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ECONOMICS OF RICE PRODUCTION IN SIERRA LEONE

Report of a Survey in Three Northern Districts

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I. INTRODUCTION

1.1: Background

1. The Government of Sierra Leone has prioritized agriculture as the most important sector of the national economy around which it is focusing its development efforts. This is not surprising because agriculture contributes 50% of GDP and employs over 75% of the national work force. Seventy-four percent of the land area of the country, covering 5.4 million hectares, is suitable for cultivation. This area comprises 4.3 million hectares of upland and 1.1 million of lowland. Over 90% of the lowland area is arable and suited to rice cultivation. These include the very fertile inland valley swamps found in all regions of the country, the less fertile saucer-shaped bolilands in the northern region, the deep flooding riverain grasslands in the southern region and the tidal mangrove swamps of the North-western coastal belt. Rice is also grown on the upland areas, throughout the country, employing the environmentally damaging slash and burn shifting cultivation system which is being discouraged. About two-thirds of the population lives in rural communities deriving their livelihoods from agricultural pursuits. And yet, annually, the country imports nearly 40% of the national staple food, rice.

2. As a national food security strategy the Government is focusing a lot of attention on increasing agricultural productivity, with a view, especially, to reducing the national deficit in rice production. The Ministry of Agriculture, Forestry and Food Security (MAFFS) set up an Agricultural Private Sector Forum, which has now been transformed to the Sierra Leone Chamber of Agriculture, which is a company limited by guarantee under the companies act. Its aim is to promote private investment in agriculture, with emphasis on national self-sufficiency in rice.

3. At the request of the Government of Sierra Leone (GOSL) and in recognition that agriculture has been prioritized as the most important sector of the national economy for reasons of national food security and the high concentration of the population in agricultural employment, the Soros Economic Development Fund is contemplating the development of a commercial rice project in the country by way of investing in segments of the value chain of the commodity, and has engaged Enterprise Development Services Ltd (EDS) to conduct a feasibility study for the establishment of medium to large scale rice processing enterprise(s) in Sierra Leone.

1.2: General Study Objectives

4. The study examined the feasibility of commercial rice production and processing in Sierra Leone. It was conducted in two of the five ecologies, in which rice is grown in the country; the mangrove swamp in the North-Western coastal areas (Port Loko and Kambia Districts) and the Bolilands in the Northern region (Bombali and Tonkilili

Districts). The two areas were selected because of the high probability of getting concentrated areas of rice production to feed medium size rice mills.

5. The rice based farming systems in both areas were studied to estimate average costs of production, output and income. The study aimed to determine whether the existing farming systems in the two selected areas could each support the profitable and sustainable operation of a medium sized rice milling plant of 1-3 tons per hour output using existing or improved rice production technologies.

1.3: Specific Objectives

6. The specific objectives of the farm survey were to:
   i) Generate information on the economics of rice farming under current technology in the two ecologies of the Bolilands and the Mangrove Swamps.
   ii) Estimate total annual rice production and marketable surplus in the two production systems.
   iii) Evaluate the economics of use of improved technology in rice production in the two ecologies and estimate potential marketable surpluses.

1.4: Study Methodology

7. An analysis of the rice value chain was conducted in each ecology to determine the nature and levels of project interventions in the various segments of the chain that would be needed to achieve project profitability and sustainability. This included investigation of appropriate farm and mill input supply systems, product assembly and output marketing options for the mills and knowledge transfer/extension systems, as well as alternative financing mechanisms.

8. Apart from farmers interviewed during a farm survey, discussions were held with Local Government Authorities in the Chiefdoms and Districts covered by the study, importers of rice, traders handling both domestic and imported rice, Ministry of Agriculture, Forestry and Food Security (MAFFS) staff including the Deputy Minister responsible for mechanization services and field extension staff, staff of the Sierra Leone Agricultural Research Institute (SLARI), Statistics Sierra Leone, and of the Customs Department of the National Revenue Authority.

II. RICE PRODUCTION AND MARKETING IN SIERRA LEONE

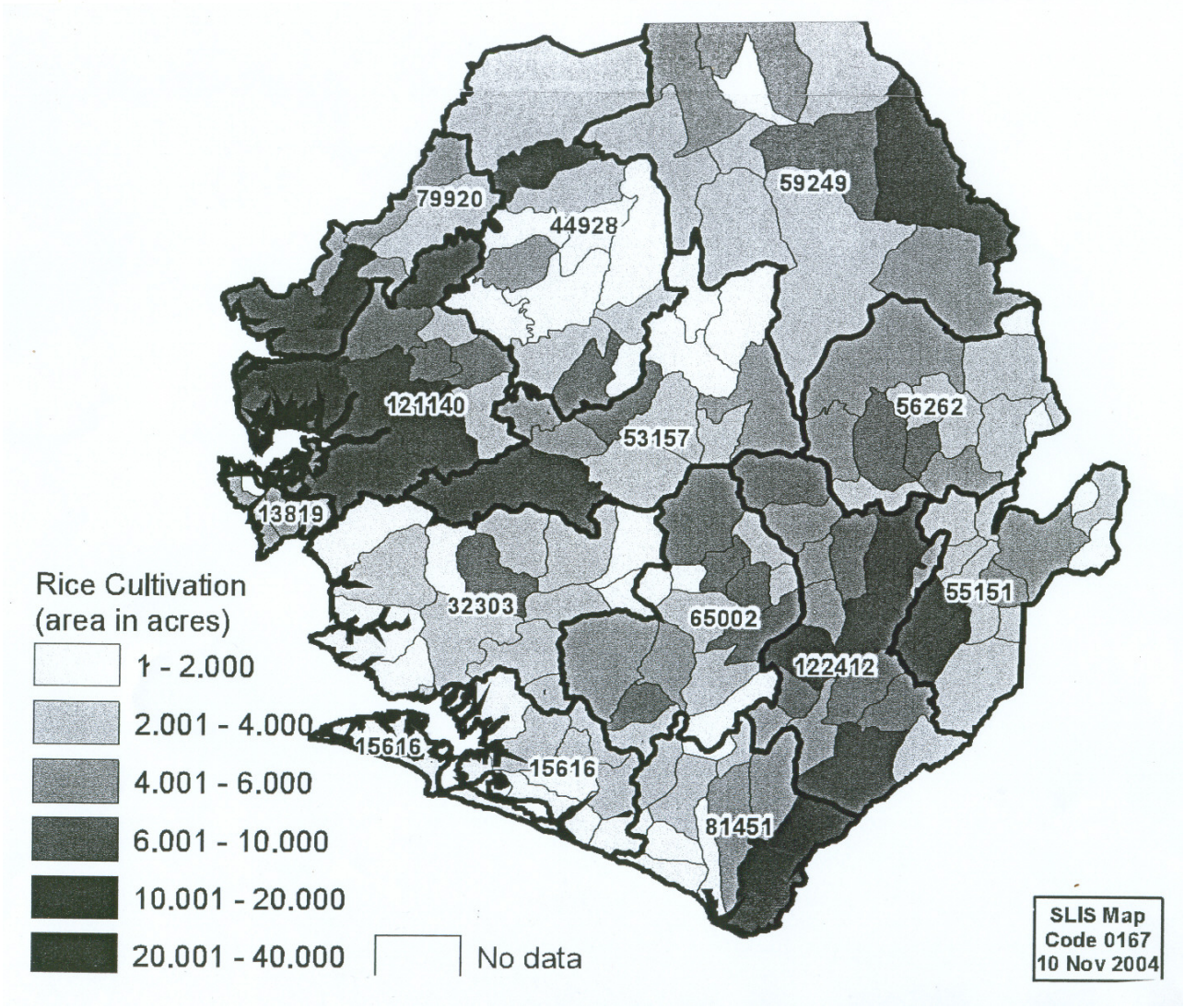
2.1: Rice Production

9. Rice is the staple of Sierra Leoneans. Annual per capita consumption of rice (104 kg) is amongst the highest in sub Saharan Africa. It is grown mainly by small scale farmers on both the upland and diverse lowland ecologies. Sierra Leone has not been able to produce enough rice to meet local consumption demand since the late 1970s. From 1960 to 1975 production of rice increased through expansion of land area and to some extent an increase in yield. In 1975 Sierra Leone is said to have experienced self sufficiency in rice. Records of over 600,000 tons of paddy production are reported at the end of the seventies. In the late eighties, production fell to an average of just above 500,000 tons; further declining to about 460,000 tons in the mid 1990s when civil war engulfed the entire nation. The lowest production (198,000 tons of paddy) was recorded at the peak of the civil war in 1999. Since then, rice production is estimated to have increased from 310,000 tons of paddy in 2000 to 637,983 tons in 2007. The distribution of production by District in 2007 is shown in Table 1. Map 1 shows the density of production by Chiefdom, confirming that chiefdoms in the Scarcies area in the northwest of the country, the bolilands in the center and the riverain grasslands in the south east have the highest concentrations.

Table 1: Rice production and area cultivated in Sierra Leone in 2007 by Districts

District	Paddy Production (Mt)	Area Cultivated (Hectares)
Kailahun	56481	58539
Kenema	51947	56685
Kono	36761	38831
Bombali	67538	78311
Kambia	65111	50369
Koinadugu	46005	51011
Port Loko	74638	97575
Tonkolili	58317	75035
Bo	35196	51464
Bonthe	19345	19616
Moyamba	42802	43836
Pujehun	28160	28795
Western Rural	5702	9421
Total	637983	659487

Source: PEMSD/MAFFS



Map 1: Density of paddy rice production by chiefdoms in Sierra Leone, 2004

10. Rice production in Sierra Leone is largely undertaken by small-scale farmers. During the 2004/05 cropping season it is estimated that 56 percent of households cultivated less than 1 ha each of farm land while only 44 percent cultivated 1 ha and more. Rice field area per household ranged from 0.25 ha to 5.5 ha with an average of 1.06 ha.

11. Using a consumption requirement of 104 kg per person, PEMSD/MAFFS[1] estimated total consumption requirement at 560,000 mt of clean rice in 2007. Using an allowance for seed and losses of 7.5% of paddy production, and a rice mill recovery rate of 65%, it estimated that self sufficiency was 68.6% with total paddy requirement of 930,000 mt at 100% self-sufficiency. However, as discussed later, these estimates are difficult to reconcile with rice import statistics.

2.2: Domestic Rice Processing and Trade

12. After harvest most farmers leave rice sheaves in the field to dry. Threshing and winnowing are usually done by hand and further drying is on mud floors and tarmac roads. Access to concrete drying floors is limited to a small proportion of farmers in the country. The quality of local rice marketed is generally low due to adulteration with stones and other foreign matter during the drying process, and use of traditional milling methods.

13. There is only one large rice mill in the country – a 1 ton/hour mill installed by the Chinese in Bo city in the Southern Province. Since its installation in 2004 it has not operated because of unavailability of paddy supplies due to its location far from the major surplus rice producing areas of the country, and the failure to establish a proper business model for its operation as a custom milling facility or a rice milling company that purchases and mills rice in its own account.

14. There were over 300 small rice mills in the country in the late 1980s. Most were destroyed or rendered non functional during the country's civil war. By 1996 only about 90 were functional[2]. In 2004, it was estimated that a total of 53 small scale rice mills existed in the country. Sixty percent of these mills were in the Northern Province. Current indications are that the number is significantly higher.[3]

15. Thus hand pounding and use of small scale steel cylinder mills constitute the major means of rice processing in the country. Parboiling is widely practiced and parboiled rice constitutes a substantial proportion of local rice in the market particularly in the North.

16. Locally produced rice is currently traded in a poorly organized market in small quantities by a few wholesalers but mainly by retailers (See Figure 1). Traders operate from stores

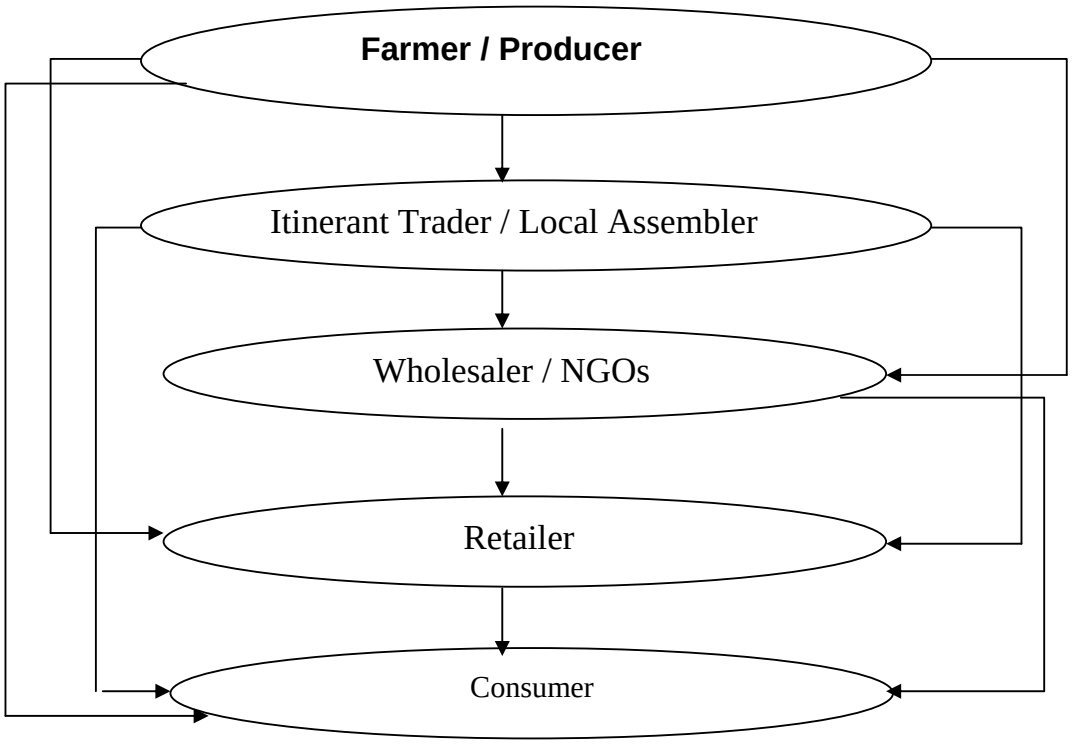
[1] Planning, Evaluation, Monitoring and Statistics Division (PEMSD), Ministry of Agriculture, Forestry and Food Security (MAFFS), Update of Agricultural production as at 2007

[2] Dunstan Spencer and Associates, Rice Trade and Price Policy Study, Ministry of Agriculture and Natural Resources and The World Bank, Agricultural Sector Support Project, Final Report, January, 1997.

[3] For example the EDS farm survey in March/April 2009 identified 42 functional mills in Mambolo and Samu Chiefdoms in Kambia District, 8 in Bombali District and 7 in Tonkolili District.

near the major retail markets and sell to retailers by the bag. The retailers sell in the local markets by cup measures which are not officially standardized.

Figure 1: Marketing Channel for Locally Produced Rice in Sierra Leone



Source: MAFFS, 2005, Figure 4.3

17. All domestic rice processing and trade in the country is currently a private sector activity. MAFFS currently has in its possession 26 small scale units funded by UNDP and has two large scale (1 ton/hour) mills on order funded by the Indian Government. It is understood that MAFFS intends to turn all the mills over to the private sector for operation although the modalities and mechanisms of such privatization are not clear.

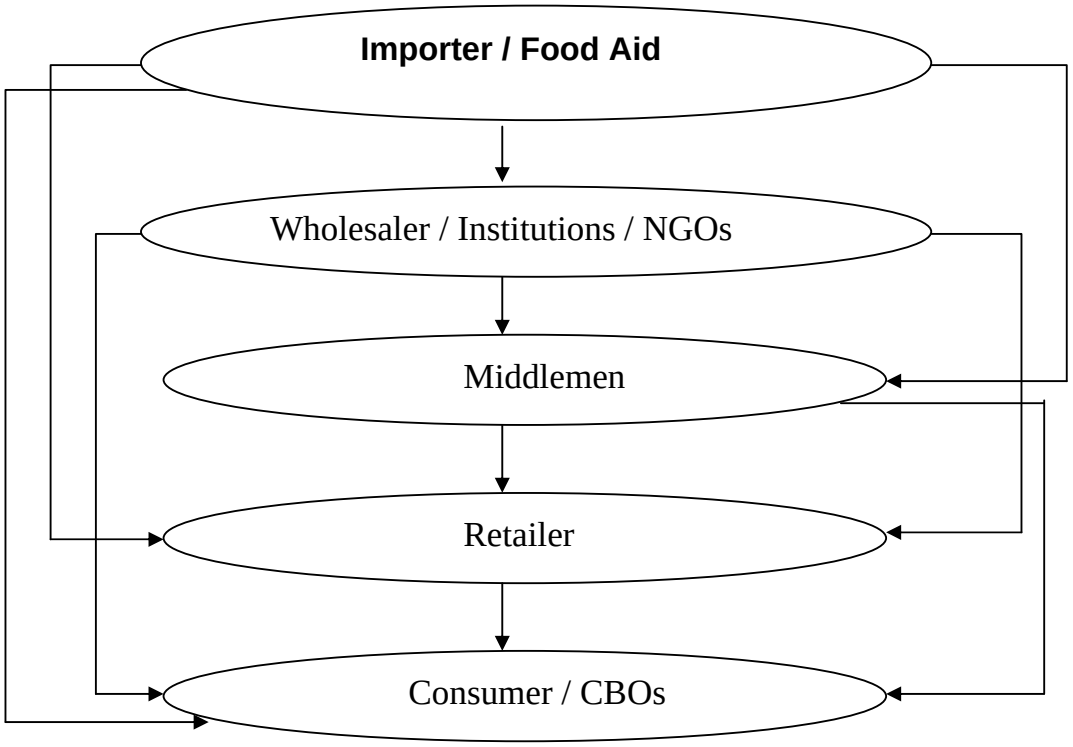
2.3: Imported Rice Trade

18. Figure 2 shows the marketing channels for imported rice. It is evident that the structures of the marketing systems for local and imported rice are similar, except that the players and marketing agents at each level are different.

19. Historically, the marketing of rice in Sierra Leone has enjoyed government support and intervention to ensure widespread availability to low income households. The Rice Department, later Ministry of Trade was greatly involved in the rice trade during the colonial and early post-colonial periods, when Sierra Leone was about 95 percent self-

sufficient in rice production. The Rice Department marketed both paddy rice and milled rice alongside private operators and businessmen who dominated the market at the time.

Figure 2: Marketing Channel for Imported Rice in Sierra Leone



Source: MAFSS, 2005, Figure 4.4

20. All imported rice trade is currently undertaken by the private sector. The key government agencies and parastatals involved in the rice trade during the 1970s and 1980s included the Rice Department, the Rice Corporation and the Sierra Leone Produce Marketing Board (SLPMB), but by the late 1980s the private sector had assumed the dominant role in the marketing of both local and imported rice.

21. In 2008 approximately 158,000 metric tons of rice was imported into the country by five importers, who were all located in Freetown[4]. Wholesalers/merchants purchase from them in cash and transport large numbers of bags of rice to provincial destinations to sell by the bag from their shops to retailers. The retailers sell by cup measures to consumers in local markets stalls. According to the largest rice importer, Freetown and its environs, is the largest market for imported rice, consuming approximately 45% of

[4] The five rice importers and quantities imported in 2008 are as follows: Commodities Trading Company (44,500 mt), Tradex Company (52,500 mt), Harmony Trading Co (51,192), Samco Ltd (7,000 mt), and Ibrahim Bazzy and Sons (2,750 mt)

imports. Freetown is followed by the Eastern Province (Kenema and Kono) and the Southern Province (Bo) as major markets. Of the four administrative regions, the Northern Province takes the least volume of imported rice due to the high local production from the bolilands in Tonkolili and Bombali Districts and the mangrove swamps of the Scarcies area of the Kambia District.

22. Although government statistics show increases in local rice production over the last three years, importation of rice has nonetheless been increasing over the same period, 2006 to 2008 instead of falling (Table 2). For example, in a Ministry of Agriculture "Update of Agricultural Production as at 2007" paddy production increased by 21% from 2005 to 2007. If this data is correct, the increase has had a perverse impact on commercial rice importation, which increased by 10% in 2007 and continued to increase by 58% in 2008.

23. Furthermore the import figures do not reconcile with the domestic rice production and self sufficiency figures reported earlier. For example the 2007 imports figure of 99,839 mt of clean rice, when converted to paddy equivalent at 65% milling recovery gives a figure of 153,600 mt of paddy, leaving a gap of 138,400 mt paddy, indicating that the allowance for seed and losses is an overestimate, and/or the milling recovery rate used is an underestimate, and/or that production is underestimated, and/or that self-sufficiency is overestimated. The latter is most likely and poses a continued challenge for national food security policy and an opportunity for investment in domestic rice production and processing to replace imports.

Table 2: Rice Imports into Sierra Leone (mt), 2006-2008

Year	Commercial	Food Aid	Total
2006	90,680	805	91,485
2007	99, 839	0	99,839
2008	157,942	1,218	159,160

Source: Customs Division, National Revenue Authority

24. According to the major importers, the bulk of rice imports are in mainly three grades:

Grade	**Approx. % of Import**
25% broken	70%
5% broken	23%
100% broken	5%

25. Importers reported importing virtually only raw milled rice (about 98%). Only an insignificant quantity (less than 2%) of parboiled rice is imported due to the higher cost of that commodity and the general acceptance of raw milled rice by the market. Rice importers deal mainly in the spot market for rice of various origins, (but mainly Indian

and Pakistani) and grades and are therefore confronted with relatively high and variable prices. Importers reported cif prices of $350 to $405 per MT for 25% broken rice.

III. FARM SURVEY

3.1: Objectives

26. The objective of the farm survey carried out by EDS was to study the rice based farming systems in the mangrove swamps and bolilands in order to estimate average costs of production, output and income. The aim was to determine whether the existing farming systems in the two selected areas could each support the profitable and sustainable operation of a medium sized rice milling plant of 1-3 tons per hour output using existing or improved rice production technologies.

27. Specifically, the farm survey was to:

    a. Generate information on the economics of rice farming under current technology in the two ecologies of the Bolilands and the Mangrove Swamps.
    b. Estimate total annual rice production and marketable surplus in the two production systems.
    c. Evaluate the economics of use of improved technology in rice production in the two ecologies and estimate potential marketable surplus.

3.2: Sample Selection

28. Since reliable secondary data on rice production in the selected Districts was not available at the Chiefdom[5] level, the Chiefdoms in the target Districts were listed in order of importance in rice production, using information from experts (Ministry of Agriculture field staff, Research staff etc). The two or three most important rice producing chiefdoms were then selected for study.[6] They were:

    - Bombali District (Bolilands)
        - Lebeisaygahun
        - Sanda Tendaren
        - Gbendembu Ngowahun
    - Tonkolili District (Bolilands):
        - Kholifa Mabang
        - Kholifa Rowalla
        - Yoni

[5] Administrative areas within a District

[6] The two most important rice producing chiefdoms In Bombali District fall within the proposed sugar cane farm for a Bio-fuels project and were therefore eliminated from consideration Two other chiefdoms were selected

- Kambia District (Mangrove Swamps)
    - Samu
    - Mambolo

Sixty farmers were purposively selected for interview within each chiefdom. Input, output, processing, marketing and pricing information were collected from them.

3.3: Input Use

29. Table 3 shows that farm sizes ranged from 1.5 ha for Inland Valley Swamps (IVS) in the Tonkolili District to 10.2 ha for boliland farms in the same District. Mangrove swamp farms in Kambia District averaged 3.4 ha. As expected farmers seed rates are higher in the Mangroves where transplanting is the norm, than in the Bolis where seed broadcasting is practiced. But with averages of over 100 Kg/ha, farmers seed rates in the two ecosystems are considerably higher than the recommended 40 – 60 Kg/ha.

30. A new development over the last decade is that almost a third of mangrove farmers now use fertilizers and about a quarter use pesticides, mainly to control crabs. Application rates of fertilizers are very low, mainly under 100 Kg/ha of 15-15-15 NPK. Supplies are obtained from traders who import the fertilizers and pesticides from Guinea, and provide them on loan to the farmers to be repaid at harvest in the form of supplies of paddy to the traders at agreed prices that are usually below the open market price for paddy at harvest time.

31. About a third to a half of mangrove and boli farmers pay rent for their field, ranging from almost Le 20,000 per ha in the bolilands, to almost Le 200,000 per ha for the more productive mangrove swamps. The Table also shows that virtually all Boliland farmers in Tonkolili mechanically plough their fields. In the bolilands in Bombali the proportion is about a third. The proportion of rice farmland harrowed and seed harrowed mechanically is much less than that ploughed.

32. Table 4 shows that hired labor is widely used by rice farmers in both ecologies in virtually all operations. However, hired labor is not used for weeding and bird scaring in the mangroves. In fact, as Table 5 shows, these tasks are rarely performed, even with family labor. Wage rates are 20 - 30 percent higher in the mangrove swamp areas than in the bolilands.

Table 3: Percentage of farmers using different inputs and average quantities used by farmers who used the input on their largest rice field

							Mechanical Cultivation				
			Seed	Fert	Pesticides	Land Rent	Plough	Harrow	Seed Harrow	Combine	
District	Rice System	Area (Ha)	Kg/ha	Kg/ha	Le/ha	Le/ha	Le/ha	Le/ha	Le/ha	Le/ha	
Bombali											
	Boli										
	% Using			3.1	0.0	34.4	37.5	31.3	18.8	12.5	
	Average	7.3	93.6	12.5		19,581.3	149,778.5	47,238.9	40,229.6	98,807.6	
	IVS										
	% Using			0.0	0.0	29.4	5.9	5.9	5.9	0.0	
	Average	1.8	89.7			26,740.3	265,980.6	156,459.2	156,459.2		
	Upland										
	% Using			0.0	0.0	30.0	20.0	10.0	0.0	0.0	
	Average	2.5	72.5			10,933.3	50,000.0	16,000.0			
Tonkolili											
	Boli										
	% Using			0.0	0.0	51.5	93.9	48.5	69.7	15.2	
	Average	10.2	101.6			32,273.1	99,724.4	77,270.9	46,331.8	617,021.4	
	IVS										
	% Using			0.0	0.0	18.2	0.0	0.0	0.0	0.0	
	Average	1.5	73.9			29,909.4					
	Upland										
	% Using			6.3	0.0	62.5	0.0	0.0	0.0	0.0	
	Average	2.1	50.6	76.9		13,594.2					
Kambia											
	Mangrove										
	% Using			28.3	24.5	30.2	0.0	0.0	0.0	0.0	
	Average	3.4	106.9	45.9	16,908.6	198,668.8	0.0				
	Boli										
	% Using			57.1	0.0	28.6	42.9	14.3			
	Average	2.0	137.1	106.7		38,015.9	413,219.8				

Note: Leone (Le) is the Sierra Leone currency with a rate of exchange at the time of the study of Le 3050 = 1 US dollar
Source: Field Survey

Table 4: Percentage of farmers using hired labor for different rice crop activities in their largest field, average use (person days per hectare), and average wage rates (Leones per day) by farmers using hired labor for a particular enterprise during the 2008 crop season

		RICE FIELD 1 INPUT-Hired Labor																				
		Land Clearing		Nursery Work		Plough		Puddle		Plant/Transplant		Weed		Bird Scaring		Harvest		Threshing		Transport		
District	Rice System	Wage	PD/Ha	Wage	PD/Ha	Wage	PD/Ha	Wage	PD/Ha	Wage	PD/Ha	Wage	PD/Ha	Wage	PD/Ha	Wage	PD/Ha	Wage	PD/Ha	Wage	PD/Ha	Avr Wage
Bombali																						
	Boli																					
	% Using		16		22		56		53		56		59		19		94		69		38	
	Average	5,000	4	4,500	2	9,028	5	6,088	9	5,235	7	4,942	7	2,958	6	5,256	13	6,261	4	10,337	4	5,474
Bombali	**IVS**																					
	% Using		0		35		82		82		76		12		6		94		82		47	
	Average			4,287	5	6,067	23	5,893	13	5,308	647	5,000	9	5,000	6	4,835	20	4,871	6	2,151	6	4,585
	Upland																					
	% Using		50		50		70		0		30		80		0		80		60			
	Average	6,000	19	6,200	12	5,250	16			5,167	16	5,188	14			5,438	17	8,833	2			4,675
Tonkolili																						
	Boli																					
	% Using		9		3		67		61		18		94		3		100		73		45	
	Average	7,500	12	6,000	1	5,916	3	5,928	4	5,477	3	5,322	5	4,914	7	5,854	11	4,862	3	16,997	2	5,752
	IVS																					
	% Using		18		73		100		100		91		18		0		100		73		27	
	Average	5,750	16	5,891	12	6,075	26	6,296	22	5,544	33	7,350	16			5,569	22	11,088	10	2,900	8	5,951
	Upland																					
	% Using		88		0		100		0		25		94		0		100		44		19	
	Average	5,495	15			5,404	17			4,777	14	4,906	15			7,020	15	5,143	7	5,333	3	3,638
Kambia																						
	Mangrove																					
	% Using		8		62		96		100		89		0		0		98		89		13	
	Average	7,044	10	10,037	5	7,810	16	7,659	13	6,983	26					9,369	13	12,212	7	21,250	0	6,791
	Boli																					
	% Using		0		57		71		100		71		0		0		71		71		0	
	Average			23,196	19	8,840	14	7,419	27	5,879	26					5,729	28	16,483	7			7,505

Note: Wage = Leones/person day; PD/Ha = Person days/hectare
Source: Field Survey

Table 5: Percentage of farmers using family labor for different rice crop activities, and average use (person days per hectare) by farmers using family labor for a particular enterprise during the 2008 crop season

District	Rice System	Family Labour									
		Land Clear	Nursery Work	Plough	Puddle	Plant/Tplant	Weed	Bird Scaring	Harvest	Threshing	Transport
Bombali											
	Boli										
	% Using	13	41	41	41	59	41	38	78	72	56
	Average	6	1	1	1	1	3	13	5	1	2
Bombali	**IVS**										
	% Using	12	82	47	65	71	29	29	82	65	71
	Average	2	5	5	6	6	4	18	5	3	4
	Upland										
	% Using	40	0	60	10	20	60	90	80	70	80
	Average	2		3	0	1	2	33	2	1	4
Tonkolili											
	Boli										
	% Using	15	3	70	76	30	94	55	97	94	88
	Average	2	1	2	3	1	7	13	10	2	2
	IVS										
	% Using	45	91	82	73	100	82	36	100	91	100
	Average	11	11	10	6	13	15	35	11	8	8
	Upland										
	% Using	94	6	94	94	25	100	38	100	94	94
	Average	5	15	7	7	6	18	85	16	6	4
Kambia											
	Mangrove										
	% Using	9	96	92	98	96	11	17	98	94	55
	Average	2	2	2	2	2	2	2	2	2	5
	Boli										
	% Using	43	100	100	100	100	57	14	100	100	86
	Average	5	5	3	3	5	5	6	5	5	5

Source: Field Survey

3.4: Sales and Marketing

33. Table 6 shows that mangrove swamp rice farmers have the highest marketable surplus. About 50% of their production is sold, compared to about 30% for Boliland farmers. Parboiling of domestically produced rice is still widespread in Sierra Leone with, in most cases 60 – 70% of farmers home-consumed rice being parboiled. The proportion of rice sold by farmers that is parboiled is lower (20-30% in the bolis and about 50% in the mangroves), but most of it is parboiled by traders before milling. Machine milling by small rice mills is common in the Mangroves swamps with 70% of the rice sold being machine milled by farmers. In the bolis a much smaller proportion is machine milled, with 60 – 70% being sold as husk.

34. Most rice sales take place in 2 - 3 batches a year in the farmers' village (Table 7). However a third of mangrove farmers make sales in the nearby periodic (Lumor) market, with a quarter transporting some of their husk rice to Freetown for sale. Rice prices obtained by farmers vary slightly by region and type of rice farming system, with boli and mangrove swamp farmers in the Kambia District receiving the highest prices (Table 9)

3.5: Cost and Returns

35. Tables 8 and 9 present data for costs and returns of rice farming in the three districts studied. Cost of production are highest in Tonkolili because of mechanical cultivation charges which allowed farmers to cultivate larger farms and the use of high seed rates to compensate for non use of fertilizers in the the low soil fertility soils and to help reduce weed competition.

36. Returns to family labor are highest in mangrove swamp farming, being about eight times the going wage rate. Upland rice farming yields a return per day which is just about the same or less than the going wage rate. The overall conclusion is that using existing technologies, rice farming in the bolis (mechanically cultivated without fertilizer use) and the mangroves (hand cultivated with little or no fertilizer use) is highly profitable to domestic farmers.

3.6: Potential Paddy supply to proposed mills

37. Table 10 shows that there is sufficient marketable surplus in the catchment areas of the proposed mills. Two ton an hour mills operating at full capacity will use 7% of the potential supply of paddy in the Mile 91 (Tonkolili District) catchment area, 12% in the Mambolo (Kambia District) catchment, and 36% in the Batkanu (Bombali District) catchment.

Table 6: Proportion of rice production that is sold, and processed in different ways (maximum of 10)

District	Rice System	CONSUMPTION/SALES			PARBOILING		HAND POUND - Family Lab.		HAND POUND - Hired Lab.		MACHINE MILL		Husk sold
		Consumed	Gift+Seed	Sold	For Home	For Sale	For Home	For Sale	For Home	For Sale	For Home	For sale	
Bombali	Boli	4	3	3	7	3	8	2	0	0	1	1	6
	IVS	5	2	2	8	3	9	2	0	1	0	0	4
	Upland	6	2	2	9	2	8	2	0	0	0	0	7
Tonkolili	Boli	4	2	3	6	2	8	1	1	0	1	1	7
	IVS	5	2	3	8	1	7	1	0	0	2	1	6
	Upland	5	2	3	5	0	10	1	0	1	0	0	8
Kambia	Mangrove	3	1	5	4	5	2	0	0	0	8	7	3
	Boli	6	1	3	8	4	3	0	0	0	7	4	3

Source: field survey

Table 7: Percentage of farmers using different channels for sales of rice, and number of sales per year

		Farm Gate		Village		C/Dom Hqts		Periodic Mkt		Makeni		Freetown		Sales/ Year
		Husk	Clean	Husk	Clean	Husk	Clean	Husk	Clean	Husk	Clean	Husk	Clean	
Bombali	Boli	0	0	59	13	6	0	3	0	6	3	0	0	2
	IVS	0	0	41	24	0	0	0	0	0	0	0	0	2
	Upland	0	0	70	10	0	0	10	0	0	0	0	10	2
Tokolili	Boli	0	0	73	55	0	0	0	0	0	0	0	0	3
	IVS	0	0	73	27	0	0	0	0	0	0	0	0	3
	Upland	6	0	75	25	0	0	0	0	0	0	0	0	3
Kambia	Mangrove	4	0	85	40	0	2	32	2	2	0	21	4	3
	Boli	0	0	71	43	0	0	0	0	0	0	0	29	2

Source: Farm survey

Table 8: Weighted Average Cost of Rice Production from Farmers Largest Rice Field in 2008

District	Rice Type	Area	Seed	Fertilizer	Pesticides	Land Rent	Mech Cult	Hired Labor	Variable Cost	Family Labor
		Ha	Leones						Leones	Person Days
Bombali	Boli	7.3	524,281.3	44,687.5	0.0	49,218.8	664,115.6	1,326,452.1	2,608,755.2	103.7
	IVS	1.8	144,088.2	0.0	0.0	13,823.5	59,852.9	675,250.0	893,014.7	53.2
	Upland	2.5	152,600.0	0.0	0.0	8,200.0	29,000.0	879,152.8	1,068,952.8	100.0
Tonkolili	Boli	10.2	2,426,015.2	0.0	0.0	169,393.9	2,617,756.1	1,388,198.7	6,601,363.9	315.2
	IVS	1.5	196,727.3	0.0	0.0	45,000.0	0.0	1,429,655.4	1,671,382.7	142.3
	Upland	2.1	188,875.0	16,875.0	0.0	29,100.0	0.0	931,386.4	1,166,236.4	209.4
Kambia	Mangrove	3.4	518,754.7	77,122.6	14,037.8	203,000.0	0.0	1,978,228.2	2,791,143.3	52.2
	Boli	2.0	397,142.9	432,000.0	0.0	21,428.6	377,953.0	1,582,286.2	2,810,810.6	73.3

Source: Farm Survey

Table 9: Weighted Average Returns in Rice Production from Farmers Largest Rice Field in 2008 in Sierra leone

District	Rice Type	Area	Output		Returns to Family Labor				Wage	Rice Price	Yield
		Ha	Kg	Le	Le	Le/Day	Margin (Le/day)	Le/Ha	Le/Day	Le/Kg	Kg/Ha
Bombali	Boli	7.3	5,163.3	5,445,903.0	2,837,147.8	27,348.0	21,873.7	388,002.6	5,474.3	1,054.7	706.1
	IVS	1.8	1,452.5	1,601,900.0	708,885.3	13,330.8	8,746.3	403,314.9	4,584.5	1,102.9	826.4
	Upland	2.5	1,660.0	1,546,171.4	477,218.7	4,771.7	96.7	190,887.5	4,675.0	931.4	664.0
Tonkolili	Boli	10.2	12,073.5	12,525,103.5	5,923,739.6	18,792.9	13,040.4	581,397.9	5,752.5	1,037.4	1,185.0
	IVS	1.5	2,310.4	2,714,677.3	1,043,294.6	7,329.1	1,377.8	693,428.4	5,951.3	1,175.0	1,535.6
	Upland	2.1	1,406.4	1,413,400.6	247,164.1	1,180.6	-2,457.8	115,463.5	3,638.4	1,005.0	657.0
Kambia	Mangrove	3.4	4,463.8	5,655,476.7	2,864,333.4	54,839.6	48,049.0	846,254.9	6,790.6	1,267.0	1,318.8
	Boli	2.0	3,120.0	4,494,494.8	1,683,684.1	22,974.2	15,469.2	853,424.3	7,505.1	1,440.5	1,581.5

Source: Farm survey

Table 10: Potential Paddy Supply to proposed rice mills from their catchment areas (1)

Item	Mambolo Mill	Mile 91 Mill	Batkanu Mill
(a) Population(2)	90,682	147,194	62,166
(b) Average household size in the District	7.3	6.5	6.6
(c) Estimated number of households in Catchment (a/b)	12,423	22,645	9,419
(d) Average household rice production (tons)(3)	8.77	13.46	6.65
(e) Household Marketable surplus (%)(3)	52.0	30.0	30.0
(f) Household Marketable surplus (tons) (3)	4.56	4.04	2.00
Catchment Marketable Surplus (tons) (c x f)	56,653	91,485	18,838
Percent marketable surplus demanded by mill (4)	11.9	7.3	35.7

Notes:

(1) Catchment areas for the mills are – Mambolo (Samu and Mambolo Chiefdoms in Kambia District); Mile 91 – Yoni, Kholifa Mabang, and Kholifa Rowalla chiefdoms in Tonkolili District); Batkanu (Lebeisaygahun, Sanda Tendaren and Gbendembu Ngowahun chiefdoms in Bombali District).

(2) 2004 Population survey

(3) From Field survey

(4) 2 tons per hour mill operating at full capacity milling 6720 tons paddy per year (1.5 shifts per day, 8 hours per shift, for 280 days per year)