Broadly speaking, the world market in milled long grain rice or Indica rice can be divided into parboiled and regular milled. It can further be divided as high (less than 10% brokens), medium (10-20% brokens), and low (more than 20% brokens) quality based on the brokens content (a number of countries, of course, import/export a mix of rice qualities). Just as there is only limited substitution between Japonica and Indica rice in countries where rice is the staple, so too is there very limited substitution between regular milled and parboiled rice.

Milled parboiled rice is traded in two distinct markets depending on the quality of the product. Low quality parboiled rice has, in addition to high number of brokens and foreign matter, a dark color and a strong odor, and is exported principally by Burma and Thailand. The most important importers are Bangladesh, Sri Lanka and Liberia. Low quality parboiled rice sells at about the price of broken regular milled rice. High quality parboiled rice has a yellow tinge. The U.S., Thailand and Italy are the principal producers of high quality, non-smell parboiled rice and Saudi Arabia and Nigeria are the largest importers. In addition, as indicated earlier, the European Community, Canada and South

Africa import significant quantities of high quality brown parboiled rice. In the U.S. high quality parboiled rice usually sells at a premium to high quality regular milled rice. In Thailand the reverse is true with parboiled 5% (non-smell) selling at a discount to regular milled 5%.

High quality regular milled long grain. The U.S. and Thailand are the principal exporters and the most often cited benchmarks are U.S. No. 2/4% long grain and the Thai 100% B. Significant amounts of consumer demand exists in the U.S., Western Europe, Uruguay and Argentina for this quality of rice. In the Middle East, the principal markets are Iran and Iraq. Although most consumers in Southeast Asia prefer high quality long grain rice, only Malaysia, Singapore and Hong Kong are significant buyers.

Medium quality regular milled long grain. The U.S., Thailand, and Pakistan are the principal exporters. The USSR, Brazil, Hong Kong, Malaysia, and Indonesia are the principal importers of this quality of rice.

Low quality regular milled long grain. The principal exporters of low quality rice are Thailand, Pakistan, and Burma. Indonesia is the largest single importer of this quality of rice, and most of West Africa also imports this quality rice.

Brokens are usually considered the lowest quality of raw-milled rice. Brokens are purchased by countries which have either a history of milling rice by hand pounding or by

those with a severely constrained foreign exchange position. (In addition, brokens are used in the brewing industries in many countries.) The principal exporters of brokens are Thailand and Burma and the largest buyers in recent years have been Senegal (where brokens are preferred), Madagascar, Mauritius and Gambia. Besides the biometric difference, brokens traded in the market must have the same physical characteristics as the quality full grain rice. There is no market for brokens that are also chalky of bad odor, or discolored, as found in Sri Lanka.

D. Importing Countries

The ten largest rice importers annually took in between 4.4 and 7.2 million tons during the last 5 years, or 38-50% of the rice traded. Rice import demand in the 1970's became increasingly dispersed as a result of rising consumption in West Africa and the Middle East, and stagnating demand, as a result of the spread of high yielding varieties (HYVs), in Asian countries. Ten years ago all 10 of the world's largest rice importers were Asian countries, and these accounted for 60% of the import volume. Within the last ten years, there has been a marked variation in the levels of imports of the major buyers. India changed from a major importer to an exporter, Vietnam from an exporter to an importer, and Indonesia has emerged as the largest importer. Table 1 lists the principal importing and exporting countries, and the estimated volumes involved, for the period 1980-84. The

TABLE 1

WORLD RICE TRADE
CAL YEAR 1980 TO 1984
(IN THOUSANDS OF METRIC TONS)

	CAL YR 1980	CAL YR 1981	CAL YR 1982	CAL 1983 JUNE15	CAL 1983 JULY14	CAL 1984 JULY14
EXPORTS						
UNITED STATES	2977	3008	2487	2300	2200	2200
ARGENTINA	107	110	125	75	75	120
AUSTRALIA	321	335	530	375	300	350
BURMA	675	674	713	800	800	900
CHINA, MAINL.	1116	583	470	1000	900	900
CHINA, TAIWAN	261	92	307	850	900	500
EC-10	804	785	612	871	871	880
EGYPT	178	134	25	24	35	35
GUYANA	81	78	36	50	50	75
INDIA	501	1031	586	250	250	250
JAPAN	653	795	318	400	400	250
KOREA, N.	284	200	250	300	300	300
NEPAL	10	43	50	0	0	50
PAKISTAN	968	1127	794	1175	1250	1200
PHILIPPINES	231	83	0	100	100	50
THAILAND	2700	3049	3620	3500	3500	3200
URUGUAY	165	220	217	240	165	225
SUBTOTAL	12032	12347	11140	12310	12096	11485
OTHER COUNTIES	543	598	411	479	551	406
WORLD TOTAL	12575	12945	11551	12789	12647	11891
IMPORTS						
BANGLADESH	168	34	415	100	100	100
BRAZIL	239	142	124	400	400	350
CANADA	95	105	108	115	115	120
CHINA, MAINL.	18	110	250	100	150	100
CUBA	224	200	200	200	200	200
EAST EUROPE	332	352	295	344	314	317
EC-10	889	1277	1046	1007	967	1025
HONG KONG	359	360	353	350	350	350
INDONESIA	2040	543	332	2000	2000	1500
IRAQ	379	350	369	475	475	400
IRAN	507	583	475	650	650	650
IVORY COAST	257	335	363	400	375	350
KOREA, S.	822	2292	228	221	221	100
KUWAIT	85	95	100	110	110	110
MALAGASY	177	193	357	250	250	250
MALAYSIA	167	267	392	350	300	300
MEXICO	128	66	16	20	0	50
NIGERIA	404	662	651	650	600	700
PERU	251	103	63	150	150	170
PORTUGAL	20	128	110	125	100	100
SAUDI ARABIA	356	427	480	500	500	500
SENEGAL	304	340	357	425	425	400
SINGAPORE	187	178	192	175	160	175
SOUTH AFRICA	126	134	146	128	135	140
SRI LANKA	189	168	186	160	120	100
SYRIA	39	72	110	110	110	110
U.A. EMIRATES	441	285	170	175	175	175
U.S.S.R.	694	1283	750	500	500	750
VIET NAM, SOC. REP.	135	140	130	100	75	100
SUBTOTAL	10032	11225	8768	10290	10027	9692
OTHER COUNTRIES	2124	2174	2153	2342	2609	2155
UNACCOUNTED 1)	419	-454	630	157	11	44
WORLD TOTAL	12575	12945	11551	12789	12647	11891

1) THIS REPRESENTS EXPORTS NOT ACCOUNTED FOR IN REPORTS FROM IMPORTING COUNTRIES. SINCE THIS IS RECURRING IT IS TAKEN INTO ACCOUNT IN THE ASSESSMENT OF THE YEAR AHEAD.

SOURCE: PREPARED OR ESTIMATED ON THE BASIS OF OFFICIAL STATISTICS OF FOREIGN GOVERNMENTS, OTHER FOREIGN SOURCE MATERIALS, REPORTS OF U.S. AGRICULTURAL ATTACHES AND FOREIGN SERVICE OFFICERS, RESULTS OF OFFICE RESEARCH, AND RELATED INFORMATION.

COMMODITY PROGRAMS, FAS, USDA

Source: USDA Foreign Agricultural Circular, Grains. June 24, 1983

major importer in 1983 will be Indonesia with 2.0 million tons, although in 1982 it ranked 13th with 332,000 tons. The second largest importer will be the EEC, with 967,000 tons, followed by Iran, Saudi Arabia, the USSR and Iraq. South Korea, which was the largest importer in 1981, with 2.3 million tons (17.6% of all 1981 traded rice), is expected to need only 221,000 tons in 1983, down 96% from the year before.

E. Exporting Countries:

From Table 1, it can be seen that five countries dominate the exporting group - Thailand, U.S., Pakistan, China and Burma. In particular Thailand and the U.S. accounted for nearly half of all exports in the period 1980-83. India, which exported over 1.0 million tons in 1981, is expected to drop to 250,000 tons in 1983. Taiwan has gone from 92,000 tons to 900,000 tons in the same period, with its estimated 1983 exports equal to those of China.

F. Supply and Demand Projections:

The traditional rice exporters' comparative advantage in production rested on their large, flat river deltas that simplify planting. Modern technology, centered on the HYVs, requires good water control, and this happens to favor the environment of the traditional Asian importing countries[3/],

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3/ Amman Siamwalla and Stephen Haykin, "The World Rice Trade: Structure, Conduct and Performance." IFPRI, June, 1983.

who have made irrigation development the keystone of their major agricultural investment programmes. The process actually started in Japan nearly 100 years ago, followed by Korea and Taiwan in the 1920s. These countries were the pioneers of advanced rice technology and they were rather belatedly followed by the rest of Asia from the 1960s onward. The traditional exporters were the last to adopt HYVs; not until the late 1970's did Burma launch a concentrated program to adopt the new technology, while Thailand is still ambivalent about promoting higher yields per se on the same intensive lineas its neighbors.[4/] Table 2 gives the rate of progress in the adoption of HYVs in Asia in the decade 1966-1977, and Table 3 shows the share of total area sown under HYVs in 1973-75.

Table 3 also indicates the potential for increased productivity. While a decade ago Sri Lanka and the Philippine already had over 60% of their total paddy areas sown with HYVs, Burma and Thailand had just 6% and 7% respectively. Even South Korea and Pakistan with 92% and 100% of their rice areas already under irrigation, had respectively just 26% and 39% of this area under HYVs.

A more detailed discussion on the projection of increased rice production in the individual countries is given in the following chapter. The general impression of those studying

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4/ Siamwalla and Haykin, ibid., p. 20.

TABLE 2

AREA PLANTED TO MODERN VARIETIES OF RICE IN ASIA, 1965-1978

Country	1965/66	1966/67	1967/68	1968/69	1969/70	1970/71	1971/72	1972/73	1973/74	1974/75	1975/76	1976/77	1977/78	1978/79
						(000 ha)								
South Asia	7.1	888.7	1856.2	3192.7	5095.0	6563.0	8704.0	10288.1	12476.4	13428.8	15506.7	N.A.	N.A.	
India	7.1	888.4	1785.0	2681.0	4253.6	5454.0	7199.4	8167.4	9717.5	10779.6	12742.0	13731.0	15516.0	17619.0
Bangladesh	-	0.2	67.2	154.2	263.9	460.1	623.6	1064.4	1548.8	1443.6	1552.0	1280.0	1201.9	
Nepal	-	-	-	42.5	49.8	67.8	81.6	177.3	205.1	222.6	216.4	220.3	N.A.	
Pakistan	-	0.1	4.0	308.0	501.4	550.4	728.5	647.1	636.6	630.9	665.3	677.9	N.A.	
Sri Lanka	-	-	-	7.0	26.3	30.7	70.9	231.9	368.4	352.1	331.0	N.A.	N.A.	
Southeast Asia	42.3	145.3	797.3	1854.7	2669.3	3409.1	4346.2	5204.3	N.A.	N.A.	N.A.	N.A.	N.A.	
Burma	-	-	3.4	-166.9	143.0	190.9	185.1	199.2	247.6	309.9	320.9	349.0	N.A.	
Indonesia	-	-	-	198.0	831.0	902.6	1332.9	1928.0	3100.8	3440.0	2633.8	3428.9	N.A.	
Laos	-	0.4	1.2	2.0	2.0	53.6	30.0	50.0	N.A.	N.A.	N.A.	N.A.	N.A.	
Malaysia (Penin)	42.3	62.7	90.7	96.1	132.4	164.6	197.4	212.2	217.0	213.2	222.3	N.A.	N.A.	
Philippines	-	82.6	701.5	1351.7	1353.9	1565.4	1826.8	1679.9	2176.6	2175.0	2299.7	2416.7	2446.8	
Thailand	-	-	-	-	3.0	30.0	100.0	300.0	400.0	450.0	600.0	960.0	N.A.	
Vietnam (South)	-	-	0.5	40.0	204.0	503.0	674.0	835.0	890.0	900.0	N.A.	N.A.	N.A.	
East Asia														
Korea Rep.	-	-	-	-	-	-	2.7	187.5	139.0	306.9	274.0	533.0	660.0	
Total Asia	49.4	1034.4	2653.5	5047.4	7764.3	9972.1	13050.2	15492.4	N.A.	N.A.	N.A.	N.A.	N.A.	

N.A. - data not available

Source: D. Dalrymple, Development and Spread of High Yielding Varieties of Wheat and Rice in the Less Developed Nations, September 1978.
For the Philippines: BAECON Statistics Division
For India - 1978/79 - Directorate of Economics and Statistics, Ministry of Agriculture.
For Bangladesh - 1976/77-1977/78 - Bangladesh Bureau of Statistics, 1979 Statistical Yearbook of Bangladesh.

World Bank Rice Handbook February 1981

TABLE 3

Share of total area of rice sown with high-yielding varieties (HYVs), irrigated and shallow rainfed, selected Asian countries, 1973-75

Country	Total Area Irrigated	Total Area Irrigated or Shallow Rainfed	Total Area Sown with HYVs
		(percent)	
Traditional importers			
Bangladesh	11	33	15
India	39	72	28
Indonesia	39	59	40
Malaysia	63	88	38
Philippines	40	96	62
Sri Lanka	50	83	67
Traditional exporters			
Burma	16	96	6
Nepal	17	92	18
Thailand	24	49	7
Vietnam	13	70	30[a]
Others			
China, People's Republic of	90	98	n.a.
Japan	96	96	n.a.
Korea, Republic of	92	100	26
Pakistan	100	100	39

Sources: Columns 1 and 2: Randolph Barker and R. W. Herdt, *Rainfed Lowland Rice as a Research Priority—An Economist's View* Research Paper 26 (Los Baños: International Rice Research Institute, 1979), Appendix Table 1, p. 34 Column 3. Adelita C. Palacpac, *World Rice Statistics* (Los Baños: IRRI, 1978), Table 13, p 40.

Notes: Shallow rainfed area is that having a maximum water depth of 5-15 centimeters Percentages for total area sown with HYVs are for 1974/75. n.a. means not applicable.

[a] This figure is for South Vietnam only.

From Ammar Siamwalla and Stephen Haykin "The World Rice Market: Structure, Conduct, and Performance". IFPRI June 1983.

production trends in the World Bank, USDA, IFPRI and FAO is that the world rice production is likely to maintain steady growth in the next 10 years but with annual world trade stagnating in the 10-12 million tons range (i.e., a progressively smaller share of total production). Major Asian importers are likely to meet self-sufficiency goals, despite rising consumption through population and income growth. The only growing import markets are anticipated to be in the Middle East and Africa, but to a point, with the former constrained by the small size of the population and the latter by inability to pay for ever increasing imports.

The adoption of HYVs has involved enormous investment by farmers and governments in water control, research, extension price supports, and the related fields. These efforts have paid off; for example, Thailand doubled its production in 1961-82 although the area expanded by only a third and there was no emphasis on HYV technology. Crucial to understanding why rice production increased in Asia is the macroeconomic policy setting which has changed radically in the past ten years. Previously, nearly all Asian governments exploited their agricultural sectors, of which rice is by far the largest component, through price policies geared to providing cheap food for urban consumers at the expense of the rural rice producers. Imports were encouraged at the expense of local producers by over-valued exchange rates and even subsidies, as used to happen in Sri Lanka. Faced with

such adverse domestic terms of trade, farmers in most countries could not increase production in line with demand, except in the low-cost areas such as Thailand. However, since the early 1960s, and particularly after the 1973-75 "food shortage crises", nearly all Asian countries (Sri Lanka and Bangladesh being the last) have reversed these price policies, to enhance food production and rural income through higher producer prices, i.e., changing the domestic terms of trade to now favour rural producers. Farmers have reacted positively by expanding marketed output, and self-sufficiency goals are being met. Thus overall production is keeping up with demand that is growing through population growth, and in Southeast Asia with rapidly rising incomes as well. Consequently, an already thin international market is becoming an even more reduced market, with international prices below the levels of most domestic support prices in the majority of countries. Traditional exporters already have difficulty in getting rid of their surpluses, even in 1982/83, when the monsoon was the worst since 1973-75. As the momentum of production continues in the 1980s, larger surpluses are inevitable, and competition for markets will intesify, involving more discounts, concessionary financing, barter and grants.

G. Prices

Given the above, the forecast is for more stability in international market prices, implying static to declining real prices of traded rice. The World Bank's fob projection

for Thai 5%, at constant 1981 prices, is $326 per ton in 1985, compared to the 1960-70 average price of $525 per ton. In current dollars Thai 5% has dropped from an average of $477 per ton fob in 1980/81 to $272 per ton in 1982/83.[5/] In June 1982 Thai 5% parboiled fob was posted at $255 per ton with actual prices $10 less, and Thai 25% broken was quoted at $222 per ton fob. Bearing in mind that the 1982 monsoon was the worst since 1973-74, with output in Asia 1982/83 down 10 million tons from 1981/82 and import requirements for 1983 up 20% on 1982 (USDA estimates), this decline in Thai prices is very indicative of future trends. Ominously, low quality rice is currently selling for about the same price per ton as wheat on c & f basis; according to USDA, Sri Lanka purchased 60,000 tons of US wheat in June 1983 at $147 per ton fas, or about $190 c & f, while USDA reports that India is importing Burmese and Thai rice, 25-35% broken, for under $200 per ton, c & f.[6/]

5/ World Bank, "Half-Yearly Revision of Commodity Price Forecasts." June, 1983. The July posted price was $260 per ton. For other prices, see Tables 6 and 7.

6/ In December, 1982, the private sector in Colombo apparently paid $190 c & f for 25,000 tons, whereas the Food Commissioner paid an average $180 fob in 1982 for 161,000 tons.

II. CHARACTERISTICS OF RICE IMPORTING COUNTRIES

A. Indonesia

Rice production in Indonesia grew from 15.1 million tons in 1975 to 23.1 million tons in 1982, an increase of 53%. In the same period consumption grew 38% from 16.9 million tons to 23.3 million tons. Although in the late 1970's production stagnated because of pests and disease problems, the growth rate since 1980 has gone up with the introduction of new varieties and the expansion of irrigation. The strength of this progress was tested in 1982 when, despite a drought in the main November-March season, average 1982 yields were 17% higher than in 1980, and production reached a record of 23.1 million tons. Drought also hit in early 1983, again during the main crop season, but production is estimated to be down just 4%. These two consecutive droughts did increase Indonesia's import needs from 332,000 tons in 1982 to an estimated 2.0 million tons for 1983, and a projected 1.5 million tons in 1984. Thus a 5% shift in production can effect 70-80% of the volume of current imports, so a resumption of normal weather in 1984 and 1985 will permit Indonesia to reduce imports to the minimum.

All imports are done by the Government agency BULOG, free of duty. BULOG imports not only to meet gross production-consumption deficits but also to maintain stable low prices for consumers in Jakarta. BULOG has diverse sources of supply, but the main suppliers have been Thailand, U.S. and

Burma, China, North Korea and Japan. The Indonesian trade is very well established and tightly controlled, principally by Chinese firms based in Hong Kong, Bangkok and Singapore, with the U.S. grain trading multinationals in second place. The types imported are medium and low quality regular milled long grain rice, Japonicas and some glutinous.

B. South Korea

Korean production peaked at 6.0 million tons in 1978 when the country touched self-sufficiency. But weather, disease and pest problems reduced production 33% to 4.0 million tons in 1981, necessitating imports of 2.2 million tons. In 1982, despite drought, production was 5.1 million tons and imports dropped to 550,000 tons. With the same land area as Sri Lanka, but two and a half times the population and just one growing season, Korea has limited capacity for growing paddy; just 1.2 million ha. All of it is now irrigated and producing high yields, over 4 tons per ha. on average. Further yield increases are possible, since only 50% of the area is sown to HYV (although traditional varieties give good yields, too), and producers have the incentives, given a guaranteed price equal to U.S. $950 per ton for Grade II brown rice in 1983, about equal to Rs. 23 per kg.7/

7/ USDA Foreign Agricultural Service Personnel Communication from Dr. Tom Slayton.

All importing is done by government, both to bridge local deficits and stabilize price movements. Profits on sale of imported rice go some way to cover the losses on the government's rice operations since storage costs are not passed on to consumers. Imports are primarily from the U.S., followed by Thailand and Japan.

C. Bangladesh

During the period 1973-81, Bangladesh's average annual imports were 80% of Sri Lanka's, but more volatile; some 60-80,000 tons in good years, but up to 720,000 tons in bad years like 1979. Imports in 1981 were just 34,000 tons, but rose to 415,000 tons in 1982 when there was a bad drought. Imports are expected to drop down to 100,000 tons in both 1983 and 1984, and by 1985, Bangladesh should technically be self-sufficient, assuming good weather. Like Sri Lankans, Bangladesh imports parboiled rice.

Historically 85% of Bangladesh's food imports come under concessional terms, with the U.S. and Japan the main sources. Government imports the rice with the primary object of providing rations to supplement civil servants' salaries, and then to supply low cost rice to the cities.8/

The estimated production for 1982/83 is 14.17 million tons, rising to 14.5 million in 1983/84, i.e., about ten

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8/ USDA, ERS. South Asia Review of 1982 and Outlook for 1983. August. 1983.

times Sri Lanka's level, though for a population only seven times as big.[9/] Of all the major Asian food importers, Bangladesh was the last to begin reversing price policies that penalized rice producers; not until 1982 did the government's sale price of coarse rice exceed the official procurement price. Currently, the coarse rice procurement price is about $244 equivalent per ton, equal to Rs. 5.95 per kg.[10/], and this is expected to have a very positive effect on production. Potential growth, given continued profitable producer margins, is good; even now only 18% of the area sown to rice is under HYVs and average yields are only 2.0 tons on 10.3 million ha. Even when Bangladesh reaches technical self-sufficiency by the mid 1980's, its government may probably continue to import about 300,000 tons per year, under concessional terms, in order to maintain its cheap supply of wages for civil servants.

D. Other Major Asian Importers

Vietnam, which was a major rice importer in the past two decades, re-emerged onto the export market in 1982 as a supplier of some 150,000 tons of high quality rice, which it

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9/ In 1977, per capita consumption in Bangladesh was 155 kgs., the third highest in the world (See Table 4). Proportionally, there is more good quality rice available to consumers in Bangladesh than in Sri Lanka.

10/ Equal to Samba III at the Colombo wholesale market at the end of August, 1983 (See Table 5).

TABLE 4

WORLD RICE CONSUMPTION PER CAPITA

Kg/Capita

Countries	1966	1970	1975	1977	1978
U.S.A.	6.0	6.0	6.0	6.0	8.0
Japan	117.0	112.0	96.0	88.0	86.0
France	3.0	3.0	3.0	4.0	3.0
Italy	3.0	6.0	5.0	6.0	7.0
Canada	2.0	2.0	3.0	4.0	4.0
Chile	10.0	10.0	6.0	7.0	7.0
Bangladesh	162.0	169.0	163.0	158.0	155.0
Brazil	54.0	48.0	45.0	48.0	48.0
Colombia	25.0	20.0	33.0	35.0	44.0
Turkey	4.0	4.0	5.0	4.0	5.0
Iran	29.0	27.0	33.0	36.0	36.0
India	65.0	76.0	71.0	77.0	76.0
Pakistan	22.0	33.0	28.0	26.0	27.0
Thailand	233.0	215.0	195.0	183.0	179.0
Korea Rep.	143.0	152.0	144.0	158.0	156.0
The Philippines	91.0	96.0	89.0	89.0	100.0
Malaysia	133.0	128.0	125.0	138.0	134.0
Egypt	37.0	41.0	41.0	35.0	35.0
Nigeria	5.0	4.0	6.0	10.0	11.0
Algeria	1.0	0.5	0.4	0.4	0.4
Ivory Coast	45.0	59.0	47.0	60.0	55.0
China	91.0	97.0	101.0	102.0	107.0
U.S.S.R.	4.0	5.0	6.0	7.0	8.0

Source: U.S. Department of Agriculture FAS issued Dec. 1980, World Bank Economic and Social Data Division, PPD.

partly exchanged for 100,000 tons of low quality imports. It may retain its net exporter status in the future. Singapore and Hong Kong each annually import about 500,000 tons of high quality rice, but these imports have been slowly declining over the past 10 years, despite rapidly growing demand for total cereals. Malaysia currently imports about 300,000 tons, less than it did of the 1960s. Government policy is to attain 85% self-sufficiency and rice imports in the future are expected to remain at the 200-300,000 level as incremented consumer demand moves towards other cereals: as incomes rise, marginal consumption of rice apparently drops. Imports into these three markets are totally dominated by China and Thailand.

The Middle East emerged as a major importer over the last ten years, with the Gulf countries importing 1.6 million tons in 1982. These are high quality rice markets, and growth prospects are good only up to a point. Excluding Iran, the total population of the Arab Gulf countries is about equal to Sri Lanka's, and much of the rice consumption is accounted for by the 3-4 million temporary residents from South and Southeast Asia who work there. This market is highly competitive and fiercely fought over by the U.S., Thailand and Pakistan, who have 95% of the market.

West Africa is the other market that has grown rapidly in the last decade. Currently it imports 2.0 million tons, more than the countries of the Persian Gulf. Production in

West Africa has risen 40% since the early 1970's, more than the population growth, but consumption has doubled, thus necessitating large scale imports. Five countries, Nigeria, Ivory Coast, Senegal, Liberia and Sierra Leone account for 80% of West Africa's import. Nigeria imported 600,000 tons in 1982, followed by Ivory Coast and Senegal, each with 350,000 tons. Nigeria is a commercial buyer of high quality packeted parboiled rice, while the others are low quality markets, with a substantial proportion of their imports coming under concessional arrangements. Governments totally control imports, through licenses or government-to-government contracts. The U.S. and Thailand are the main suppliers, followed by Burma.[11/] Cameroon, which used to import about 20,000 tons per year on average in the past, upped its imports to 300,000 tons in 1983, all coming from Pakistan.

Other African markets imported about 1.0 million tons in 1981/82, with Malagasy accounting for 357,000 tons, followed by South Africa, Mauritius, Mozambique and Tanzania. Except for South Africa, all these are low quality markets with substantial amounts coming under concessional arrangements. Demand in these countries is projected to rise strongly, but except for South Africa, all face severe financial problems and will need to depend on more food aid to sustain these imports.

11/ Tom Slayton, Special Report on West African Rice."

The industrial countries of Europe represent a steady, slow growing market, currently importing 2.5 million tons. The USSR is the largest importer, 750,000 tons in 1982, down from 1.3 million tons in 1981. The E.E.C. as a whole imported 1.3 million tons and Eastern Europe around 300,000 tons. These countries are generally high quality markets. The USSR has special arrangements with India, taking more than half her exports, while most of Eastern Europe's supplies come from North Korea, Burma and China. Imports into Western Europe are of high quality, and come from diverse sources, which include South America as well as the U.S. and Asia.

III. CHARACTERISTICS OF RICE EXPORTING COUNTRIES[12/]

A. Thailand

Over the past decade, Thailand's rice production has increased from 9.0 to 18.75 million tons in 1982; drought has reduced this year's crop to 17.25 million tons. Though lacking a high priority program to introduce HYVs, Thailand has increased its rice production by a very respectable 7-8% per annum and the momentum is likely to continue as new varieties are released. In the same period, exports have also doubled to a record 3.62 million tons in 1982, and despite an 8% drop in the 1983 production estimates, current surpluses available for exports total over 3.4 million tons.

Thailand has concentrated its rice expansion, research and development on upgrading the quality of its paddy and milled rice, since the incremental returns on quality improvements are much higher than on mere increases in production. In the past decade, while total exports have doubled, exports of top-grade white rice have quadrupled, such that in 1982, 100% whole rice accounted for a third of all exports. She has responded to market forces as the traditional buyers of medium quality Thai rice have upgraded the quality of their purchases. Given the projected increased availability of rice in the world market, this quality approach should ensure Thailand's share of the total market. Even so,

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12/ This chapter also draws heavily on Dr. Tom Slayton's reports, namely the USDA report, "Asian Rice Situation and Outlook" (undated).

future surpluses available for export are likely to increase, as research on improving quality automatically produces varieties that are both better yielding in tons of paddy per hectare and milling out-turn.

The guaranteed producer prices for paddy is currently equivalent to $114 per ton, or Rs. 58.0 per bushel. From Sri Lanka's perspective, Thai millers not only get a much better quality of paddy for about the same price, but given their experience and investment in milling, transport storage and shipping infrastructure over the past two decades, their processing and marketing costs per ton of rice are much lower. Consequently, their export prices at current exchange rates are lower than the Colombo wholesale price for medium quality local rice that is not of export grade at all. For example, in June, Nigeria contracted to purchase 7,000 tons of 100% parboiled rice for $250 per ton fob.[13/] With freight and port charges of $50 per ton, the c & f price Lagos would be about $300 per ton, equivalent in Sri Lanka terms to Rs. 490 per bag of 67 kg., or Rs. 7.3 per kg., about what Samba Gr. II was selling for in the Pettah wholesale market at the beginning of September when the local market was over supplied, and prices around the lower end for the year (See Table 5). And Samba II is just not comparable to this 100% parboiled.

13/ See Table 6. In September, Syria purchased 10,000 tons 100% B raw milled at $307 c&f, according to Bangkok trade sources.

TABLE 5

Average Wholesale Prices of Rice at Pettah and Duplication Road Markets during 26th Aug. - 1st Sep. 1983 (Rs/67 kg)

	Duplication Road Market	Pettah Market		
	26th Aug. to 1st Sep. '83	26th Aug. to 1st Sep. '83	19th - 25th Aug. '83	Average * % change
Samba Gr. I	512	520	502	+1.76
Samba Gr. II	466	475	440	+3.83
Samba Gr. III	-	400	400	0
Parboiled Gr. I	-	436	430	+0.69
Parboiled Gr. II	362	363	360	+0.41
Kora Gr. I	400	388	395	-0.89
Kora Gr. II	-	367	353	+1.94
Raw red	434	420	412	+0.96
Raw white	350	383	386	-0.39

* For Samba grade I : $\frac{520-502 \text{ or } 502-520}{502+520} = \pm 1.76\%$

Source: Agrarian Research and Training Institute. Food Commodities Bulletin, Colombo.

Government regulates the exports of rice and earns reven through its rice premium, which is an export tax, curren'ly 15% ad valorem on the fob price. Although the export business is dominated by well established Chinese trading houses, the government is increasingly moving into the trade directly through negotiating more government to government contracts.

B. Burma

From the early 1960's to the last 1970's Burma's socialist governments effectively ran down their country's rice industry, which for 70 years, until the 1950's, was the largest exporter in the world. Farmers were over-taxed through artificially low procurement prices and lack of consumer goods to buy. In addition, through neglect there was massive disinvestment in the milling industry. By 1973/74, Burma's production has fallen below domestic consumption, and in 1973 the local market was de-stocked to meet export commitments to Sri Lanka. The situation since has improved, as price and supply policies have slowly become more responsive to farmers' needs. From a low point of 157,000 tons in 1973, exports are expected to reach 830,000 tons in 1983, still less than half of what they were 20 years ago, but below expected surpluses.

Beginning in 1977/78, Burma has implemented a successful policy to upgrade yields and farm incentives. HYVs, which covered only 4% of the area the early 1970's, have now spread to over half the paddy fields. Production in 1983 is

TABLE 6

RECENT THAI RICE SALES

Destination	Quantity (1,000 MT) Current	Est. Cumulative 1/	Quality 2/	Price $/MT 3/	Delivery	Date Of Report
China	5.2	213.2	A-1 Spec.	N/A	N/A	6/23
Djibouti	1.0	1.0	P 100%	260	N/A	6/17
Dubai	1.0	9.1	P 100%	260	N/A	6/17
India	70.0	72.2	25% B	222-224	Jul-Aug	6/20
Indonesia	3.0		Gl 10%	N/A	Jul	6/10
	6.0	354.9	Gl 10%	N/A	N/A	6/23
Iraq	15.0		100% B	N/A	Jun	5/31
	1.8		100% B	N/A	N/A	6/10
	30.0		100% B	268	Jul-Aug	6/22
	30.0	318.5	100% B	N/A	Aug-Sep	6/22
Italy	5.2	37.6	A-1 Spec.	N/A	Jun	6/10
Japan	4.0	10.7	A-1 Spec.	N/A	Jul	6/22
Madagascar	10.0		A-1 S	N/A	Jun	5/31
	10.0		A-1 S	N/A	N/A	6/10
	10.0	87.8	A-1 S	N/A	N/A	6/23
Malaysia	1.0	114.0	Gl 10%	N/A	N/A	5/31
Netherlands	3.0	13.1	B 100% B	N/A	June	6/17
Nigeria	5.0		P 5%	N/A	May-Jun	5/31
	20.0		P 5%	N/A	May-Jul	5/31
	5.0		P 5%	247	June	6/10
	17.5		P 5%	N/A	N/A	6/13
	7.0		P 5%	250	N/A	6/17
	44.0	317.0	P 5%	N/A	N/A	6/23
Reunion	3.0		A-1 Spec.	N/A	N/A	6/17
	3.0	6.0	A-1 Spec.	N/A	N/A	6/23
Somalia	1.0	13.0	P 10%	N/A	N/A	6/10
Tanzania	5.5	10.5	10%	N/A	Jun	5/31

1/ For all qualities for 1983 delivery.
2/ P=Parboiled, B/5%, etc.=Brown rice 5% brokens, etc., Gl=Glutinous, S=Super, F=Fragrant.
3/ F.o.b. basis unless otherwise indicated. Price information is in many cases unconfirmed and as reported through unofficial market sources.
4/ Includes Nigeria/West Africa.

N/A Not available.

Source: USDA Foreign Agriculture Circular, Grains, July 14, 1983.

TABLE 7

RECENT RICE EXPORTER BUYING ACTIVITY
REPORTED BETWEEN MAY 26 AND JUNE 23, 1983

Buyer	Origin	Quantity 1,000 Tons	Quality 1/	Price $/MT 2/	Delivery Period	Date of Report
Brazil	Suriname	3.0	N/A	Barter 5/	N/A	6/9
Cuba	N/A	20.0	15%	247-250 4/	Aug	6/11
El Salvador	U.S.	4.8	#5/20% LG	252-256 3/	Jun-Sep	5/31
Honduras	Colombia	1.0	15%	395 4/	Jun	6/3
India	Thailand	70.0	25%	222-224	Jul-Aug	6/17
Indonesia	Pakistan	50.0	15/20%	230	Jul-Dec	6/21
	Thailand	3.0	Gl 10%	N/A	Jul	6/10
		6.0	Gl 10%	N/A	N/A	6/23
Iran	Thailand	15.0	100% B	N/A	N/A	5/31
		1.8	100% B	N/A	N/A	6/10
		30.0	100% B	N/A	Jul-Sep	6/22
		30.0	100% B	N/A	Jul-Sep	6/22
Korea, N.	Burma	10.0	25%	207	Jun-Jul	6/1
Malaysia	Burma	5.0	5%	225	Jun	6/1
Nigeria	U.S.	10.5	P #2/4% LG	414	Jun	6/2
		15.3	P #2/4% LG	N/A	Jun-Jul	6/16
	Thailand	5.0	P 5%	N/A	May-Jun	5/31
		20.0	P 5%	N/A	May-Jul	5/31
		17.5	P 5%	N/A	N/A	6/13
Peru	U.S.	19	#5/20% MG	314 3/	Jun-Aug	6/10
		10.5	#5/20% LG	378 3/	Jun-Jul	6/10
N/A	U.S.	50.0	B, MG	N/A	Jun-Jul	6/7, 16
N/A	Colombia	15.0	Rough	160	Aug-Sep	6/1

1/ P = Parboiled, LG = Long Grain, MG = Medium Grain, SG = Short Grain, Gl = Glutinous, B = Brown, F = Fragrant, and P/B = Parboiled Brown.
2/ F.o.b. basis unless otherwise indicated. Price information is in many cases unconfirmed and as reported through unofficial market sources.
3/ P.L.-480 sale, FAS basis.
4/ C&F.
5/ Barter with milled rice option.

N/A Not available.

Source: USDA Foreign Agriculture Circular, Grains, June 24, 1983.

expected to reach 8.7 million tons, up 64% on the 1973/75 levels. With enormous areas of land still to be planted to HYVs, and continuing extension and research, Burma is expected to maintain its growth momentum in the future and build up even larger exportable surpluses.

While success has been achieved in raising yields and marketable surpluses, Burma has still a ways to go to rehabilitate its milling and trading infrastructure. Poor mill equipment and management means that Burma will largely be a seller of low quality rice, for which the world market is shrinking. Bad storage and shipping facilities have seriously discouraged previously regular buyers, notably the African countries, forcing them to shift their business to Pakistan, Thailand and Taiwan. If Sri Lanka becomes self-sufficient, Burma will then lose its biggest customer, and will press hard to find other markets for its growing surpluses.

Burmese officials are aware of their industry's deficiencies and much investment, backed by foreign aid, is flowing into the milling and trading sectors. Still, for some time Burma will be the residual supplier of low cost rice, and if Sri Lanka ever seriously moves into exporting rice, it will face formidable Burmese competition. The bottom line is the price at which the Myanama Export Import Corporation, the government rice trading monopoly, buys its

paddy. Currently it pays just $49 per ton,[14/] or about Rs.25 per bushel, for Emata quality grade, a well-known long grain type. Despite this extremely low price, it is apparently adequate to generate a return to farmers that encourages them to grow more paddy to sell to the government, although they prefer to sell their best qualities and types on the local free market which pays better.

C. Pakistan

Up to 1970, Pakistan was a minor exporter in the world market, selling high priced Punjabi Basmati internationally and low quality parboiled rice from the Sind to East Pakistan, now Bangladesh. The HYV technology is particularly suited for the arid but irrigated Indus plain, and rice production, which had stagnated at around 2.2 million tons in 1969-75, rose by third to 3.3 million tons in 1981/82. Despite bad weather in 1982/83, the current crop is expected to drop only 5%, thanks to the irrigation system, which covers about 100% of the rice area, freeing Pakistan from the vagaries of the monsoon.

Pakistan's recent export performance has been dramatic. Sales reached 1.0 million tons in both 1979 and in 1981, overtaking China and Burma, making Pakistan the third

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14/ Slayton, ibid. Prices relating to Burma, Pakistan and India are also from Dr. Slayton's field report.

largest exporter, after Thailand and the U.S., a position it is likely to maintain. With wheat the preferred staple, and in which the country is now finally achieving an exportable surplus, Pakistan will have large rice surpluses for export, and be a formidable competitor to the Thais and the Burmese. With 15 million ha. of irrigated land potentially capable of double cropping (more than the total area of irrigated land in all North America), and average yields still only 2.5 tons per ha., Pakistan has a vast potential to exploit its rich agricultural endowment for international trade. Rice is its best monsoon cereal crop, and current government procurement rice prices are just $158 per ton, Sri Lanka Rs. 3.85 per kg. for medium quality parboiled IRRI-6 (Basmati for export is procured for $303 per ton, Rs.7.35 per kg.) Hence, at current exchange rates the Rice Export Corporation of Pakistan, the government's rice exporting monopoly, is buying average export quality parboiled rice for a price that is just 29% above the guaranteed minimum price for paddy in Sri Lanka.

D. India

India in the mid-1960s was the largest importer of rice in the world and was a net importer of rice as recently as 1976. In the last decade, annual milled production has risen about 12.5 million tons from around 41 million tons in 1971-73 to 53.5 million tons in 1980-82. Exports rose dramatically from 133,000 tons in 1976 to a peak of 1.0 million tons in 1981, when India ranked fourth in world rice exports.

India suffered severe drought in the last monsoon (the worst since 1972/73) and production for 1982/83 is down 7.5 million tons, to an estimated 46.0 million tons. Exports were reduced to 586,000 tons in 1982 and are projected to be 350,000 tons for both 1983 and 1984. However, in order to meet stocks, stabilize prices and obtain an adequate flow for the PDS, (Public Distribution System), which provides subsidized rice to approximately the poorest 200 million people, India has contracted over 300,000 tons of rice imports from Burma and Thailand. Total imports may actually reach 1.0 million tons in 1983, but given the current normal monsoon, import requirements, for stock building, should be much less in 1984.

In the past, whenever domestic rice and wheat procurement was inadequate to meet the requirements of the PDS, India has resorted to imported wheat. Although this does involve foreign exchange costs, imported wheat saves the government from having to increase domestic procurement which would drive up local prices and thus accelerate inflation. Furthermore, a ton of imported wheat cost less to buy than local rice, there was usually some credit and price concession available, and above all a ton of wheat is more nutritious than rice. This year though low quality rice is available for the same c & f price as wheat (under $200 per ton), and unlike wheat, which has to be milled and bagged, imported bagged rice can be brought directly to port and distributed without these additional processing costs.

Assuming continued good weather, India will remain a net exporter of medium quality rice, most of which goes to the USSR, and of some Basmati. With ongoing expansion in production through extension in irrigation (2.5 million ha. per year) and wider spread of HYVs, India can easily produce enough export quality rice throughout the 1980's, but may import low quality rice when local shortages curtail government procurement at cheap prices for the PDS requirements. For the current crop the official procurement price for coarse paddy is Indian Rs. 1,320 per ton, equal to Sri Lanka Rs.3.10 per kg., and for coarse rice Indian Rs.2,203 per ton, equal to Sri Lanka Rs.5.15 per kg.[15/] This kind of rice is similar to the medium quality rice of Sri Lanka and yet is cheaper, equal to Sri Lanka Rs. 345 per 67 kg bag, or Rs. 5.15 per kg, that Kora II, the cheapest rice in Sri Lanka (Table 5), sells for at the Pettah.

E. Other Rice Exporters

The other main exporters are the countries of East Asia, and their 1982 and 1983 export estimates are listed below (1,000 tons).

	1982	1983
China	470	1000
Taiwan	307	850
Japan	318	400
North Korea	250	300
Philippines	0	100

15/ FAO Special Report Food Crops and Shortages. 12 August 1983, page 9. See Table 8 for South Asian procurement prices.

China is a traditional major rice exporter, as is North Korea. Taiwan has recently emerged as a major exporter, but nearly all its 1983 exports are subsidized, since like Korea, domestic paddy procurement prices at $470 per ton, equal to Rs.11.50/kg. are way above comparable world levels, being a major component of the Government's rural development and income distribution policy. Currently Taiwan is offering good quality rice to Indonesia, Ivory Coast and Cuba for $200 per ton fob, implying a subsidy of at least that much. Japan too has surpluses as a result of very high domestic price supports ($1200 per ton for brown rice), and nearly all of its exports are at concession rates, implying very heavy subsidies, approaching $1000 per ton.

The Philippines emerged as an exporter after 1977 with peak exports of 236,000 tons in 1979, a testament to the successful programme there for intensifying rice production. But weather, pests and diseases still determine net export availabilities and thus the Philippines is an erratic supplier. Since 1980 production has stagnated, mainly because of bad weather, and exports plunged to zero in 1982. For 1983 and 1984 exports are projected by the USDA to be in the 50-100,000 ton range.

The Philippines' export experience has interesting lessons for Sri Lanka. Although a net importer (600,000 tons in 1972) until five years ago, the country was fortunate in having large modern mills close to port areas

where rice that was milled for domestic consumption could be re-milled and mixed to export standards. With continuing domestic surpluses, paddy could be milled directly to world standards.[16/] Furthermore, major millers and rice traders/ exporters are ethnic Chinese with close contacts in the Asia rice trade, particularly in close-by Borneo, Sulawesi and Sarawak. Yet the Philippines has to offer substantial discounts to enter the world market and pay considerable commissions (5-10%) to dealers and brokers. With the current guaranteed paddy price of $170 per ton, Rs. 4.15 per kg, and low world prices, Philippines exports are neither economic or financially viable. Unlike India, the other new major exporter, the Philippines has no unique variety like Basmati, nor a special economic relationship with a major buyer such as the USSR, to underpin a regular, if small, export trade.

16/ FAO. Problems and Issues of Food Grain Management on the Decade of the Eighties in Ten Asian Countries. Jakarta 7-10, December 1982 - page 6.

IV. POTENTIAL EXPORTERS AND IMPORTERS

The only potential exporter in Asia is Kampuchea, which ceased exports in 1972. In the 1960's it exported up to 491,000 tons (1965), but by 1975 was importing 350,000 tons. It is still importing 50,000 tons, but domestic production has rebounded since the tragic era of the late 1970's, and by the mid-1980's it may re-emerge as a small supplier for low quality rice, but information is just not available for further discussion.

A potential importer is China, whose current exports are close to million tons, but she has imported 200,000 in each of the last two years. Also, China has been importing 12-14 million tons of wheat each year in the period 1980-1983, about one eighth of all world wheat trade. Adequate data is not available to make firm analysis, but two factors stand out:

1. Since 1976, while yields have increased, the area under rice has diminished slowly. The current economic policies have relaxed somewhat the compulsory cultivation of rice, part of which has to be delivered to the state at low prices. Farmers have been permitted to switch some irrigated land formerly under paddy to more profitable production of vegetables, fruits and livestock feed.
2. Since China imports wheat for direct food consumption, it is clear that there is a grain deficit which is met by these imports. Since wheat prices have historically been much cheaper per ton than rice, supply much more reliable, nd wheat per kg. much more nutritious compared to rice, it has

been economic for China to import only wheat. Furthermore, given China's overloaded surface transport capacity, it is cheaper for her to ship imported wheat to the huge coastal cities than freighting supplies from inland areas.

China's annual wheat production is currently 68 million tons, and rising rapidly. It is only 42% of the rice production, which is currently 161 million tons. If rice consumption increases as a higher rate than production[17/], it is conceivable that China, like India, could increase imports of low quality rice, while continuing to export high quality rice, assuming the current situation of low quality rice prices being lower than wheat prices (per ton c & f) persists. If China does increase its rice imports, it would merely buy more from present suppliers in East Asia, and in quantities that do not drive up prices of such rice.

17/ In the period 1967-80, the average annual rate of growth in consumption slightly exceeded the growth in production, but with the trend lines converging. USDA data.

V. FEASIBILITIES OF SRI LANKA BECOMING A RICE EXPORTER

If Sri Lanka's rice production progresses to a level where it has persistent surpluses over and above working, buffer and emergency stock requirements, it will have great difficulty in economically disposing them in the international market, given projected supply and demand balances, as discussed already.

With a great deal of ingenuity and research, Sri Lanka's rice breeders have developed HYVs that suit local growing conditions and market requirements. As confirmed by Dr. Senadhira, the Deputy Director of the Central Rice Breeding Station, none of the varieties issued by the Station are exportable in the raw milled state, while the parboiled types, even with much improved milling and grading, are only of low export quality standards. Even then, there is no world market, except at distress prices, much lower than currently prevailing for the cheapest varieties in the Colombo wholesale market. To breed totally new varieties solely for export quality, as is underway now on a small scale, takes at least ten years to accomplish satisfactorily, and then more years to build up adequate farm-level production. Given projected market conditions, and very severe competition from existing exporters, the economic justification for embarking on such a programme for research and development is not perceivable. Farmers will not plant the new varieties unless the millers offer premium prices relative to existing varieties, and millers cannot

do this without assured and profitable markets, unless Government subsidizes the difference between local and fob prices, about Rs. 3 per kg. on present prices if the rice is of export type and quality.

Besides the issue of varieties and markets, Sri Lanka still has a great milling constraint. As explained more fully in Part II of this report, there are presently no such mills capable of consistently producing rice in the quantities and qualities required for the international market, and at a price that would cover all related costs. The milling industry, after decades of low level technology and management, is just beginning to adapt to changing local conditions. Government policies have to change more, to making milling, as compared to rice trading, a financially viable proposition. Millers need a definite price framework that would enable them to run their mills in a financially viable manner, i.e., sufficient operating margins and assurance of market to sustain full-scale operation. Only then will investment and technology flow into the sector. Millers will then have to concentrate on meeting the local market demands and this alone will take several years to achieve on an adequate scale. Some have suggested that the Paddy Marketing Board (PMB), with its large new mills, could undertake such a task, rather than the private millers. This is not possible; the PMB has much higher operating costs than the private sector, and totally lacks the

management and marketing expertise.[18/] Furthermore, it is losing what few milling technicians and operators it has because of low salaries and other conditions.

To export, investment in breeding and milling will need to be supplemented by improvements in storage and transportation infrastructure. Sri Lanka is geared to importing large quantities of bagged rice. To reverse the flow, new investment is required in quality storage and port facilities, so that paddy can be dried, cleaned, milled, bagged and shipped at the lowest cost and minimum of delay. Potential buyers will have to be assured that their ships will be loaded with dispatch and minimum of restrictions; the Burmese experience, cited earlier, is a good example of buyers turning away because of bad port and storage management, despite adequate port-level infrastructure and supplies, and years of experience with the Burmese rice authorities.

Getting quality rice in the required quantities onto a ship at the minimum cost possible is just half the problem. Marketing issues are the other half. As the Philippines example shows, the costs of entering the international rice trade are extremely high. Not only are there heavy search and broker fees (5-10%) but buyers will also insist on heavy discounts in order to break

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18/ The Ministry of Finance and Planning estimates that although PMB pays only Rs. 14.30/100 kgs. to quota miller, PMB's own milling costs (not counting the new USAID-financed mills) are closer to Rs. 17.00/100 kg. PMB's depreciation rates are larger than the private sector's, and it pays 6-7% interest, against the market rate of 22-30%. As a government agency used to a controlled environment, PMB has no marketing skills to tackle the international trade.

connections with their traditional suppliers. Furthermore, unlike the Chinese millers and exporters of the Philippines, who have close and long standing business relations with the buyers and dealers, also Chinese, in other Asian importing countries, potential Sri Lankan exporters have no such network to tap into.

Next comes the question of the reaction of established exporters to the prospect of Sri Lanka prowling onto their commercial territories. If Sri Lanka achieves self-sufficiency, Burma for a start will lose its largest market. With the heavy political and financial investments committed to raising the quantity and quality of rice exports now beginning to pay off, Burma is going to fight very hard to find markets for the volumes previously taken by Sri Lanka. Whatever market Sri Lanka finds it goes without question that the buyers concerned will bargain with Sri Lanka, Burma, and others, to achieve the best deal. All things considered, at the margin buyers will shun the unknown new supplier and stick to those whom they have dealt with before. Intimate business relations built over the years are hard to break unless the new competitor offers a significantly more attractive product. This could involve a unique quality or variety (such as Basmati), or barter repayment (such as the Indian - USSR arrangement), or good financing (as per the U.S., Japan and Taiwan), or fast delivery. None of these are foreseeable for Sri Lanka. And as already explained earlier, there is a very limited substitution between different varieties and types of rice. Consumers stay with their preferences even for low quality rices

and will change only to higher grades within the preferred variety. This is true whether the market is small, like the Maldives[19/] or large like Senegal, with its liking for brokens.

Finally come the issues of prices and economic costs. As already indicated, Burma's government mills are presently buying Emata quality grade paddy for an equivalent of Rs.25/- per bushel, just over a third of the guaranteed price offered to Sri Lanka's farmers. Despite this terribly low price, it is apparently sufficiently attractive for Burmese farmers to increase their marketing to the state. The Rice Export Corporation of Pakistan can buy average quality parboiled rice suitable for export, for an equivalent of Sri Lankan Rs.3.80 per kg., slightly above the Sri Lanka guaranteed price of Rs.2.99 per kg for paddy at the PMB stores. India's government procurement for average grade paddy in July 1983 was Rs.3.10 per kg, very close to the guaranteed price of Rs.2.99 per kg. in Sri Lanka. (Table 8)

Since Burma and Pakistan are the two competitors that Sri Lanka will take on if it ever really builds up surpluses of even low quality export rice, a closer look at these two countries' strengths is useful. Not only are their mills buying paddy at prices that are 60-70% below the guaranteed minimum offered to

19/ The Maldives import about 10,000 tons of raw-milled rice annually, these days from Pakistan. They buy cheap rice, and have no taste for any of the Sri Lankan varieties. The lower shipping cost from Colombo would not be sufficient to offset the basic fob price difference with Karachi, even if Sri Lanka were to produce the desired variety.

TABLE 8

SUPPORT PRICES FOR PRINCIPAL FARM COMMODITIES IN SOUTH ASIA

Country/ commodity	Marketing year	Grade	1975/76-80/81 Average	1980/81	1981/82	1982/83	Notes
				Taka/ton			
Bangladesh							
Rice	July/June	coarse, aman	3,859	4,890	5,172	5,716	Procurement price
(% change)			(9.7)	(9.5)	(5.8)	(10.5)	
Wheat	July/June	F.A.Q.	2,504	3,130	3,375	3,675	"
(% change)			(10.7)	(4.5)	(7.8)	(8.9)	
				Indian rupees/ton			
India							
Paddy	Oct./Sep.	coarse	850	1,050	1,150	1,220	Procurement price
(% change)			(7.4)	(10.5)	(9.5)	(6.1)	
Rice	Oct./Sep.	coarse	1,386	1,745	1,940	2,040	"
(% change)			(8.5)	(10.4)	(11.2)	(5.2)	
Wheat	Apr./Mar.	F.A.Q.	1,108	1,170	1,300	1,420	"
(% change)			(2.4)	(1.7)	(11.1)	(9.2)	
Corn[1]	Oct./Sep.	F.A.Q.	845	1,050	1,160	1,180	"
(% change)			(7.5)	(10.5)	(10.5)	(1.7)	
Groundnut	Oct./Sep.	F.A.Q.,	1,742	2,060	2,700	2,950	Support price
(% change)		in shell	(9.4)	(8.4)	(31.1)	(9.3)	
Soybean	Oct./Sep.	F.A.Q.,	1,686	1,980	2,300	2,450	"
(% change)		yellow	(7.4)	(13.1)	(16.2)	(6.5)	
Cotton[2]	Aug./Jul.	common	577	599	N.E.	686	
(% change)			3	0	—	—	
				Nepalese rupees/ton			
Nepal							
Rice	Oct./Sep.	standard	2,629[3]	2,870	3,150	N/A	Procurement price
(% Change)			(5.5)	(6.3)	(9.8)	N/A	
				Pakistani rupees/ton			
Pakistan							
Rice	Oct./Sep.	IRRI-6,	1,290	1,575	1,812	2,000	Procurement price
(% change)		av. brkns	(6.2)	(20.0)	(15)	(10.4)	
Rice	Oct./Sep.	Basmati	2,803	3,425	3,750	3,825	"
(% change)			(6.7)	(16.2)	(9.5)	(2.0)	
Wheat	May/Apr.	standard	1,147	1,450	1,450	1,600	"
(% change)			(8.0)	(16.0)	(0)	(10.3)	
Corn	Oct./Sep.	standard	857	857	857	857	Support price
(% change)			(0)	(0)	(0)	(0)	
Soybean	Oct./Sep.	standard	N/A	2,680	2,925	3,050	"
(% change)			N/A	(0)	(9.1)	(4.3)	
Sunflower	Oct./Sep.	standard	N/A	2,950	3,325	3,500	"
(% change)			N/A	(22.3)	(12.7)	(5.3)	
Cotton[2]	Aug./Jul.	american	778	869	925	952	Procurement price
(% change)			(4.9)	(8.0)	(6.4)	(2.9)	
				Sri Lankan rupees/ton			
Sri Lanka							
Paddy	Jan./Dec.	coarse	1,996	2,450	2,817	2,817	
(% change)			(12.5)	(25.0)	(15.0)	(0)	

N.E. = None established. N/A = Not available. F.A.Q.= Fair to average quality.

[1]Same procurement price is established for corn, sorghum, and millet. [2]Cotton prices quoted per 480 lb bale. [3]1977/78-1980/81 average.

Sources: Official government data for each country.

South Asian currency exchange rates

	FY80	FY81	FY82	FY83[1]
Bangladesh (Taka/$)	15.48	16.34	20.04	23.39
India (Rs/$)	8.01	8.02	9.17	9.60
Pakistan (Rs/$)	9.90	9.90	10.55	12.60
Sri Lanka (Rs/$)	16.53	19.25	20.83	22.18

Note: Fiscal years defined in country tables.

[1]As of March 1983.

Source: International Monetary Fund.

the Sri Lankan farmer, but their milling and marketing infrastructure is far superior. Mill managements are highly competent and fully attuned to the developments in the world of rice markets every day. Even in Burma, despite its socialist style of management, there are efficiently run mills, sitting on solid infrastructure that has long been paid off. These mills can fill and ship a large order promptly for regular clients. Not a few Burmese mills have their own docking facilities, and all are served by cheap water transport.

In Pakistan, new mills are being built as joint venture projects with Saudi and Kuwait investors. Just as the American milling and food processing firms built their mills in Europe to maintain market penetration, so Pakistan is encouraging its large Arab buyers to invest in its milling sector, to guarantee continued access to markets and finance for its rapidly growing export trade.[20/]

In terms of economic costs, the incremental investment needed to produce an extra ton of rice is much lower in these two countries than in Sri Lanka. Both countries already have adequate irrigation, so at the margin, irrigation investment is zero. For Sri Lanka, however, new irrigation is a pre-condition to self-sufficiency and beyond, and this investment is costing up to Rs.200,000 per ha. Just to get a 10% gross return per annum

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20/ Although Pakistan has been importing wheat and exporting rice for 30 years, rice consumption has grown less than population since 1969. Per capita rice consumption is 25 kg., against 140 kg. for wheat. Pakistan and the U.S. stand out as major exporters where wheat, not rice, is the staple domestic cereal.

on this investment implies an annual yield of 6,689 kg. paddy per ha., assuming the current farm-gate price of Rs.2.99 per kg., (Rs.62.50/-per bushel). Even on this yield, the true economic return actually will be lower, since production, O&M and other overhead costs will have to be deducted. The net return could quite possibly be negative. The point is that Pakistan and Burma already have a natural endowment that costs up to Rs.200,000 per ha. to develop in Sri Lanka. (Table 9 gives basic area and production data.) Their incremental production is dependent on continued investment in improved on-farm technology and in milling. In this respect they are on the same footing as Sri Lanka, but even here they have important advantages. Whereas 75% of Sri Lanka's rice area is already under HYVs, in Pakistan and Burma the area is under 50%, for these countries adopted HYV technology later than Sri Lanka. They have therefore greater potential for low-cost high-return expansion through disseminating HYVs. Both countries also have urea factories based on cheap, domestic natural gas; Sri Lanka has to import every kg. of mineral nitrogen, so in foreign exchange her fertilizer costs are much higher. Thirdly, both Burma and Pakistan for a long time have been growing and exporting huge quantities of rice that are known export commodities; Sri Lanka isn't even at the starting gate with this fundamental element. Finally, both countries already have in place the necessary investments that ensure a regular outflow of up to 1 million tons of rice each year, and vast stocks in port warehouses waiting for orders. In Sri Lanka the situation is the opposite.

TABLE 9

RICE PRODUCTION AND TRADE IN BURMA AND PAKISTAN

RICE	AREA HARV	YIELD	ROUGH PROD	BEG STOCK	MILLING RATE	MILLED PROD	TOTAL IMPORTS	TOTAL EXPORTS	CONSUMPT TOTAL	JAN-DEC TRADE			
											IMPORTS FR US	TOTAL IMP	TOTAL EXP
COUNTRY BY TIME PERIOD	1000 HA	MT / HA	1000 MT	1000 MT	PERCENT	1000 MT	1000 MT	1000 MT	1000 MT	CAL YR	1000 MT	1000 MT	1000 MT
BURMA													
(61)1962 (JAN-DEC)	4,254	1.52	6,486	- - -	62.50	4,054	- - -	1,744	2,318	62	- - -	- - -	1,744
(62)1963 (JAN-DEC)	4,654	1.65	7,666	- - -	62.50	4,791	- - -	1,712	3,979	63	- - -	- - -	1,712
(63)1964 (JAN-DEC)	4,877	1.60	7,798	- - -	62.50	4,869	- - -	1,413	3,456	64	- - -	- - -	1,413
(64)1965 (JAN-DEC)	4,979	1.71	8,509	- - -	62.50	5,318	- - -	1,335	3,983	65	- - -	- - -	1,335
(65)1966 (JAN-DEC)	4,848	1.78	8,258	- - -	62.50	5,161	- - -	1,128	4,033	66	- - -	- - -	1,128
(66)1967 (JAN-DEC)	4,513	1.39	6,285	- - -	62.50	3,928	- - -	546	3,382	67	- - -	- - -	546
(67)1968 (JAN-DEC)	4,796	1.69	7,942	- - -	62.50	4,964	- - -	331	4,633	68	- - -	- - -	331
(68)1969 (JAN-DEC)	4,764	1.72	8,200	- - -	62.50	5,125	- - -	562	4,563	69	- - -	- - -	562
(69)1973 (JAN-DEC)	4,671	1.71	7,986	- - -	62.50	4,991	- - -	677	4,314	70	- - -	- - -	677
(70)1971 (JAN-DEC)	4,889	1.78	8,179	- - -	62.50	5,112	- - -	844	4,268	71	- - -	- - -	844
PAKISTAN													
(71)1971-72(JUL-JUN)	1,457	2.29	3,343	457	66.66	2,226	189	198	1,986	72	189	189	388
(72)1972-73(JUL-JUN)	1,480	2.32	3,436	688	66.66	2,288	- - -	789	1,813	73	- - -	- - -	771
(73)1973-74(JUL-JUN)	1,513	2.44	3,686	294	66.66	2,455	- - -	505	1,857	74	- - -	- - -	478
(74)1974-75(JUL-JUN)	1,604	2.16	3,468	387	66.66	2,316	- - -	478	1,857	75	- - -	- - -	498
(75)1975-76(JUL-JUN)	1,710	2.36	3,929	378	66.66	2,617	- - -	763	1,961	76	- - -	- - -	861
(76)1976-77(JUL-JUN)	1,749	2.35	4,110	263	66.66	2,737	- - -	883	1,948	77	- - -	- - -	864
(77)1977-78(JUL-JUN)	1,899	2.33	4,429	177	66.66	2,950	- - -	818	1,947	78	- - -	- - -	783
(78)1978-79(JUL-JUN)	2,026	2.42	4,913	378	66.66	3,272	- - -	1,815	2,118	79	- - -	- - -	1,366
(79)1979-80(JUL-JUN)	2,034	2.37	4,829	509	66.66	3,216	- - -	1,066	2,248	80	- - -	- - -	968
(80)1980-81(JUL-JUN)	1,935	2.42	4,685	399	66.66	3,120	- - -	1,244	2,052	81	- - -	- - -	1,127
(81)1981-82(JUL-JUN)	1,985	2.50	4,955	223	66.66	3,300	- - -	951	2,188	82	- - -	- - -	900
(82)1982-83(JUL-JUN)	- - -	- -	- - -	472	- -	- - -	- - -	- - -	- - -	83	- - -	- - -	- - -

Source: USDA Foreign Agricultural Service. Reference Tables on Rice Supply-Utilization for individual Countries, Sept. 30, 1982.

The above three factors add up to formidable barriers for Sri Lanka's export ambitions, even to the "low quality" in West Africa, India and Bangladesh, which superficially may offer the most likely markets for Sri Lanka. These are above all price sensitive markets that buy in quantity, i.e., in shipments of 10,000 tons or more, as is general in the rice trade, at the cheapest price. Sri Lanka does not have the exportable quantities of the necessary varieties or qualities at the prices needed to meet the consumer requirements of these markets. It will take ten years to develop the needed volume, assuming the farmers will take up varieties with no assured markets. At present, Sri Lanka only has low quality parboiled rice that could be shipped in quantity. The only markets possible are Bangladesh and Liberia. The former is likely to be self-sufficient before Sri Lanka, while the latter is tied into U.S. concession sales with low quality parboiled rice that is very different from Sri Lanka's. India does not import parboiled rice normally, and the rice she does import, from Burma and Thailand, is at fob prices that are below those prevailing at the Colombo wholesale market. In any case, India is expanding her rice production, and in good years does not need to import, so she is an unreliable market. In other African markets, at least for the next ten years, Sri Lanka is an unknown supplier that can always be undersold and out-traded by the established exporters, namely Burma and Pakistan, when not up against subsidized sales by the U.S., Taiwan, Japan or international aid agencies.

In sum then, Sri Lanka will remain a high cost, uncompetitive producer of rice as far as the world market is concerned, for the

next decade. This means that in the foreseeable future it cannot be a consistent exporter of 10,000 tons and more per year at remunerative prices. There may be an export market below 10,000 tons of local parboiled packeted rice to Sri Lankans resident abroad, who would like to buy Samba and other local varieties for the Sunday (or Friday) yellow rice lunches. Colombo businessmen with good trade contacts abroad in cities with many Sri Lankan residents (in the Persian Gulf, in Australia) could develop this market by grading, re-milling and packeting the rice in 1 lb. or 1 kg. packs. The c & f cost will be high, since the local demand, and thus prices, are already high relative to international prices for these select types of rices. At the foreign grocery stores patronized by Sri Lankans, say in Jiddah or Dubai, these packets will have to compete with the best, like Basmati, Thai 100% and Uncle Ben's, probably selling for the same retail price. How the market will fare given this situation is difficult to predict. Faced with Samba and Basmati at the same price, how often will even the most homesick Lankan opt for Ceylon and Samba?

VI. RECOMMENDATIONS

The attainment of self-sufficiency in one year does not in itself make a country an exporter the following year. In 1971 India achieved rice self-sufficiency, and there was much government publicity of major future rice exports. These did indeed develop, but not immediately, as between 1972 and 1977, India again was the world's leading importer. The weather can play havoc to the best laid plans of governments.

If a consistent surplus does develop, government policies will have to adjust, to keep domestic supply and demand in balance, since these surpluses will not be exportable at fob prices that would cover costs. The options are:

1. Reduce relative producer prices. This is not recommended since it would undermine the basic goal of rural development and rice self-sufficiency. More important, at self-sufficiency levels 1.6-1.7 million tons per annum, rice would be the single largest economic activity in Sri Lanka, and a renumerative paddy price is the paramount determinant of farmers' incomes, and election votes.
2. Improve local grading requirements. Current standards are about the lowest in Asia, and in practice rarely adhered to. What goes on between the paddy dealers, the local PMB store managers and the Food Department's buyers is a lot different from what is gazetted. Standards are there, but not for rigorous implementation. The real test will come from market forces: millers will strive to produce better

grade rice as the market for quality rice expands (it hardly existed before 1978). The question is how well the PMB could implement these higher standards, given its structural and statutory limitations in the face of fast changing market demands.

3. Improve milling performance. Investment must flow into the private rice milling sector so that mills can and do produce better quality rice. Better milling depends on an improved flow of better quality paddy, which in the short-term means more rigorous padding cleaning and grading, which may require rejecting as unacceptable up to 20% of the gross paddy weight that is currently milled. The issue then is providing the millers adequate margins so that the new investment in equipment and mill processes produce a fair return. The problem here again is the PMB's milling activities. Its high overheads and excessive operating costs create processing costs of over Rs.17 per kg. of rice, which is much higher than what PMB allows the private sector on quota milling. Some 200 mills have to depend on this toll or quota milling, since they lack funds to buy and hold paddy. PMB purchases 15-35% of the production, but can mill only a proportion of its stocks, with the quota mills taking the balance. Subsidies from Government enable PMB to mask its real costs to such an extent that it can underprice its milling services, and these in turn restrain improvements in the private sector, by reducing operating margins for toll

milling. PMB buys paddy at Rs.2.99 per kg. and must sell only rice, at R.6.03 per kg. to break even, despite the subsidies. Its mill investments are also over-capitalized; the Sittandi mill cost Rs. 27 million (PMB estimates) while Richard Peiris and Company paid Rs. 5 million for a similar capacity mill in Anuradhapura starting the same time.

4. Infrastructure improvements. As self-sufficiency is reached, large investments will be needed in storage and stocks at on-farm, dealer and miller levels. Currently, the stock holding function is carried out by the exporting countries that have supplied Sri Lanka up to now. At the current 300,000 tons level of imports, it implies 500,000 tons of paddy to store, and this volume will have to be dispersed within the domestic sector when imports cease. In particular, large stocks will have to be held from the Maha harvest to the end of the Yala season, i.e., from March to October. The requirements for working capital for just stock holding will be enormous: if the carry-over for six months averages 50 million bushels, half the yearly need, at Rs.70 per bushel this means a credit of Rs.3,500 million, with monthly interest cost of Rs.64 million at 22%. Interest cost alone for six months then would work out at Rs.7.80 per bushel, 11% of the current paddy price. Where will these funds come from in March/April, so that farm-gate prices don't crash?

The best answer to issues 2, 3 and 4 is for the PMB to become the official stockist, supplemented by expanded Bank of Ceylon discount facilities for private sector stocks. The PMB should de-emphasize milling and concentrate its resources on paddy purchasing to uphold the guaranteed price at harvest time. These stocks would then be released to millers regularly onto the open market during the Maha growing season, at steadily rising prices that reflect PMB storage and interest costs; the latter can continue to be at highly subsidized rates, as the government wishes. By emphasizing its stock-holding role, PMB would need to develop new skills, different from its present role of buyer and miller of paddy. However, Sri Lanka already has an established stock holder, the Food Department. Some merging and institutional rearrangement would therefore be necessary, starting now. The Food Department would lend the funds, to the private sector as well as the PMB, to hold the required stocks of paddy at harvest. The PMB, as the largest stockist with probable access to cheap loans from government, would ensure orderly releases of its stocks by selling paddy to the millers to meet regular market demands. To lessen milling margin distortions and the associated administrative problems, PMB should consider selling-off its mills; the new ones financed by USAID could be retained, but perhaps run by the private sector on management agency contracts. In this way, the mills could be run more efficiently, as skilled staffs could be retained by being paid better, and modern market-oriented management approaches be applied to the country's most valuable food processing industry.

Better milling will improve the average quality of rice, and thus enlarge the domestic market. It is axiomatic that all things being equal, improvement in the quality of rice will encourage greater consumption. Greater domestic consumption is the best outcome one can desire from the forthcoming increase in production, and here Sri Lanka has ample scope. From Table 4, it can be seen that in 1978 in the Asian countries where rice is the staple, per capita consumption ranged from 134 kg. in Malaysia to 155-156 in Bangladesh and Korea, to 179 kgs. in Thailand. China and Philippines were in the 100-107 kgs. range, but these countries, like India's 76 kgs., have substantial minorities whose staple is wheat (and corn in the Philippines), not rice. In Sri Lanka per capita rice consumption is 90-100 kgs., having been held down by physical restrictions on supply as well as poor quality of what is available. Given abundant quantities of good quality, well milled rice, there is every reason to expect an increase in per capita consumption. Properly managed, this incremental consumption should absorb all the expected surplus. If per capita consumption were to reach Malaysia's 135 kgs. by 1990, then total demand would be almost 2.2 million tons of rice for a population of 16 million.

5. The above options emphasize quality improvement to reduce the low quality surplus. The only alternative thereafter is to hold production and divert land away from paddy. Rain-fed lands in the Dry Zone, at least, can be

shifted to hybrid maize[21/], which could yield an average 5-7 tons per hectare in Dry Zone areas receiving 30-50 inches of rain for a better net return than available from paddy. The other alternatives are oilseeds, particularly groundnuts, cassava and livestock production, particularly goats on improved pasture legumes. Fodder and livestock production is also a possibility in rainfed areas of the Wet Zone. All these options assume improved technology that has already been tried and tested on large areas in many other developing countries.

More critical is to switch well-drained irrigated land out of paddy. If Mahaweli land costs up to Rs.200,000 per ha. to develop, even a paddy yield of 10 tons per ha. per year in two crops will generate only Rs.35,000, or 17.5% gross at farm-gate. Calculating this production at economic prices, (deducting all recurrent costs and pricing the rice at export values), will probably yield a very low or even negative return. Expensive land such as this should not be used for paddy. It should be primarily under intensive horticultural production, in a system that also includes paddy, livestock, cotton and sugar, depending on the soil and other micro-ecological conditions. The markets would be primarily domestic and South India. However, this whole

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21/ In Zimbabwe and Zambia, where conditions are very similar to those of the Dry Zone, maize yields of 6-7 tons per ha. are the norm with 30 inches of rain, by good farmers.

issue of the production and marketing of field crops other than paddy is the subject of another study team.

SECTION 2

I. THE POTENTIAL FOR AGRO-INDUSTRIAL PRODUCTS/ SUBPRODUCTS BASED ON RICE

A. Overview

White rice, 72% of the weight of clean paddy[22/], comes in two grades, whole and broken. Under all circumstances and conditions, wherever rice is a staple, the whole grain is the most valuable product of milling. All other products and by-products (brokens, bran, husk and other by-products), have lower value. The object of good milling is to achieve the highest yield of whole grain, of good appearance, odor and uniformity. In high income countries where rice is not a staple, small quantities of whole grain rice are subject to further processing and added value to produce quick-cooking rice, breakfast cereals, dry and frozen mixes and snacks. These are the limits of whole grain rice processing. Brown rice is rice that has been dehusked or shelled, but not polished, so it still retains its bran. Although more nutritious than white rice, brown rice generally sells for less than white rice in international trade.

In international trade, brokens are grains that are less than 3/4 of the whole grain. The quality of a given volume of rice is inversely related to the content of brokens contained. Generally speaking, brokens sell for about 70% of the value of

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22/ This is the theoretical ratio, not the milling yield, which is always a few percentage points lower.

whole grain rice, provided that in all other respects other than grain length, they are identical to the whole grain in terms of color, odor, texture, etc.

Husk, which is 20% of the weight of clean paddy, is the most valuable by-product of milling, as a source of fuel. The energy value of husk is 3,000 kcals per kg. or 5,400 BTUs per lb., so that 12.7 kgs of husk are potentially equal to one imperial gallon of fuel oil. Alternatively, one ton of husk in energy value equals 328 liters of fuel oil, worth Rs. 1,595 today. Husk has been used to parboil paddy since man first employed this process. Currently it fuels steam boilers in larger mills in Sri Lanka, but these single-pass boilers are very inefficient, requiring 3 kgs. of husk to produce one kg. of steam. Modern triple-pass husk boilers are 9-10 times more efficient, generating 3-4 kgs. of steam per kg. of husk, so that in practice they extract the maximum potential energy from the husk, getting from 3 kgs. of husk as much steam yield as does one kg. of oil in an oil-burning boiler. With this level of yield, a parboiling mill can be totally self-sufficient in energy, producing heat from its husk to dry and parboil paddy and operate an electric generator of sufficient power for mill needs. The husk not only produces energy, but the resulting ash has a high value, much in demand in steel making, currently selling in Europe for about Rs. 5000 per ton c & f.

Bran, which is 8% of the weight of clean paddy, is used directly for animal feed, since it has a high content of fat and protein. Bran can be more valuable, but at a greater cost in processing, via solvent extraction, to separate the oil, which is 16% of the bran and good for cooking. The resulting meal is a more valuable feed than the bran, as it has a higher content of protein.

The main problem with bran compared to other sources of edible vegetable oils is its instability. With raw milling the rancidity, or free fatty acid (FFA), content of bran increases by about 1% per hour, and when this reaches 20% it is not economic to process for edible oil; the oil extracted is suitable only for soap making (as is done in Sri Lanka now). To slow down the build-up of FFA, bran should be stabilized immediately after milling. This is done by subjecting it to some cooking in saturated steam. Parboiling has the same effect, and bran from parboiling mills can be and is used for oil extraction without further steaming, provided it is delivered to the solvent extraction plant within three weeks. Also, in parboiling, the fat content of the bran is increased substantially, to 17-20%, as against the fat content of bran from white rice, which is 12-15%, making it less valuable.

II. THE POTENTIAL FOR ENHANCING THE VALUE OF MILLED PRODUCTS IN SRI LANKA

A. Present Situation

Currently, Sri Lanka's milling industry can be characterized as being of low technology, producing low quality rice, with a high wastage rate. The availability of good quality rice, i.e., whole grain rice that is of good color and odor, of uniform shape and kernel size, free of discolored grains and foreign matter, is low, and when available, commands premiums of 30-50%. With most of the milling still done in hullers where the bran is removed, then mixed in with the husk, much bran is lost, as this huller mix is of no commercial value, being of very low feed value. Although parboiling mills use husk for steam raising, lack of investment in the right technology precludes them from obtaining more income from the husk and husk-bran mixes, as evident by the piles of husk visible around many mills.

Official PMB calculations of Sri Lanka's rice production are based on a theoretical yield of 68% for parboiled and 66% for raw milled rice. Rice is, however, sold with a large proportion of foreign matter and poor quality grains, and it is necessary for the housewife to pick these out, thus losing 5-7% of the purchased rice, before cleaning and cooking. The frequency of discolored grains and bad odor is higher than anywhere else in Asia, and the actual percentage of whole grain less than officially claimed; here a whole grain means 1/2 broken while internationally it must be 3/4.

To raise the value added in milling, better standards have to be applied throughout the process, beginning with the paddy. The necessary steps, and their approximate costs and returns are described below, but the pre-condition for rapid improvement is that millers be assured of earning adequate returns on milling operations. This is not the case yet in Sri Lanka, where milling margins are artifically depressed by the PMB (see Part I), choking-off the needed inflow of investment.

B. Paddy and Milling Improvements

Ideally, farmers should produce paddy that is:

1. produced from certified seed;
2. grown and harvested with due attention to correct practices;
3. mechanically threshed on clean yards;
4. winnowed;
5. dried to 14% moisture before it is stored or sold; and
6. Stored in a safe manner without intermingling of varieties.

Where this happens it ensures millers high quality input, for it is the overall quality of paddy that determines the ultimate yield of quality rice; modern milling machinery, even in the best of circumstances, cannot make good rice from bad paddy.

Paddy entering the market in Sri Lanka is generally conceded to be of very poor quality, with a high percentage of

mixed varieties. However, without waiting for farmers to change, Sri Lankan millers can carry out highly cost-effective measures that will improve their milled outurn and thus net returns, by separating and then milling the different varieties. Paddy drying, especially at the end of the Maha when it rains as the harvest begins, is another obvious need. However, private millers are not ready to invest in drying facilities, claiming it doesn't pay. They would rather delay purchasing until the weather is clear, and farmers bring in paddy that has dried out. The wet paddy stays on the farm (40-50% of total production remains as farm-level and does not enter the marketing system), and is sold to the PMB, whose local buyers have less rigid standards, as regards moisture content. In this way, it is the farmers and the PMB who pay the cost of deteriorating wet paddy. In any case, millers hold-off buying as long as possible after the Maha, to force down the prices, as well as the moisture content. However, only by drying can paddy be stored for periods of six to eight months. Milled rice stored for periods as long as this deteriorates rapidly, even when dried and well-stored. With self-sufficiency, drying paddy is a necessity, with the incremental cost recovered by the value added from reduced spoilage; savings should be over 10% of the value of paddy stored, if dried properly.

The PMB, being obliged to buy wet paddy at the end of the Maha, has been urged to install mechanical paddy driers for

its stores. A locally made 4-ton LSU drier, equipped with an electric fan and wood-burning furnace, would cost approximately Rs.450,000 installed. It could dry one ton of paddy an hour, from 22% to 14% moisture, at the cost of Rs.200 for electricity and Rs.50 for wood fuel and Rs.100 for labor, total Rs.350 per ton. The saving would be at least 10% in the paddy processed. With the minimum price of paddy at Rs.2990 per ton, Rs.62.50/bu, a 10% savings is only Rs.299, so mechanically drying paddy is not economic. This bears out the millers' claims, especially when one considers that even spoiled paddy has some value as feed.

Under the present system, milling is a minimal process, yielding a high proportion of brokens, and only half the potential bran yield. The milling yield can be improved and the gross returns augmented, if millers cleaned and graded their paddy prior to milling. In this way, they could eliminate up to 20% of undesirable mass that need not be milled, and proportionally cut the energy and labor cost presently incurred in needlessly processing it. The low quality paddy that can be separated can still be sold to local huller mills and other buyers, since such buyers are not quality concious, although they may demand a discount. By milling only the graded paddy millers can get premiums of at least 20% on their rice, the difference for example between Samba Gr. I and Gr. II. The comparative cost structure is given below.

C. Present System of Mill Input/Output

	Product		Weight Kgs.	Value Rs.
Purchases	Paddy	100%	1000	3,353.00 (market price Sept. 1983)
Output	Husk	21%	210	
	Bran	4%	40	40.00 @ Rs.1,000/ton
	Moisture loss	1%	10	
	Unexplained losses	6%	60	
Total Rice Yield		68%	680	3,425.24 Rs.5.057/kg
Gross income				3,465.24
Less Paddy purchases				3,353.00
				112.24
Less Processing Cost*				112.24 (PMB rate)
Net				0.0

*Raw milling excluding gunnies, transport, interest.

The net return to milling is in fact zero, confirming the millers' claims that milling by itself does not pay adequate returns. The millers make their money on trading and riding out the seasonal price swings. Underlying all the calculations on the rice-paddy ratios is the reality that 10% of the estimated rice, although paid for is eventually sorted out and thrown away prior to cooking by the ultimate consumer.

D. Improved System

By cleaning the paddy prior to milling, 100-200 kg. of undesirable paddy and extraneous matter will be removed, as explained below:

Raw paddy, corrected for moisture and refraction	100%
Removal of husks, immatures, etc.	5%
Removal of thin, shelled and short grains	5-15%
Yield of clean paddy	80-90%

The cost-benefit effect of carrying out this cleaning is illustrated below. It is assumed that the higher quality rice produced will sell at Grade I, and that the cleanings will sell for 80% of the prevailing price for upgraded paddy. The prices for by-products are those prevailing in September 1983 in Anuradhapura.

	Product		Weight Kgs.	Value Rs.
Purchases	Paddy	100%	1000	3,353.00 @ Rs.3.353/kg
	Cleanings	20%	200	536.48 @ Rs.2.68/kg
Input to Mill	Paddy	100%	800	
Output	Husk	21%	168	
	Bran (well-milled)	8%	64	64.00 @ Rs.1000/ton
	Chips	1%	8	20.00 @ Rs.2500/ton
	Brokens	5%	40	100.00 @ Rs.2500/ton
	Moisture loss	1%	8	-
	Unexplained losses	2%	16	-
Total Rice Yield		62%	496	2,997.82 @ Rs.6.044/kg.
Gross Income				3,718.30
Less Paddy Purchases				3,353.00
Gross Profit				365.30
Less Milling Cost on 800 kgs				89.79
Net Profit				275.51

E. Investment Needed

Cleaning the paddy prior to milling generates a profit of Rs.275.51 per ton of paddy, all other factors being equal. Higher quality rice, fetching better prices, is produced, and losses reduced.

To achieve this cleaning requires the following equipment:

1. A cleaner/aspirator for eliminating large debris (straw, strings, mud, etc.), sand, dust, fine straw and husks.
2. Girth separators to eliminate shelled grains (those without husks), brokens, immature grains and seeds.
3. Length separator to eliminate paddy of wrong length, brokens and red rice to achieve uniform paddy for milling.
4. A recovery system to salvage any good paddy from the cleanings streams.

The equipment needed, even of minimum size, is appropriate only for the largest mills, i.e., those that can handle 2 tons of paddy or more per hour. The required equipment costs are as follows:

Equipment	Cost Rs.[23/]
1 Cleaner/aspirator 3TPH	122,000
3 Girth separators @ 1 TPH	585,000
2 Length separators @ 2 TPH	244,000
1 Recovery separator 1 TPH	73,000
Total computed cost 1982	1,024,000
Inflation 30%	307,200
Total cost 1983	1,331,200

The direct incremental operating cost of running this equipment is 5 kw. per hour, which is R.14.00 per hour with electricity at Rs.2.80 per kwh. This would reduce the profit per ton of paddy from Rs.275.51 to Rs.261.51. To recover the investment of Rs.1,331,100 at a profit of Rs.261.51 per hour requires the processing of 5100 tons of paddy, which is 2550 hours for a 2 TPH mill, or just under 18 weeks, assuming the mill operating 24 hours a day, six days a week during the peak milling season. In other words, the investment in quality production can be recovered handsomely well within the first season's operation.

Some millers have inquired about mechanizing their bagging operations. Automatic gunny packing and sewing machines, only available in capacities of 10-30 TPH, cost about Rs.300-500,000 f.o.b., or Rs.500-200,000 installed. Hand sewing and packing currently costs Rs.100 per ton, so the pay-back required is 5-8,000 tons rice, or 4,000-6,500 hours of

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23/ From Asian Development Bank. Anuradhapura Dry Zone Agricultural Development Project, 1982.

operation for a 2 TPH mill, which could mean 1 1/2-3 years at current rates of utilization, also a good rate of return.[24/]

Some millers have expressed the desire to go for really high quality grading and packaging, to capture what they perceive is a growing local market for packaged, branded rice. For this they would require the following:

- ESM or SORTEX Electronic color sorters. Minimum size 2 TPH. Cost Approx. Rs.1.6 million fob. Adding freight, duties, commissions and spares will bring the installed cost to Rs.3.0 million. Color sorters are needed because there is no mechanical method to separate dark, yellow or red grains of the same size as regular rice. High quality paddy, presently not available to Sri Lankan millers, is without these detriments and does not require color sorting.
- Automatic packaging (form and fill poly bags). Minimum capacity 3 TPH, cost new approx. Rs.875,000 f.o.b. Installed cost including duty probably Rs.1.6 million. Second-hand, reconditioned machines are available at half the cost, and are recommended.

24/ There is much access milling capacity in Sri Lanka. No mill operates at full capacity, i.e., 5,600 hours per year, because of imbalance in paddy supply and rice demand, the latter being influenced by Food Department imports. Under such circumstances, the payback on the automatic packing and sewing machines would be longer, and perhaps no cheaper than hand bagging.

To install both pieces of equipment would cost about Rs.4.6 million, nearly equal to a new, locally built 2 TPH parboiling mill. Based on U.S. and South American experience, the operating cost, including bags, adjusted for local conditions, would be about Rs.1259 per ton rice, Rs.1.25 per kg. Some millers think that such high quality local rice packaged in poly bags can sell for a premium of Rs.2-3 per kg. wholesale. At Rs.2.5 per kg. the net return after deducting operating costs would be Rs.1.25 per kg. At this margin, the pay-back on Rs.4.6 investment would be recovered on 3,680 tons of rice, 2-3 years for a well run 2 TPH mill, processing 2-3,000 tons of its very best rice each year. This is an acceptable rate of return and would be even better if second hand machinery is purchased. Going into such packaging pre-supposes investment in the first alternative, that of putting in the paddy cleaners, which are the prerequisite to producing the needed stream of quality grains.

F. Increasing Value Added in By-Products

Brokens: There are four primary agro-industrial uses for brokens and chips; brewing beer, poultry rations, fermentation into ethyl alcohol and grinding into rice flour.

Beer: In many countries beer is made from rice brokens which are otherwise of good quality and content. Sri Lanka's beer production is 3,900,000 gallons per year, and declining. This production requires 1000 tons of malt. The Three Coins Brewery in Colombo has the equipment to use 100 tons of

brokens a year, enough to meet 25% of its malt requirements. However, it has not been able to procure local brokens of sufficient quality to use for making beer. Given acceptable quality of brokens and if both the breweries switched completely to rice, the total demand would only be 1000 tons. The savings on malt imports would then be equal to about Rs.5 million per year.

As Poultry feed: Brokens are almost as high in feed value as maize, since they contain 5-7% digestible protein. Brokens are also good feed for pigs and dairy cows. The present price paid by the Oils and Fats Corporation is Rs.2500 per ton, 50-60% of the whole rice price, in line with the ratio in other countries. Oils and Fats Corporation is prepared to buy any amount of brokens at its price. The current compound feed market can absorb about 10,000 tons of grain.

Ethyl Alcohol: One ton of brokens will yield about 300 litres of pure alcohol. The process involves changing starch to sugar and then to alcohol, using very simple distillation techniques. Distilled rice liquor, wrongly called rice wine, can be produced, but in Sri Lanka, with arrack and toddy readily available and cheap, rice liquor is not likely to take on. However, if tax incidences can be arranged, rice brokens can be used to produce ethyl alcohol for gin and sake. Existing distilleries and breweries can do the processing as the technology of alcohol fermentation is

basic, and surplus capacity exists, e.g., Three Coins Brewery. One thousand tons of rice would produce 600,000 litres of 100 proof alcohol annually. From U.S. experience with farm-level alcohol production (based on maize), the capital cost of a locally made distillery producing 200,000 litres of pure alcohol would be Rs.1.2-1.5 million. The main production cost, after the brokens, is the energy needed for distillation: 1 kg. of oil equivalent for 4 litres of pure alcohol. This energy can come from a husk boiler-generator, given the correct setting. An example of this exists in Vercelli, Italy. Detailed cost analyses on ethanol production in Sri Lanka are not possible in this report. The breweries may be able to do this exercise.

Rice Flour: Used for making noodles and string hoppers, rice flour is not a large item in the local market. Harischandra Ltd., of Matara estimates the total market for commercial flour at only 1500 tons per year. If the market expands, the local millers are quite able to accomodate it. However, most people prefer to buy the rice and pound it into flour at home, so the cost of processing is zero. No rice noodles or flour are traded in international markets. An option open for further analysis is substituting rice flour 10-15% for wheat flour in the manufacture of biscuits and bread. This can be done fairly easily, but the key determinant is market acceptability.

Cold Cereal: Such as rice crispies is not in the Sri Lanka diet, and is not exportable.

Fast Cooking or "Instant" Rice: Has a market only in Europe and the U.S. The large multi-national food processors have developed brand products with General Foods the dominant supplier. Fast cooking rice has not found favour in countries where rice is a staple.

Frozen Rice Products: Have been tested in the U.S. and failed.

Flavoured Rice Mixes: Are sold in Europe and the U.S., again as brand products by major food manufacturers. They are generally packets of rice with a pinch of seasoning included. Sales are very small, and exclusively in high-income countries where rice is not a staple.

Rice-based Snacks: Exist in all rice-eating countries. In India they are very popular items, but all made at home and in food boutiques. Preparation is very simple, involving frying or baking with spices, and all done at home or in the boutiques. Snack consumption is part and parcel of overall rice consumption.

High Nutrition Rice: Is brown or red rice, i.e., rice that has not been polished or whitened by removing the bran, which has all the valuable nutrients. Parboiled milled rice is more nutritious than raw milled rice, as in parboiling the water soluble minerals migrate from the bran to the grain. Even so, parboiled rice is not as nutritious as red or brown unmilled rice. Rice is sometimes fortified with vitamin enriched powder that is glazed on after polishing.

However, washing this rice prior to cooking, which is the practice in all rice countries, removes this fortification.

Husks: As mentioned earlier, husk is a valuable source of fuel, but not utilized to its full potential in Sri Lanka. Much husk is just thrown away by the raw rice millers and even those large parboiling mills that have installed husk boilers realize only 10% of the energy possible. With the efficient triple-pass husk boilers now available, 1 ton of local husk, so long as it is dry, will give the same amount of steam as 328 liters of fuel oil would in an oil-burning boiler. With fuel oil selling for Rs.4.80 per liter, the husk value to the mill is potentially Rs.1575 per ton, more than the value of bran. Probably, the most advanced husk boilers are manufactured by Gariboldi Snc. of Milan, who is also a world famous innovator of parboiling technology, and himself a miller of high quality parboiled rice. His smallest boiler produces 1,666 kgs. of steam at 15 kgs./sq. cm. from 390 kgs. of husk, or ten times the rated output of the boilers that PMB has installed in its new mills, with the same husk input. This husk requirement is equal to the hourly output of a 2 TPH mill and steam output more than adequate for the parboiling and drying requirements of such a mill. The same steam could also be used for drying paddy prior to its storing and to run a generator driven by a reciprocating steam engine. Gariboldi Snc. also manufactures larger, high pressure (45 kgs./sq. cm.) water-tube boiler that generates 1000 kw per

hour via a turbine, plus 10,000 kgs of steam for mill operation. The smaller boiler (firetube) sells for about Rs.2.5 million f.o.b., excluding generator, while the larger water-tube boiler sells for Rs.25 million, including generator. Table 10 gives a hypothetical analysis of these two machines.

The other manufacturers of more efficient single-pass boilers are Mernak Ltd. of Brazil, McBurney and Producers Rice Mill, both of U.S., plus Japanese companies. One Mernak boiler, designed for a 5 TPH parboiling mill, produces 2000 kgs of steam plus 260 kw of electricity through a steam engine-alternator.[25/] It costs about Rs.3.5 million fob. In the U.S. where fuel oil costs about the same as in Sri Lanka, the pay-back on husk-fired boilers is less than a year, on just the process steam value alone.

The husk ash is also valuable. In Europe continuous casting mills are the largest buyers, using it to insulate molten steel. They pay about Rs.5000 per ton c & f for ash packed in 20 kg. poly bags. However, the moisture and carbon content of the ash must be less than 1% and 5% respectively. Allowing for freight and other charges, the net value of ash to Dry Zone Mills would be about Rs.1250 per ton ex-mill. This adds an additional Rs.250 to the fuel value of a ton of husk. If a total energy use is made of

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25/ The steam goes first through the engine, to drive the piston, and then goes into the mill, at much lower pressure.

husk, to produce electricity, steam and ash, the value of a ton husk then becomes

500 kwh of electricity @ Rs.2.80/kwh	=	Rs.1400
4000 kg, steam = 328 liters fuel oil @ Rs. 4.80	=	1575
200 kg. ash @ Rs.1,250/ton	=	250
		3225

If a 1000 kw plant, burning 2 tons of husk per hour costs Rs.25 million f.o.b., the installed costs including duty would probably come to Rs.50 million. Its hourly gross revenue would be equal to 2 X Rs.3,225 = Rs.6,450, implying a pay-back of 7,750 hours, or one year's base-load operations. Incremental operating costs of replacing an existing boiler with this would be zero, since the boilerman and other workers are already employed. In effect the capital costs is the same as for a conventional oil or coal fuel plant but the fuel costs, 90% of life-time operating costs, are close to zero.

The sophisticated combined-cycle approach to husk utilization is really for a very large agro-industry[26/], or the CEB, being beyond the financial capacity of the milling sector in Sri Lanka. However, a few of the largest millers contemplating new boiler investments should consider the smaller, triple-pass firetube boilers with the steam engine-alternators attached. They could then be totally self-sufficient in energy, and

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26/ Such as the paper mills and oil mills, where energy is a major cost item.

places where there is a surplus of husk, in the days when not milling they can still use the equipment to sell power to neighbors or the CEB at a reasonable price per kwh. The total energy potential could be quite large at self-sufficiency: on 2.5 million tons of paddy, there would be over 525,000 tons of husk and husk-bran mixture available each year, equal to 175,000 tons of fuel oil. These new husk burning boilers can just as easily burn paddy straw, providing it is milled or ground down to 7-9mm fines. Total straw production in Sri Lanka is about 2.5 million tons, so just 21% of this straw, if fed into boilers, could yield energy equal to another 175,000 tons of oil a year. To gather this energy would involve transport and grinding (5 kw per ton) costs, but with dispersed boiler locations, these costs would be manageable, and much lower than imported oil or coal in terms of Rs. per Kcals.

Other uses of husk are very minor - very low grade feed (5% of poultry rations), and mulching. Briquetting is not possible, as it would cost more to briquette husk than coconut fibre, which the Ceylon Tobacco Company has found to be uneconomic. Ash has better uses, as a soil conditioner and insect retardant. In Japan ash is put onto the rice nurseries and vegetable plots, and in Sri Lanka the Rice Processing and Development Center is testing its uses as an insect retardant. Apparently the sharp edges of the silica ash seems to remove the wax coating of many common insects,

TABLE 10

HYPOTHETICAL COSTS AND BENEFITS OF INSTALLING A HUSK BURNING ELECTRIC GENERATOR

1. Parameters

Husk Input:	2,000 kgs per hour
Steam Output:	8,000 kgs per hour
Steam Pressure:	45 kgs/sq cm
Electric Output:	1,000 kw per hour
Ash Output:	400 kgs per hour

Assume plant replaces existing oil-fired boiler in an agro-industry, therefore no additional labor needed. Also, present boiler consumes 82 litres of fuel oil per 1,000 kgs of steam (industrial average). To ensure adequate husk inflow, plant should be located within existing mill concentrations, e.g., Anuradhopura. Trucks delivering paddy to mills can backhaul the husk for a short distance, up to 5 kms. Millers would deliver this husk; it would be a backhaul on an otherwise empty run to pickup paddy to supply their mills. They would benefit by receiving uninterrupted power at Rs 2.80 per kwh.

2. Hourly Revenue

	Rs
10,000 kgs of steam, equal to burning 656 litres of oil @ Rs 4.80 per litre	3,150
1,000 kwh electricity @ Rs 2.80	2,800
400 kgs ash @ Rs 1,250 per ton*	500
Total Hourly Revenue	6,450

3. Investment Cost

Total Plant Cost fob Europe	25,000,000
Freight, Installation, Other Costs	25,000,000
Total Installed Costs	50,000,000

4. Payback = Rs $\frac{50,000,000}{6,450}$ = 7,750 hours

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*C&F cost Europe Rs 5,000 per ton

Less Freight	Rs 2,500	
Postchanges	500	
Bagging	250	
Road transport	1,000	3,750
Ex-will value		1,250 per ton

Source: Gariboldi Snc. Milan. Personal Communication

cutting them or dehydrating them. Diatomaceous earth, commonly used as an insect retardant in the U.S., has the same action. No economic use has been found for producing silica from ash as a substitute for carbon black in rubber products.

Bran: Paddy contains 8% bran, which has two uses, for feed and for edible oil extraction.

Straight bran contains 12.5% protein, 13.6% fat, 61.6% fiber, plus thiamin and minerals, and is best used for poultry and cattle rations. Prices range from Rs.1000 per ton at the Oils and Fats Corporation to Rs.2000 per ton paid by some poultry operators to select mills that produce good bran. At these prices and with transport costing Rs.1.6 per mile, bran cannot be transported too far.

Bran oil is a desirable edible oil, half the value of coconut oil, but equal to other vegetable oils. Bran from huller mills is of no use, since it is mixed with husk (the mix can only be used as fuel). Nor is bran from raw milling used for edible oil, as it becomes rancid within a day. Modern parboiling mills do produce good bran and the Lever Bros' Polonnaruwa plant is well placed to receive most of the projected output. There are also two or three plants put up to process soyabeans, and these can just as well handle bran; the technology is the same, and plant capacities are well above available soya supplies.

Bran from parboiling mills, when processed, yield 20% oil that sells for Rs.12,500 per ton, and 20% meal that sells for Rs.1500 per ton. Hence the gross value from a ton of processed bran is about Rs.2000 per ton, but with processing costs about Rs.1250 per ton, it hardly pays to de-oil the bran, especially when the costs of handling and extra transport are considered. In fact, these days bran is processed into rice oil only in those countries that are short of other vegetable oils and there are high duties or other restrictions on oil imports. For Sri Lanka, it is better to develop the feed market, as bran is equal to 80% of the feed value of maize for dairy, poultry and pig rations.

III. RECOMMENDATIONS

A. For Improved Rice Production

1. Implement the quality standards for paddy procurement in line with acceptable standards prevailing elsewhere in the world. These standards are presently being considered by Government, and if implemented will raise the overall quality of paddy entering the market.

2. Encourage investment by mills in paddy cleaning and separation prior to milling. The pay-back on such investment is extremely good, but the pre-condition is to remove ceilings on milling margins. Private mill's quota rate should be equal to the PMB's actual cost, which currently is close to Rs.17.00 per 100 kg. of parboiled rice. PMB's quota rate for private millen is only Rs.14.30 per 100 kg., which does not cover all costs.

3. As the local market for quality expands, mills should consider adding additional rubber roll shellers to reduce brokens and keep separate the husk from the bran. These shellers are made in Colombo by Somasiri and are of excellent value.

4. There seems to be a lack of understanding of the basic scientific principles of parboiling and drying. Present practice with mechanical drying involves too high temperatures and too little air flow, resulting in discolored grain. In parboiling with the CFTRI method, there is a tendency to overcook the paddy.

5. At the new PMB mills, the management and operating problems are obviously overwhelming PMB engineers and technicians, both at the mills and in Colombo. An experienced miller, with a hands-on plant and senior mill management background, not an academic or researcher, should be brought in to help PMB bring its new mill into operation. He would also provide manuals and guidelines that will assist all millers to have an understanding of full-scale operations of large mills.

B. By-Product Utilization

1. Utilize the husk more efficiently by investing in modern triple-pass husk boilers, and generate electricity as well as steam. Export ash, and use it locally as an insect retardant in gunnies of paddy and other produce that will subsequently be processed or cleaned, and encourage its use in vegetable gardens and rice nurseries.

2. As the market for feed develops, white rice mills may consider investing in bran stabilizers. They could buy bran from neighboring smaller parboilers or raw millers for Rs.1 per kg, stabilize and sell it for Rs.2 per kg. to poultry and dairy operations. A 2 TPH white rice mill could put in a locally made rotary stabilizer for Rs.125,000 to stabilize 200 kgs. of bought-in bran per hour. The incremental cost would be the steam needed, so

this investment will only be viable when the mills are equipped with more modern boilers that will provide the excess steam and generate a gross income of Rs.200 per hour, for a payback of 625 hours.

3. Allow market forces to determine future development of rice processing and marketing. This means that government should not force artificially low margins on private mills, while at the same time disregarding, and masking with subsidies, PMB's higher per ton costs. Furthermore, when mills request credit to import modern boilers, government should give them high priority. Through the CEB, government could do the most in developing a market for husk, as a fuel to replace imported oil in electric generation. If only half the available husk, 250,000 tons were to go into co-generation, the output of electricity (2 kg. husk = 1 kwh) would be 125,000,000 kwh per year. This is equal to a 42 MW oil fuel station running 3000 hours (4 months dry season only) per year. Such a plant could cost Rs.1.5 million to install, and use 32,000 tons of oil that today costs at least Rs.160 million a year in foreign exchange.

Using the husk-based system, power capacity would be dispersed or decentralized around the country, in small units, reducing transmission costs. This system would be superior to a single power station, since besides producing the electricity, there would also be process steam production, which in energy terms would be equal to the

amount of electric generated. Furthermore, if select mills were encouraged to install these husk-fired co-generating plants, in a joint venture or lease-back operation with CEB, then the latter can get its capacity for no capital outlay or management obligations on its part.[27/] Large millers in association with banks and finance companies, can borrow the needed capital at favourable interest rates (14%), and make a profit on the energy production itself.

All the above recommendations favour the large millers. This is a natural development, since in food processing and energy production, there are returns to scale. However, these recommendations, if developed, will take several years to implement, and will not effect the 40-50% of paddy production that does not enter the marketing system. Thus farmer held and consumed paddy will always be milled by the local huller.

27/ Dr. Mohan Muasinghe, Energy Advisor to H.E. The President. told the team that it is government policy to decentralize electric production, particularly where this encourages use of locally produced fuels in place of imported oil.

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