

PN-AA N-673
6980135/62
ISN-31853

Rice Policy in Mali

by

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July 1979

This paper was prepared as part of a project funded under Contract AID/AFR-C-1235 by the U.S. Agency for International Development.

INTRODUCTION

The Republic of Mali was the victim of a severe drought between 1972 and 1974, which caused it to import nearly one-fourth of its average annual consumption of cereals. The extraordinary cereals imports during the drought were the peak of a rising trend of imports, especially of rice, which had begun in the late 1960s. That trend was largely the result of the stagnation of rice and coarse grains output after Mali, formerly French Soudan, became independent in 1960. Early policy, which relied on an expansion of collectivist agricultural production in the face of inadequate producer incentives, neglected the new nation's two unique advantages in rice production. The first of these advantages was the Office du Niger, the largest irrigation scheme in West Africa, initiated by the French in the 1930s to produce cotton for export and rice for local consumption. The Office suffered from organizational and agronomic problems which the French and the first government were unable to solve. The second advantage was the possibility of large-scale, low-cost rice land development in the flood plain of the Niger River.

The new government, which came to power in 1968, changed Mali's approach to expanding rice production and, after the setback of the drought, its policies enabled the country to regain self-sufficiency and even to export rice. The development of Malian rice policy and the country's options for the future are the subject of this study, which is organized into four sections: a description of the economic geography of Mali; a historical analysis of the rice policies of the governments since independence; an evaluation of current problems and policy options; and a prognosis of future policy developments.

ECONOMIC GEOGRAPHY

Data on the population of Mali, distributed into its six administrative zones, are shown in Table 1. Although there was no complete census until 1976, that population is estimated to be growing at an annual rate of 2.5 percent, based on comparisons with partial surveys done in 1960 and 1967. Population density is low generally, and the vast Saharan section of the country is almost uninhabited. The population depends on the wetter sub-Saharan zones (the northern limit of which is defined roughly by a line extending between the cities of Kayes and Mopti) and that dependence appears to have grown since the late 1960s.¹ There is a good deal of dry season (January to May) migration out of Mali toward the coastal countries, especially the Ivory Coast, and some more permanent loss of population has occurred in the regions near Timbuktu and Kayes.

The urban proportion of the population grew from approximately 9 percent in 1967 to nearly 13 percent in 1976; because there is some reason to believe that the rural population was underrepresented in the 1967 survey, it is possible that the urban share has, in fact, increased more rapidly than these numbers imply.² Most of the urban migration has been to Bamako, the capital city, which is perhaps seven times as large as the next largest city, and it appears that there have been important movements toward the city of Mopti as well.

Mali is one of the poorest countries in the world, with a per capita product (in 1975 prices) of \$85. Real gross domestic product has grown at roughly 3.5 percent annually since independence in 1960, and per capita product has grown at slightly more than 1 percent. The rural population has incomes of between \$50 and \$90 with an average of perhaps \$60, and depends

Table 1.--Regional Distribution of Population, 1976^{*a}
(thousands of people)

Region	Total	Rural	Urban ^a	Density (per km ²) ^b
Kayes	871	797	74	7.3
Bamako	1,320	875	445	14.7
Sikasso	1,172	1,097	75	15.3
Segou	985	897	88	17.5
Mopti	1,236	1,182	54	13.9
Gao	724	673	51	0.9
Total	6,308	5,521	787	5.1

* Source is Government of Mali, Ministère de Développement Rural, Institut d'Economie Rurale, Recensement Général de la Population du Mali: Résultats Provisoires, Bamako, 1976.

^a Urban populations are only those shown in the census as living in "communes" (the central, incorporated districts of the largest towns), of which there are 13; the urban estimate is probably low, for that reason.

^b Regional areas from Government of Mali, Ministère de Développement Rural, Institut d'Economie Rurale, Rapport de l'Enquête Agricole, Bamako, 1973-74.

largely on the subsistence rainfed cultivation of millet or sorghum. The wealthiest rural inhabitants are in the cotton and peanut areas, although livestock is a significant part of rural wealth, especially in the more arid northern zones.

National cropped areas and a recent regional division are shown in Tables 2 and 3. Areas, yields, and outputs of the major crops are shown in Table 4. Hectarage and production figures are hard to interpret as a consistent series because of the drought, but the patterns of output and of regional specialization are evident. Millet and sorghum³ cover the largest areas while the principal cash crops--cotton, peanuts, and rice in the Office du Niger--occupied only about 25 percent of the total average cropped area between 1968 and 1975. Yields of millet are low, between 600 and 800 kilograms (kg) per hectare (ha), and vary directly with rainfall. Yields of cotton, between 1,000 and 1,200 kg and of peanuts, roughly 800 to 1,000 kg, have increased lately as a result of the introduction of new techniques in development projects.

The regional distribution of crops follows the distribution of rainfall, soils, and flood water availability. Peanuts are grown on the eroded soils of northwestern Mali, which are generally suited to very extensive agriculture and to stock grazing. The productivity of those soils varies directly with rainfall, and there is little river or ground water available to supplement rainfall. Cotton is grown on ferruginous soils to the south and east of Bamako toward Sikasso, which straddle the Niger River near Segou and cover the Sahelian zone above the city of Kayes. In addition to cotton, those soils support more intensive cultivation of millet than do the eroded soils of the peanut zones, and they also support small amounts of rainfed rice in

Table 2.--National Distribution of Cropped Areas, 1968-74^{*a}

(thousand hectares)

Crop	1968	1969	1970	1971	1972	1973	1974
Millet/sorghum	882	580	546	1,008	574	736	668
Rice	198	162	133	172	169	167	185
Cotton	76	91	76	75	79	86	69
Peanuts	126	101	96	148	151	147	127
Corn	31	25	33	77	35	27	44
Total ^b	1,788	1,805	1,673	1,696	1,748	1,775	1,553
Hectares/person ^c	0.35	0.34	0.31	0.30	0.31	0.30	0.26
Hectares/member rural population	0.38	0.38	0.34	0.34	0.34	0.34	0.29

* Source is Government of Mali, Ministère de Développement Rurale, Institut d'Economie Rurale, Rapport de l'Enquête Agricole, Bamako, various years. Surveys after 1974 are not yet tabulated.

^aAll figures in 1,000 hectares.

^bTotals include inter-cropped areas, which are mostly mixes of millet and cowpeas.

^cPopulations estimated by assuming constant annual rate of growth of 2.5 percent, using 1976 census as base year and extrapolating backwards. Rural populations estimated by assuming constant annual rate of growth of 2.0 percent, using 1976 census estimate of rural population as base and extrapolating backwards.

Table 3.--Regional Cropping Patterns, 1974^{*a}
(thousand hectares)

Crop	Kayes	Bamako	Sikasso	Segou	Mopti	Gao	Total
Millet and sorghum	138	72	87	155	200	15	667
Rice	1	9	9	74	39	13	145
Cotton	-	11	29	6	2	-	48
Peanuts	82	7	15	17	6	-	127
Corn	21	4	10	3	5	-	23
Other ^b							523
Total	242	103	150	255	252	28	1,553

* Figures are from Government of Mali, Ministère de Développement Rural, Institut d'Economie Rurale, Rapport de l'Enquête Agricole, Bamako, 1973-74.

^a Discrepancies between this Table and Appendix Table 3 are attributed to the fact that the Appendix Table was compiled from more recent data sources which do not provide regional disaggregations.

^b Includes cowpeas, fonio, and cassava in pure stands plus millet or sorghum and cowpeas in mixed culture.

Table 4.--Area Planted, Yield, and Production of Major Crops

Year	Rice			Peanuts			Millet and Sorghum			Cotton		
	Area (ha)	Yield (mt/ha)	Production (mt)	Area (ha)	Yield (mt/ha)	Production (mt)	Area (ha)	Yield (mt/ha)	Production (mt)	Area (ha)	Yield (mt/ha)	Production (mt)
1961	170 ^a	1.088 ^a	185 ^a	na	na	122 ^c	na	na	850 ^c	na	na	na
1962	182	1.016	185	na	na	138	na	na	820	na	na	na
1963	200	0.950	190	na	na	167	na	na	870	na	na	na
1964	123	1.341	165	na ^b	na ^d	182	na ^b	na ^d	865	na ^b	na ^d	na ^c
1965	159	0.997	158	144	1.028	148	859 ^b	0.789 ^d	678	89 ^b	0.371 ^d	33 ^c
1966	169	0.959	162	122	1.254	153	830	0.869	721	76	0.237	18
1967	178	0.890	159	129	1.232	159	910	0.810	737	62	0.452	28
1968	198	0.857	169	140	0.850	119	1,035	0.802	830	76	0.487	37
1969	162	0.836	135	129	0.744	96	932	0.598	557	91	0.604	55
1970	133	1.174	157	118	1.152	136	745	0.809	603	76	0.605	46
1971	172	0.977	168	162	0.963	156	725	0.986	715	75	0.747	56
1972	169	1.348	158	174	0.874	152	1,258	0.568	715	79	0.899	71
1973	167	0.527	88	160	0.843	135	900	0.692	623	86	0.849	73
1974	185	0.724	134	na	na	132	na	na	660	69	0.797	55
1975	198	0.914	181	na	na	188	na	na	850	68	1.044	71
1976	224	1.116	250	na	na	205	na	na	865	87	1.149	100

^a Source is West African Rice Development Association, Rice Statistics Yearbook (1975) and Up-date (August, 1976).

^b Source is Center for Research on Economic Development, University of Michigan, Mali Agriculture: Sector Assessment (1976). Crop areas in that study appear to be based largely upon results from Enquetes Agricoles.

^c Source is Center for Research on Economic Development, University of Michigan, and CILSS, Marketing, Price Policy and Storage of Food Grains in the Sahel (1977), Mali Statistical Tables.

^d Yields are calculated from aggregate area and production figures, and should only be taken as indicating orders of magnitude

southern Mali. Nearly all of the rice in Mali is grown on the hydromorphic soils of the Niger and Bani river basins, which support the greatest densities of rural human and animal populations in the country. There is little cotton or peanuts there and the opportunities for cash incomes are restricted to fishing, herding, and rice cultivation.

Annual rainfall at the six regional capitals during a 30-year period is shown in Table 5. A comparison of Table 3 with Table 5 indicates that cotton production is centered in the comparatively moist Sikasso region, peanut production in the somewhat drier Kayes region, and rice production in the arid delta around Mopti. The relation between rainfall and population density is obscured somewhat because the wetter Sikasso region is the site of endemic human and animal diseases (onchocerciasis and trypanosomiasis) which limit crop production in its river basins, and the floods of the Niger and Bani support many people in a wide zone which receives less than half the rainfall of the Sikasso region.

RICE PRODUCTION

Table 6 describes the types of rice cultivation in Mali. The first is limited to the semi-permanent swamps around some of the main tributaries of the Niger, Bani, and Senegal rivers and occupies perhaps 15,000 ha. There is no water control in this system and yields vary from 1 to 2 metric tons (mt)/ha without the use of improved seeds or fertilizers. Attempts have been made to introduce animal traction, improved Asian oryza sativa varieties, and water control through simple diversion dams in the Operation Riz Pluvial et Bas-Fonds, Sikasso, run by the Compagnie Malienne pour le Développement des Fibres Textiles (CMDT) and in the Operation Petits Perimetres in Kayes. Although

Table 5.--Average Regional Rainfall, 1943-73^{*a}
(millimeters)

Kayes	Bamako	Sikasso	Segou	Mopti	Gao
720	1,050	1,300	720	520	260

* Figures are from Le Mali: Dossier d'Information, 1972/73, SEDES, Paris, 1974.

^a These averages are taken at regional capitals and conceal some variations within regions.

Table 6.--Key Characteristics of Rice Production Techniques

Production technique	Area, 1976 (ha) ^a	Gross paddy yields, 1976 (mt/ha) ^b	Paddy production, 1976 (mt)	Type water control	Crops per year	Source of power		Improved seeds	Ferti- lizer cides
						Land preparation	Harvest		
Gravity irrigation ^c (Office du Niger)	39,922	2.25	89,425	Diversion dam	1	Oxen	Manual	Yes	No
Controlled flooded ^d (Segou)	34,355	1.58	54,281	Partially controlled flooded	1	Oxen	Manual	Yes	No
Traditional swamp ^e and rainfed	11,000	1.20	13,200	None	1	Manual	Manual	No	No
Improved swamp and flooded (Sikasso)	4,000	1.80	7,200	Small diversion dam	1	Oxen	Manual	Yes	No
Traditional flooded ^f (Delta)	110,000	0.50	55,000	Unimproved flooded	1	Oxen and manual	Manual	No	No
Controlled flooded ^f (Mopti)	16,074	1.15	18,485	Partially controlled flooded	1	Oxen	Manual	Yes	No

^a Seeded areas.

^b Per seeded hectare.

^c Source is Office du Niger, Bureau of Economic Affairs (Segou).

^d Source is Operation Riz Segou, Direction Generale (Segou).

^e Source is Operation Riz Pluvial et Bas-Fonds, Direction Generale (Sikasso).

^f Source is Operation Riz Mopti, Direction Generale (Sevare). This includes some swamp rice production in Kayes region.

studies have asserted that the land potential of this type of cultivation approaches 200,000 ha in southern Mali, expansion of this area is now limited by the onchocerciasis noted earlier (11) and by the poorly developed infrastructure of the region.

Rainfed rice in southern Mali is the second type. It is closely associated with the swamp technique in that area and has also benefited from the work of the Sikasso rice project. Paddy yields using that technique are 1 to 1.5 mt per ha, and it is intended that they will reach 2.5 mt with the improved system. The rainfed and swamp systems are essentially subsistence cultures; the aim of policy in changing them is to provide greater water security and higher, less variable, incomes to the participating farmers rather than to develop large marketed supplies for urban consumption.

The third and historically most important type of rice cultivation is the uncontrolled flooded culture of the Niger-Bani Delta north and west of Mopti (7, 13). That system has been the principal object of recent investment in Malian rice production and has been, along with the Office du Niger, the source of much of the recent growth of rice output. The traditional flooded system uses African *o. glaberrima* seed varieties, manual cultivation, and no chemicals or machines. Yields of paddy are 500 to 700 kg per ha and paddy is hand-pounded for home consumption. The traditional system is being replaced in Operations Riz Segou and Mopti by an improved technique which provides limited water control in diked polders, ⁴ *o. sativa* seed varieties, animal traction, some mechanical threshing, and small amounts of fertilizer. Output from the improved areas

is roughly 1.5 mt per ha, some of which is milled industrially for urban consumption. This improved system offers the advantages of low capital and maintenance costs and the disadvantage of little water security. The potential of the flooded technique, traditional and improved, has been estimated to be as large as one million ha, and its expansion to the present has probably taken place at the rate of population growth. Replacement of the traditional system by the improved system is constrained by the supply of foreign financing and by the risk associated with the development of poorly secured polders.⁵

The fourth type of rice cultivation is the irrigated technique at the Office du Niger. The basis of the system is a diversion weir at Markala, roughly 250 kilometers downstream of Bamako and an 8-kilometer main canal with two primary canals branching from the main canal. Although the Markala barrage cannot store water, it does provide full water control to all the rice fields.⁶

The Office is a very extensive system with average holdings of 9.5 ha (the modal holding is about 7 ha) and some holdings of as much as 80 ha. Office farmers are more specialized in rice production than are rice farmers in the adjacent Operation Riz Segou who have dry crop holdings equal on average to their rice fields. Yields in the Office are the highest in Mali; the average in three of the four sectors is nearly 2.5 mt per ha.⁷ The Office stopped using mechanized state farms in the early 1970s and has since encouraged the use of animal traction and farmer management. The Office's management has also stopped trying to utilize fully its existing irrigation capacity; it has reduced the area sown to 38,000 ha (the maximum was 40,500 ha in 1974-75), thus stalling the trend of growth of cultivated rice area after the end of cotton cultivation in 1970.⁸

COLLECTION, MILLING, AND MARKETING

There are two channels, public and private, of rice milling and marketing in Mali. The public channel is the legal monopoly of the Office des Produits Agricoles du Mali (OPAM) and the government rice projects. Paddy is collected from farmers by OPAM or by the rice projects, such as the Office du Niger, at official prices which do not vary by region, system of production, or season, and is transported to mills at official cost-price schedules. These schedules include charges for losses, sacks, collection, transport, and handling.⁹ Paddy produced in the Office du Niger is milled there and is the property of the Office until it leaves the mills whereupon it is sold to OPAM at an official ex-mill price. Paddy from the other rice projects or from independent farmers is delivered by the projects to the OPAM mills, where it becomes the property of OPAM.

Milling capacity is shown in Table 7. Hand pounding dominates in the traditional rice areas of the Delta, as well as in remote producing areas along the loop of the Niger and in swamp rice areas in Kayes and Sikasso. Industrial mills are most important in the Office du Niger, where they have operated since 1948 and where capacity has usually been adequate to process all of the officially marketed paddy. Several of OPAM's mills, which have not been used for years, are now being rehabilitated because milling capacity has recently been inadequate to meet the growth of production from the Office and the flooded rice projects. Milling ratios in the industrial milling sector are good, although the quality of output is poor with high percentages of brokens and impurities.

OPAM is responsible for the transport of rice to consumption centers. Until the spring of 1977, OPAM did not have sufficient truck capacity to move cereals and hired private truckers to supply urban consumers. Truckers

Table 7. Rice Milling Capacity in Mali*

	Annual capacity ^a (mt./paddy)	1976 output (mt./rice)	Ownership	Milling ratio	Quality (percent broken)
Industrial mills ^b					
Kourouba	6,000	0	OPAM	n.a.	n.a.
Tamani	11,000 ^c	n.a.	Private	n.a.	n.a.
Diafarabe	13,800	0	OPAM	n.a.	n.a.
Sevare	15,000 ^c	8,933	OPAM	0.63	50-70
Molodo	18,000	12,500	Office du Niger	0.65	60
Kolongotomo	12,000	4,325	Office du Niger	0.64	70
N'Diebouyou ^d	18,000	0	Office du Niger	n.a.	n.a.
Kourouma	18,000	12,400	Office du Niger	0.67	60
Small hullers					
100-150 ^e	38,000-56,000	n.a.	Private	0.45-0.70	60-70
Hand pounding ^f	n.a.	50,000-70,000	Rural women	0.70	80

-7a-

* Office du Niger mill data are from Bureau of Economic Affairs, Office du Niger (Segou); OPAM and Tamani mill data are from OPAM Directorate (Bamako) and from Operation Riz Mopti (Sevare).

^a There are plans to construct a 20,000 metric ton (paddy) capacity mill at Diolo as part of Operation Riz Segou and a 12,000 metric ton (paddy) capacity mill as part of Operation Riz Pluvial et Bas-Fonds, Sikasso, in addition to plans to double the capacity of the Sevare mill by 1981.

^b Hourly capacities of industrial mills have been converted to annual capacities on the assumption that mills work 5,000 hours per year (i.e., 20 hours/day and 250 days per year).

^c These mills have parboiling capacity. Roughly 6 percent of the Sevare mill's 1976 output of rice was parboiled.

^d This mill was not installed until the end of the 1976/77 crop season.

^e Diesel or electric machines with hourly capacities of 0.15 mt/paddy. Annual capacity has been estimated from the assumption that these machines work 2,500 hours/year. See WARDA, Survey of Rice Post-Production Technology (Mali), 1976.

^f This category includes traditional parboiled rice.

were paid at official rates which, after their increase in 1974, seemed to cover costs and to provide a reasonable return to capital. More than three-fourths of OPAM's supplies of rice and other cereals are sent to Bamako, the largest city, and to the region of Kayes and Gao, which are usually in deficit. OPAM incurs losses in supplying those regions because it is unable to vary its retail prices with the costs of transport, and profits from supplying more accessible regions do not cover those losses.

Although private cereals trade is banned in Mali, it is important in the collection and milling of paddy and in the transport and marketing of milled rice. Farmers or their wives bring paddy and rice to village markets where it is bought by traders who arrange for processing and/or transport to markets. There is little direct entry by traders into villages except on weekly marketdays. Paddy traders are usually not hullers and the owners of hullers usually do not sell rice. Most private hullers are small (150 kg/hour of paddy) diesel or electric machines, and there is an increasing tendency to locate them near producing areas, especially the improved polders of the Segou project.

While policy is to repress private trade, there is some official reliance upon it, especially upon the hullers. There are no extensive studies of the private trade and therefore no reliable estimates of marketed quantities, prices, or margins.¹⁰ Table 8 presents estimates of paddy production and of official marketings in order to arrive at estimates

Table 8.--Distribution of Shares of Marketed Paddy

Year	(1) Paddy output (thousand mt) ^a	(2) Official mar- ketings (thousand mt)	(3) Office du Niger marketings as percent of (3)	(4) Official market- ings as percent of (1)	(5) Residual supply (1) - (4)	(6) Residual rice (5) x .65
1961	148	45	83	30	103	67
1962	147	26	91	18	121	79
1963	159	33	68	21	126	82
1964	133	31	88	23	102	66
1965	125	27	83	22	98	64
1966	128	28	89	22	100	65
1967	123	37	71	30	86	56
1968	135	40	77	30	95	62
1969	108	32	79	30	76	49
1970	124	49	74	40	75	49
1971	134	42	91	31	92	60
1972	126	51	91	40	75	49
1973	61	50	94	82	11	7
1974	101	57	95	56	44	29
1975	141	83	78	59	58	38
1976	203	93	69	46	110	71
1977	n.a.	93 ^b	70	n.a.	n.a.	n.a.

^a Losses estimated at 10 percent of paddy output. Seed consumption estimated at 100 kg/ha multiplied by hectares planted in rice in the following crop year. Because hectareage and production data were unavailable for 1976/77, it was necessary to calculate seed consumption for 1975/76 as a function of hectareage planted in that year.

^b Estimated on the basis of data provided by the Bureau of Economic Affairs, Office du Niger (Segou); Operations Riz Segou and Mopti.

of the amounts available for farm consumption or private marketings in the years immediately after independence. Although it is not possible to estimate amounts actually marketed on private circuits, it may be that private trade has recently become less important than it was in the early 1960s.

CONSUMPTION AND INTERNATIONAL TRADE

Rice consumption is low in Mali, on average less than 20 kg per capita and rice's share in caloric intake is less than 15 percent.¹¹ Average consumption has been constant since independence except during the drought when it increased somewhat due to large imports. Consumption is highest in the producing areas (more than 100 kg per capita in the Office du Niger and in the traditional rice zones of the Delta) and in Bamako and other urban markets. Rice is, on the other hand, nearly unknown in the more remote rural areas of Kayes and Gao as well as in the drier zones near Mopti where millet is the principal crop.

Malian rice imports are controlled by OPAM, and exports are managed both by OPAM and by the Office du Niger. Mali exported rice in the colonial era, usually from the Office du Niger to Senegal and, after independence until 1965, to the Ivory Coast. There was no recorded rice trade from 1966 to 1968, although rice imports which might otherwise have occurred were prevented by foreign exchange shortages. Imports began in 1969 and attained their peak of 70,000 metric tons in 1974. Small amounts of rice and paddy were exported by OPAM and by the Office du Niger to the Ivory Coast, Upper Volta, and Togo in 1976/77.¹² Trade in both directions is in 25-35 percent broken, and Malian exports have historically been viewed as being of poor quality.

RICE POLICY BETWEEN 1960 AND 1968

The principal objective of Malian economic policy between 1960 and 1968 was to achieve a socialist transformation of the economy and society. The basis of that transformation was a system of planning, instituted with the assistance of French advisors. Principal policies included nationalization of industries, establishment of state industrial and commercial firms, and large public investments in transportation. The new government set up producer and consumer cooperatives, banned both national and international private commerce, and established a group of state monopolies. Orthodox French political influence and commercial presence declined greatly in the period and, with the exception of that in Guinea Mali's socialist program was the most radical and autarkic in French West Africa.¹³

The main objective of Malian agricultural policy was to supply cheap cereals to urban populations in order to hold down wages and thus foster accumulation in the new state enterprises. Another important objective was to increase exports of cotton and peanuts to finance imports of capital goods. The government intended to set up collective fields in every village, a scheme based on the premise that collective agriculture was the original and most productive African form. Other instruments were a system of fixed producer prices for cereals and export crops, fixed consumer prices for cereals, and the establishment of state agencies--OPAM with the legal monopoly on cereals trade, and the Malian Import-Export Company (SOMIEX), with the legal monopoly on the marketing of export crops. Policies were constrained by lack of financial and organizational capacity of the marketing agencies.¹⁴ Rice received a large share of agricultural investments in the first National Plan (1961-65) and has consistently been the central instrument of cereals policy throughout the country's brief history.

Table 9 shows official producer prices of millet, paddy, peanuts, and cotton and gives official retail prices in parentheses. Price policy was driven by the need to keep prices low in order to derive the maximum amounts of export tax revenue from cotton and peanuts and to provide cheap domestic cereals. The official producer price of paddy was lowered after independence in order to maintain Mali's competitiveness in the formerly protected export markets of the franc zone; the price of millet was lowered also.¹⁵ The effects of producer prices on farm incentives were not considered; or, rather, it was hoped that collectivization and the expected reduction in transport costs and commercial margins would increase crop supplies in spite of the lower prices.

Official purchases of cereals between 1961 and 1968 are shown in Table 10. In the first years after independence, official marketings of millet and rice, plus net foreign trade in millet, wheat, and rice, were less than 10 kg per capita of the total population and 100 kg per capita of the urban population.¹⁶ Nearly all of the officially marketed rice came from the Office du Niger, where control of access to the irrigation system enabled the Office's administration to collect most of the paddy grown there. Before the price increases of 1967 and 1968 OPAM was able to buy at most 6 percent of the total output of millet at a time when production, both absolutely and per capita, was high. The disproportionate share of rice in official marketings was therefore the result only of the peculiar advantage of the Office's production system because millet, then as now, provided a much larger share of total cereals output.

Estimates of the urban availability of cereals are presented in Table 11. Total production, adjusted for seed, field losses, and official marketings, was divided by estimated rural population to estimate rural

Table 9. --Official Producer and Retail Prices of Various Crops, 1961-77^{*a}

	Millet/sorghum (retail) ^b	Paddy (rice) ^c	Cotton ^d	Peanuts ^e
1959	16 (n.a.)	12.5 (n.a.)	34	14.8
1960	11.5/168 (n.a.)	12 (n.a.)	34	15.6
1961	10 (16.5)	9 (30)	34	14
1962	10 (16.5)	9 (30)	34	14
1963	10 (16.5)	11 (37)	34	14
1964	10 (16.5)	11.5 (42)	34	14
1965	11 (17.5)	12.5 (45)	34	13
1966	11 (17.5)	12.5 (45)	34	13
1967	16 (25)	16 (57)	34	16
1968	16 (25)	18 (56)	40	24
1969	16 (25)	18 (56)	40	24
1970	18 (25)	25 (76.5)	45	30
1971	18 (35)	25 (76.5)	50	30
1972	20 (35)	25 (80)	50	30
1973	20 (35)	25 (88)	50	30
1974	32 (51)	25 (88)	50	30
1975	32 (51)	40 (111.5)	50	40
1976	32 (51)	40 (111.5)	75	40
1977	32 (51)	40 (111.5)	75	45

^{*} Source is Government of Mali, Ministère de Développement Rural, Institut d'Economie Rurale, Bulletin Mensuel de Statistique, Bamako, various years except 1959 and 1960 which are from Jean Gallais, Le Delta Intérieur du Niger: Etude de Géographie Régionale, Institut Fondamental de l'Afrique Noire, Dakar, 1967, p. 300. All prices are in Malian francs/kilogram. All years are the second year of the crop season: i.e., 1966/67 is written 1967. Retail prices are shown in parentheses.

^b Mali has never established separate prices for millet and sorghum. Before 1967 there were separate prices by surplus or deficit region; the prices shown here are surplus region prices.

^c Paddy quality is white paddy. Rice quality is 40 percent broken.

^d First quality seed cotton.

^e Peanuts in the shell.

^f The Malian franc was devalued by 50 percent in 1967.

^g The higher price refers to "deficit" regions, and the lower to surplus regions.

Table 10.--Official Purchases of Cereals, 1961-68*
(thousand metric tons)

	1961	1962	1963	1964	1965	1966	1967	1968
Millet/sorghum	n.a.	20	29	16	17	26	56	60
Rice (OPAM) ^d	n.a.	2	7	2.5	3	2	7	6
Rice (Office) ^b	24.4	15.3	15	17.5	14.6	16.1	16.8	19.8
Flour ^c	4.3	6.3	9.7	3.9	20.4	12.3	10	10
Millet/sorghum (trade) ^d	-	-	2.4	-	-	6.8	10	- 8
Rice trade ^d	-12.6	-15	- 5.2	- 1.1	- 3.7	-	-	-

*Data for millet, sorghum, rice (OPAM), and trade in millet, sorghum, and rice are from W. I. Jones, Planning and Economic Policy: Socialist Mali and Her Neighbors, Three Continents Press, Washington, DC, 1976, p.367, and Comité Inter-état de Lutte contre la Sécheresse Sahélienne (CILSS), Club du Sahel, Working Group in Marketing, Price Policy, and Storage, "Mali Country Study," Marketing, Price Policy and Storage in Food Grains in the Sahel - A Survey, by Center for Research on Economic Development, University of Michigan, Ann Arbor, August 1977, Volume 2. Data for rice (Office) are from the Bureau of Economic Affairs, Office du Niger (Segou). Flour imports are from Food and Agriculture Organization, Trade Yearbooks, Rome, various years. A complete time series of official rice purchases is shown in Appendix Table 6.

^aThis category includes hand-pounded and parboiled rice purchased by OPAM (which began operating in 1962) as well as paddy purchased and converted to rice equivalent by using a milling ratio of 0.65.

^bThis category includes paddy purchased at the Office du Niger and converted to rice equivalent using a milling ratio of 0.65.

^cIncludes wheat converted to flour at a milling ratio of 0.72.

^dA negative sign (-) indicates net exports.

Table 11--Per Capita Cereals Availability, 1961-75*
(kilograms)

	1961	1963	1965	1967	1969	1971	1973	1975
Millet and sorghum								
Rural ^a	187	179	140	169	101	122	104	133
Urban ^b	0	62	41	140	47	40	105	65
<u>Total</u>	<u>187</u>	<u>169</u>	<u>130</u>	<u>166</u>	<u>96</u>	<u>114</u>	<u>104</u>	<u>124</u>
Percent imports in total	0	0	0	1	3	2	10	0
Rice								
Rural	17	20	15	12	10	12	2	7
Urban	42	44	33	50	77	71	119	99
<u>Total</u>	<u>19</u>	<u>21</u>	<u>15</u>	<u>16</u>	<u>17</u>	<u>18</u>	<u>15</u>	<u>18</u>
Percent imports in total	0	0	0	0	22	15	54	18
Total of millet and sorghum and rice								
Rural	204	199	155	181	111	134	105	140
Urban	49	106	74	190	124	111	224	164
<u>Total</u>	<u>206</u>	<u>190</u>	<u>145</u>	<u>182</u>	<u>113</u>	<u>132</u>	<u>119</u>	<u>142</u>
Percent imports in total	0	0	0	1	6	4	15	2

* Calculated from data presented in Appendix Tables 1 and 3. Complete series shown in Appendix Table 13.

^a Rural cereals availability is defined as the sum of production minus seed, losses and official marketings (paddy marketings are converted to rice at a milling ratio of 0.65) divided by rural population.

^b Urban cereals availability is defined as the sum of official marketing plus imports (or minus exports) divided by urban population.

per capita availability. Cereals imports were added to official marketings and divided by urban population to estimate urban per capita availability on the restrictive assumption that imports and official supplies were sent only to urban areas. The harvests of 1961-64 were excellent and, although there are no surveys of privately marketed supplies, it is evident that the estimated gap between rural and urban per capita cereals availability, as shown in Table 11, should have given rise to trade. That impression is reinforced by OPAM's poor performance, as suggested by its financial losses, and by the growing gap between official and market retail prices.¹⁷

The government could not maintain cereal prices, either in the cooperative markets which it controlled directly through OPAM, or in the private markets which it tried to influence through its cooperative buying and selling policies. This is apparent from Table 12 which shows the evolution of cooperative and market prices of rice and millet, cooperative and market food price indexes, and the general price level. While the table is necessarily incomplete, it does show that the government was increasingly less able to defend its retail price of rice and that only the increased marketings of 1967-68, due to the producer price increases, enabled it to defend its millet price. Consumers who could buy in the cooperatives bought at less than the market prices of cereals.

Nominal protection coefficients, defined as the ratio of domestic to c.i.f. prices, have been calculated for the entire period after independence. The results, presented in Table 13, show the bias of price policy toward consumers who bought in the cooperatives between 1960 and 1968. Consumers who could buy in the cooperatives were better off with respect to the world price of rice, than were consumers who had to buy in the market.¹⁸ When the coefficients are calculated with the c.i.f. price at Abidjan in the denominator they also show

Table 12.--Price Indices, 1961-76*

	Food price indices ^a		Millet price indices		Rice price indices ^b		GDP deflator ^c
	Cooperatives	Bamako market	Official retail	Bamako market	Official retail	Bamako market	
1961	n.a.	n.a.	100	n.a.	81	n.a.	88
1962	n.a.	n.a.	100	n.a.	81	n.a.	91
1963	100	100	100	100	100	100	100
1964	n.a.	n.a.	100	128	114	118	110
1965	117	162	106	261	122	202	112
1966	122	179	106	311	122	236	117
1967	148	191	152	255	154	241	128
1968	171	191	152	233	151	227	161
1969	161	191	152	267	151	200	167
1970	169	193	152	233	207	222	188
1971	188	234	212	270	207	252	206
1972	197	251	212	400	216	284	218
1973	214	298	212	672	238	332	226
1974	256	331	309	461	238	361	241
1975	316	350	309	405	301	341	320
1976	351	279	309	383	301	332	n.a.

* Price data are from Government of Mali, Ministère de Développement Rural, Institut d'Economie Rurale, Bulletin Mensuel de Statistique, Bamako, various years.

^a Mali has no true consumer price index.

^b Rice quality is 40 percent broken.

^c Calculated from Appendix Table 2. The Malian franc was devalued by 50 percent in 1967.

Table 13.--Nominal Protection Coefficients, 1961-76

	(1) ^a	(2) ^b	(3) ^c	(4) ^d
1961	n.a.	n.a.	n.a.	n.a.
1962	-	n.a.	-	n.a.
1963	-	n.a.	-	.78
1964	-	n.a.	-	.89
1965	-	n.a.	-	1.52
1966	-	.74	-	1.60
1967	-	.48/.55	-	1.00
1968	-	.53	-	.94
1969	.60	.55	.88	.81
1970	.96	1.02	1.12	1.19
1971	.97	1.11	1.28	1.46
1972	.97	.92	1.40	1.33
1973	.64	.57	1.07	.97
1974	.35	.34	.58	.57
1975	n.a.	.70	n.a.	.87
1976	n.a.	1.00	n.a.	1.21

^a Ratio of wholesale cooperative prices of 40 percent broken rice to the c.i.f. Bamako price of similar grade rice. The source of cooperative price data is the Bulletin Mensuel de Statistique, Bamako, various years. The source of import price data is the WARDA Rice Statistics Yearbook, 1975. Transport costs from Abidjan to Bamako were assumed to be 20 Malian francs/kilogram of rice between 1961 and 1968 and to increase by 2 francs per kilogram per year after 1968.

^b Ratio of the wholesale cooperative price of 40 percent broken rice to the c.i.f. Bamako price of 25-30 percent Thai broken rice, for which the source of data is Charles P. Humphreys and Patricia L. Rader, Rice Policy in the Ivory Coast, draft, June, 1977. The source of cooperative price data is Bulletin Mensuel de Statistique, Bamako, various years.

^c This is the ratio of the Bamako market price of 40 percent broken rice to the c.i.f. Bamako price of similar grade rice for which the source of data is that cited above in a. Market price data are taken from the Monthly Statistical Bulletin of Mali, Bamako, various years.

^d This is the ratio of the Bamako market price of 40 percent broken rice to the c.i.f. Bamako price of 25-30 percent Thai broken rice for which the source of data is that cited above in b. Market price data are from Bulletin Mensuel de Statistique, Bamako, various years.

the protective effect of transport costs. A general reduction in road transport costs of 25 percent between Abidjan and Bamako in that period would have reduced the Bamako c.i.f. price, thus bringing nominal protection coefficients (calculated at official retail prices) close to unity.

OPAM, like many state enterprises of the era, lost money (10). Although detailed information on its cost-price schedules is no longer available, OPAM's losses increased with its sales volumes, a tendency which implies that losses were not caused by high starting up costs but were instead proportional to sales. In other words, the agency was not even covering its variable costs and was subsidizing consumers. The government could not afford to continue such implicit subsidies, nor did it want to raise consumer prices more rapidly because of the effect of such an increase on the incomes of urban government workers.¹⁹

The government's lack of an effective policy to increase cereal production, especially of millet, also contributed to OPAM's failure to supply off-farm markets. Agricultural investment in the first Plan, as described in Table 14, was limited mainly to cotton and sugarcane in the Office du Niger and flooded rice production. The Office du Niger accounted for one-half of total planned expenditures in agriculture,²⁰ and the rehabilitation of flooded rice polders, built during the colonial era, received nearly another fourth. Paddy collected in the Office du Niger declined between 1961 and 1968 and the polders program had no effect on production or on marketings. The reasons for the poor performances were the absence of adequate price incentives, generally, and agronomic problems in the Office, specifically. Planned expenditures on the rainfed cereals were confined to the provision

Table 14.--Investments in First National Plan of Mali, 1961-66*

Category	Percent	Billions of Malian francs
Industry	6.3	4.0
Transport	48.3	30.5
Other	13.1	8.4
Health Housing Administration		
Power and Communications	6.7	4.3
Agriculture	25.6	16.4
Office du Niger	15.0	9.6
Polders program	3.8	2.4
Agricultural equipment	3.6	2.3
Other	3.2	2.1
Total	100.0	64.0

* Source: W. I. Jones, Planning and Economic Policy: Socialist Mali and Her Neighbors, Three Continents Press, Washington, DC, 1976, pp. 198, 204, 352.

Table 15.--Cotton and Peanut Production and Marketings, 1959-68*
(thousand metric tons)

	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968
Cotton^a										
Production ^b										
Marketings	7	7	11	13	20	25	29	18	28	33
Peanuts^c										
Production	n.a.	n.a.	122	138	167	182	148	153	159	119
Marketings	36	51	83	66	71	75	49	27	40	29

*Most sources of production data give figures which correspond closely, sometimes exactly, to marketing figures. Since virtually all production of cotton in Mali in this era was controlled by the Office du Niger or by CFDT, marketing figures are probably good estimates of total production anyway. Source of cotton marketing is W. I. Jones, Planning and Economic Policy: Socialist Mali and Her Neighbors, Three Continents Press, Washington, DC, 1976, p. 367. Source of peanut production and marketing is Comité Inter-état de Lutte contre la Sécheresse Sahélienne (CILSS), Club du Sahel, Working Group on Marketing, Price Policy, and Storage, "Mali Country Study," Marketing, Price Policy and Storage in Food Grains in the Sahel - A Survey, by Center for Research on Economic Development, University of Michigan, Ann Arbor, August, 1977, Volume 2.

^aFirst grade seed cotton.

^bData on cotton production are generally unusable.

^cUnshelled.

1/3

17a

of equipment and to the training of extension workers; those expenditures were small and output of rainfed cereals showed no systematic tendency to increase throughout the era.²¹

The second objective of Malian agricultural policy under the original government was to increase production and exports of cotton and peanuts. The cotton program, run by the French textile firm, CFDT, under an agreement with the Malian government, succeeded and official exports of seed cotton increased throughout the period. The peanut program, which consisted mainly of the entitlement of SOMIEX as the official purchaser and exporter of the crop and the weak collectivization efforts, failed and official marketings decreased from 97,000 tons in 1958 to 29,300 tons in 1968, although total production did not decrease by as much as official marketings. Changes in cotton and peanut production and official marketings are shown in Table 15.²²

While the rank order of official producer prices did not change during the first government, there was a reduction in the producer prices of paddy and millet, and a lesser one in peanuts, after independence. Those reductions, motivated by the need to keep cereals prices low and to maximize export tax revenue, hampered agricultural development in Mali. There was not at the time a general land constraint, so that it cannot be argued that raising cereals prices risked reducing the supply of export crops, with consequent adverse effects on tax revenues. Although seasonal labor constraints did exist, relative producer prices actually moved against the most successful crop--cotton. One therefore cannot conclude that the collapse of peanut marketings and the stagnation of rice marketings were due to any extraordinary price incentives given to cotton production which would have encouraged labor to move into cotton from peanuts or from rice.²³

Failure to achieve the objectives of Malian agricultural policy between 1960 and 1968 did not lead to a change in policy. There were indications that President Keita's government intended to tighten the controls it had established in agriculture, and there were no signs that it planned to abandon its fixed producer/consumer prices or to legalize private trade in grains or in the export crops. What led to the change in some policies after 1968 was the change in government.

RICE POLICY AFTER 1968

The failures of socialist Mali's agricultural policy--the inability to collect and sell enough cereals to defend official prices, the government's incapacity to bear the deficits of OPAM and of the other state enterprises, the ineffectiveness of the collective farms, and the near collapse of peanut exports--were the important and immediate influences on the agricultural policy of the military government which took power in November 1968. In 1969 the new regime allowed a limited private trade in cereals, raised the producer prices of all crops, and abolished the collective farms. The immediate consequences of those changes were to reduce official purchases of millet (official purchases of paddy did not change much because of the overwhelming influence of the Office du Niger) and to double the official marketings of peanuts. The 50 percent devaluation of the Malian franc in May 1967, as the condition of its convertibility being guaranteed by the Central Bank of France, was influential in impelling the government to raise its producer prices and in enabling it to buy more peanuts.²⁴

New circumstances--the change in the external grain trade balance due to poor harvests--were also important in forming the policy of the new government. The change in the trade balance, combined with the long-held

belief that the rice-growing potential of the Niger-Bani Delta was underexploited, led to a renewed emphasis on rice production, with two important changes from the policy of the previous regime. The first was organizing improved production in integrated rural development projects, of which the model, Operation Arachide, had been established in 1967 by the old government. The second was abandoning the effort to increase production and marketing by collectivization and a return to the traditional system of land tenure.

The harvests of 1968/69 were the first of a series of subnormal crops which culminated in the very low output caused by the severe drought of 1972-74 (3). During that period the government gave much greater, even dominant, importance to the objective of securing food production at the level of national self-sufficiency against drought. That objective had been given little attention by the first government, in part because it had been thought that the central problems of economic policy were political, and in part because rainfall and crop production in the early 1960s were good. In view of the importance given this objective, rice production, because it was believed to be more secure against both subnormal rainfall and drought, received even greater attention as an instrument of national agricultural policy.

The principal objective of Malian cereals policy after 1968 has been to regain self-sufficiency and to maintain it against crop failures. Other objectives have been to increase rural incomes and to improve the nutrition of the population. The main objective of the first government, to control the production and marketing of cereals in order to maintain low prices, has been

relegated to second rank. The central instrument of policy has been technical improvement of and investment in rice production in the Office du Niger and in the two main rice projects at Segou and Mopti. Price policy has been used to stimulate production within the system of fixed producer/consumer prices and the official monopoly of national and international cereals trade established within the first government. Policy has been constrained by the budgetary restrictions of the government, flood failures, and poor rainfall.

The immediate origins of the principal new policy objective are shown above in Table 11. Domestic per capita availability of all cereals, both on and off farm, declined after 1969; concessional and commercial imports of millet, rice, and wheat grew in volume and value and rice imports alone grew to 15 percent of the total value of imports by 1974.²⁵ The official explanation for the growth of imports was poor rainfall and the destructive activities of private traders who had been allowed to operate between 1969 and 1971.

Planners in the second government emphasized rice production for several reasons.²⁶ First, investments in flooded and irrigated rice were thought to be more secure than investments in rainfed cereals. Planners also believed that the Office du Niger could be made more productive, especially after cotton production had been abandoned there in 1970. Finally, rice was thought to be more nutritious than millet or sorghum and planners thought that the substitution of rice for either of those cereals would improve nutrition even if per capita consumption of cereals did not increase.²⁷

The choice of policies showed the influence of the important constraints. Improvement and expansion of rice cultivation were to be concentrated in the flooded rice polders at Segou and Mopti, where low land development costs

(\$500-1,000 per ha), cheap technologies (for example, higher yielding seed varieties) and restricted access to polder land allowed increases in output and official marketings with little strain on the national budget. Economic analysis of the polder projects at the time of requests for foreign financing was based on the assumption that the polders would be filled in nine out of ten years, and from that assumption the argument was made that flooded rice cultivation was more secure than rainfed agriculture. The emphasis of policy on the Office du Niger was based on the belief that its capacity was underutilized and that it was a cheap way of expanding drought-secure agriculture.

The growth of output, yields, and official marketings from the Office and from the rice projects at Segou and Mopti is shown in Table 16. The great improvement at the Office in yields and marketings was due to the 122 percent increase in the producer price between 1969 and 1974 and to the reorganization of production, which changed some of the system from that of a partially mechanized state farm to one using animal traction and private farm management.²⁸ The extensive, by Sahelian standards, control of paddy marketings by the Malian government after 1970 was the result of progress in the Office and, after 1975, of progress in the Segou and Mopti projects.

After the poor harvests at the Segou and Mopti rice projects in 1973 and 1974 because of poor floods, production and marketings grew almost to their planned levels in 1975-77. The success there was due to some of the same factors that encouraged production in the Office, principally the increase in the real price of paddy, but was also attributable to technical changes and to subsidies on irrigation works and extension services. The

Table 16. -- Production and Marketings at Office du Niger and Flooded Rice Projects *

	1970	1971	1972	1973	1974	1975	1976	1977
Office du Niger								
Production (000 mt paddy)	-	-	61.6	69.0	78.0	82.0	86.2	94.4
Yields ^a (kg/ha)	-	-	1,760	1,944	1,948	2,000	2,240	2,385
Marketings (000 mt paddy)	36.1	38.1	46.3	46.9	54.2	62.9	65.5	62.1
Operation Riz Segou								
Production (000 mt paddy)	9.8	-	18.6	4.2	8.1	45.0	55.7	38.6
Yields ^a (kg/ha)	1,240	-	-	1,342	1,556	1,752	1,750	1,373
Marketings (000 mt paddy)	-	-	-	0.8	3.1	14.7	20.9	n.a.
Operation Riz Mopti								
Production (000 mt paddy)	-	-	7.8	1.5	3.7	19.4	18.4	25.4
Yields ^a (kg/ha)	-	-	-	800	948	1,618	1,451	1,705
Marketings (000 mt paddy)	-	-	-	-	-	4.6	8.0	8.9

* Sources of data are Office du Niger (Segou), Annuaire de l'Office du Niger, in response to questionnaire submitted by Stanford Food Research Institute and West African Rice Development Association; Operation Riz Mopti, Rapports Annuels, various years (Sevare), Operation Riz Mopti, Rapports Annuels, various years (Segou).

^aYields are estimated from crop cuttings at these projects.

yield increases from the use of improved seeds and better water control in the polders are an important example of the government's ability to exploit the resources of the Niger-Bani river system and, in so doing, to control the marketed supply of paddy, which the first government failed to do.

The current government has also established regional rice projects to meet its objectives of increasing rural incomes and of maintaining regional food self-sufficiency. Those projects--small dams in Sikasso, pumping systems in Gao and Kayes--are not intended to produce rice for export to the cities (as are the Mopti and Segou projects), but to increase production in regions that tend to import even in normal rainfall years and to reduce the prospects of famine in subnormal and drought years. The installation of such projects is also intended to reduce the costs of supplying poorly accessible regions, two of which, Kayes and Gao, now receive important shares of OPAM's marketings.

Essential to the recent emphasis of policy on stimulating production and on reducing imports has been the attempt to raise real producer and consumer prices. The nominal protection coefficients presented above in Table 13 show that cooperative prices, after the increases of 1969, were close to Bamako c.i.f. prices and remained there except during the years of the drought when world prices were high and large imports had to be subsidized. Market prices were always above cooperative prices and above world prices, except during the drought. Consumers without access to cooperative supplies were therefore taxed with respect to the c.i.f. prices while consumers with access were not so taxed. The cooperative price of rice has risen faster than the rate of inflation and faster than the market price of rice, while the market price has not grown so fast as the rate of inflation since 1974.

The marketing policies of the two governments have been similar. Private cereals trade was legal after 1969, but was again banned in 1971, subject to the qualification that it is to become legal after OPAM has constituted a stock of 40,000 metric tons of cereal.²⁹ The immediate effect of liberalization in 1969 was to reduce OPAM's purchases of millet; they have never regained the level of 1968. OPAM has been able to buy much more paddy since 1969, but that success has been a counterpart to the production policies of the government. It is clear that the commodity composition of OPAM's purchases (much more rice than millet, sorghum, or maize) reflects more the system of physical control in projects than it does relative prices or total outputs. OPAM has again lost money since 1968, especially during the drought when it absorbed the costs of supplying food aid to much of Mali.

In the 1974-78 Plan it was assumed that per capita consumption of rice would increase and that of millet and sorghum would decrease, without any change in their relative prices. First, planners argued that higher paddy prices and input subsidies had to be maintained. Second, it was felt that the government could not offer consumer subsidies because it could not afford them nor could it, as with production subsidies, rely on foreign aid to pay for them. Third, the possibility that surpluses could be exported regularly was rejected, although small exports in favorable years--and the emphasis of policy was on favorable crop years when the weather was good and not on years when world prices were favorable--was considered. Planners argued that rejecting an export policy allowed the loosening of the constraint which had forced the government to lower its paddy price in 1960 (12, 16).

The main objective of rice policy, self-sufficiency, was attained in 1976 and 1977 although imports were necessary in 1978 as a result of poor rainfall and the export of stocks of paddy and rice from the 1976/77 harvest.

The problem of policy, as seen by the government, is to maintain self-sufficiency subject to supply changes caused by weather and to fluctuations in world prices.

AN EVALUATION OF POLICIES

Of the four classes of policy described in the introductory essay, investment has been the most important in Mali, with tax/subsidy and price/trade being of lesser importance. Investments have been generally associated with certain direct interventions and the two policies are discussed together.

The major investments have been made in construction and rehabilitation of irrigation works whose scale and technical complexity necessitate public intervention of some form. Although Delta farmers had long grown flooded rice, they had no capacity to make yield-increasing investments, such as dike and canal construction or mechanical deep plowing to kill wild rice, and productivity remained low until the end of the 1960s.

Secondary investments, such as those in mills and warehouses, followed from the primary investments in water control. Secondary government investments were associated with the decision to accept some paddy from producers in irrigated areas in order to amortize (in part) the capital costs of irrigation. They were also consistent with the government's objective to control cereal marketings.

Investments in irrigation, the central policy because of the country's natural and historical advantages in rice production, have been generally successful. They would not, however, have been so without complementary government interventions, especially the provision of inputs (e.g., improved seeds) and of technical advice to farmers. The failures of earlier investments (e.g., the construction of polders during the colonial period and the attempts

to rehabilitate them during the 1960s) were due to the inability to provide such services. Those interventions were also essential to exploiting the Office du Niger's underused capacity. The new Office program after 1970 involved reorganizations of production, such as the transfer of cotton lands to rice and of state farm rice land (regie) to settler management, which contributed to the growth of production in the 1970s.

Success of these public investments and interventions owes much to physical factors. The Office du Niger, with its sunk costs of irrigation, and the Niger-Bani Delta allow simple and inexpensive water control, to which entry can be restricted. Public agencies controlling the irrigation works are able, then, to control some of the supply of paddy from them. Physical control of paddy, as opposed to control through the price system, allows the government to operate its mills at roughly full capacity and thereby to avoid under-utilization of fixed capacity³⁰ without establishing an inflated paddy price in order to be able to buy paddy. On the other hand, physical factors, especially the poor national transport system, work against the input supply and crop marketing agencies because of the high costs involved in supplying some regions.

Constraints on expansion of investments in production are financial and climatic. The government's ability to expand irrigated or empoldered areas depends almost entirely on foreign financing. Attracting that financing depends, in part, on relative rates of return, and it is unclear that rice is more remunerative than cotton or groundnuts. Although the Malian government has argued that the costs of not having secure food supplies during droughts are greater than the costs of obtaining them by growing rice, it is not evident

that some investments, especially those on the polders projects, are secure enough to compensate for their lower rates of return than those on investments in export crops.

The objectives of price/trade policies have been to supply urban centers cheaply, to protect producers and consumers from price fluctuations, and to maintain fixed prices of cereals throughout the country. Policies have included banning private trade in cereals (except during the liberalization between 1969 and 1971), entitlement of a national marketing agency, and establishment of fixed producer prices and cost-price schedules for collection, milling, and marketing. International rice trade was regulated by exports from the Office du Niger before 1966 and by import quotas after 1968.

Constraints on price policy are mainly political and financial. The objective of holding fixed consumer prices in all areas results in OPAM losses on cereals supplied to the Gao and Kayes regions, to which marketing costs are higher than to the Bamako market. OPAM has also carried over deficits resulting from its shipments during the 1972/74 drought and from the subsidies it paid to consumers of commercially imported rice during the period of high world prices which coincided with the drought. The government, which establishes the prices at which OPAM must buy and sell, does not want to raise consumer prices in Bamako because of the effect on the income of its workers; it does not want to raise prices in the outlying areas to cover costs of OPAM's supplying them for similar reasons.

Price policies have had mixed results. They have, in the main urban market at Bamako, led to a price structure in which market retail prices are greater than official retail prices. This implies that there is excess demand at the official price, which OPAM cannot meet, forcing consumers to buy in the private markets. On the other hand, the bias of the price structure in favor

of consumers in outlying areas has probably enabled OPAM to control those markets by making private trade unprofitable there.³¹ That official retail prices have always been less than market prices suggests that OPAM has established a floor price and thereby helped to achieve the objective of insulating producers from downward seasonal and inter-annual price changes.

At the outset of the 1974/75 season, the official paddy price and the corresponding retail rice price were increased. This change was responsible for some of the growth of production in the Office and the flooded rice projects and the resulting growth of official marketings. Other forces behind that growth were the investments in the projects and other government interventions. The growth of production and of official marketings has not entirely eliminated the margin between the official and market retail prices, and therefore the price policy continues to effect a transfer from producers to consumers.³²

Trade is secondary to price in this class of policies. Rice's principal substitutes, millet and sorghum, are almost entirely non-traded goods. Rice trade policy is limited by the fact that high transport costs to ports cause a wide separation between Malian f.o.b. and c.i.f. prices, thus allowing the domestic price of rice to change within a wide band without changes in exports or imports.³³ When domestic prices are within that band, trade policy has no role. Trade policy was most important when Mali began to import rice after 1968, and then it consisted mainly of quota restrictions. The costs of the quotas, instituted partly because of foreign exchange shortages, fell on market consumers who paid prices above the c.i.f. price, not on consumers of OPAM rice who usually paid less than the c.i.f. price because of the limited availability of subsidized imports.

The government has used tax and subsidy policies infrequently because of budgetary limitations. Rice and other cereals are exempt from indirect consumer taxes, except those embodied in the inputs used to produce and market them. There is a small net subsidy throughout the rice sector, which benefits mainly farmers in the development projects. Those subsidies now fall largely on the capital costs of irrigation works and on the variable costs of extension services. Subsidies on farm equipment sold officially were removed before the 1977/78 crop year, and the government has announced its intention to remove all remaining subsidies, including those on fertilizers. The net subsidy on capital costs of irrigation arises from the insufficiency of in-kind water charges paid by participating farmers.³⁴ This particular subsidy is an effective policy, from the government's viewpoint, because it is paid partly out of foreign aid to the rice development projects; it allows greater incentives to farmers without higher paddy prices and thus without higher retail rice prices.

The policies described here have clearly helped the government to achieve its principal objectives, especially to reduce imports and to increase official marketings of rice. They have been only partly successful in increasing rural incomes because of the small proportion of the rural population involved in rice production. Policies have also been successful in achieving price stability, although price policy still favors those who can buy in the official stores and discriminates against those who buy in the markets where prices are higher and vary more greatly. The main impediment to the full achievement of governmental objectives is still weather fluctuations which cause output to fall, leading domestic prices to increase, and necessitating imports. A policy of achieving full production security through irrigation schemes, in order to eliminate imports in even the worst years and to

allow close to complete control of marketings, has not been adopted because of its high investment costs. Given the serious budget restrictions in Mali and the limited supply of concessional aid, such a costly policy cannot be said to have been among the alternatives. One important associated policy to reduce imports and to achieve other objectives concurrently would be the establishment of grain reserves. This has only recently begun to be implemented and it is too early to evaluate its effects.

PROGNOSIS

Since 1968 Malian rice and cereals policy has been built upon three main arguments. The first and most important is that rice production in irrigated and flooded perimeters is more secure against both subnormal rainfall and floods and severe drought than is the rainfed cultivation of millet and sorghum. That assumption is valid in the Office du Niger, but is less so in the controlled submersion polders at Segou and Mopti, from which 35 percent of Mali's projected 1980 paddy output is expected (31). If those polders are less secure than planned, there will be greater fluctuations in paddy production, and the average supply will be less because risk will impair intensification in those projects. Consequently, the government will confront a choice among the price/trade policies (especially a reliance on imports in bad years and on stocking surpluses in good years) and policies to make production more secure or some combination of the two. But secure production techniques (for example, pumping schemes like the one at San which operates as part of the Segou project) might impair Mali's export competitiveness³⁵ and its efforts to restrain domestic prices to the extent that they cost more than current techniques.

The Malian government has stated its general view that it is willing to bear the costs of more secure systems of water supply because any other policy "would bring, in case of drought, greater economic, social and political costs,"³⁶ but its capacity to do so depends upon concessional foreign financing.

The second argument is that rice is more nutritious than millet, and hence rice consumption should be increased. Policy makers have argued also that if rice is available in increasing quantities, then consumers will readily increase their purchases of it, and that the stagnation of consumption after independence was the result of the failure of production to expand. In that view, there is sufficient demand for rice at current relative prices to expand its consumption at the rate of growth of output. The limited availability of foreign aid to fund, for example, large extensions of the Segou and Mopti projects has not permitted the empirical validation of this line of reasoning, but there is no question that it is followed within the Malian government and that it influences cereals investment decisions.

The third assumption is the supposed necessity of complete government control of grain marketing. Attempts to achieve this control have never been successful and it is improbable that they can ever be so. Continuing attempts at extensive public intervention result in fairly large financial costs (e.g., OPAM's deficits) with almost no demonstrable benefits and in some hidden economic costs resulting from disincentives given to greater cereals output. The effects of this public policy have been less in the rice sector than in the rainfed cereals sector because of the government's ability to control the irrigation projects, but it is probable a more supple marketing policy for rice projects would reduce some of the costs of current policy and encourage more rapid adoption of the intensified techniques which are now the object of much extension effort.³⁷

The retention of these assumptions implies that rice will continue to be the principal instrument of Malian cereals policy. This conclusion is reinforced by the slow development of technologies for the production and transformation of rainfed cereals. That continuity of policy itself implies that one of its lesser objectives, to increase rural incomes, will not be well achieved, simply because the majority of Malian farmers do not grow rice and will not do so in the conceivable future. Though the rice projects and the Office du Niger have increased rural incomes, they affect less than 250,000 people in a rural population of 5,500,000. The emphasis of other Malian development projects is largely on production and marketing of cash crops, not on development of rainfed cereals.

If rice remains the basis of cereals policy, the high costs of some types of projects (for example, new large dam irrigation works or pumping systems) and the continuing experience of poor harvests, of which the 1977/78 crop year is the latest example, will impel policy to turn increasingly to the Office du Niger. For the Office to continue to increase productivity, policy makers must choose among intensification (incurring some capital costs not necessitated by a more extensive policy), extension of cultivated areas to utilize more fully the existing irrigation network, or some mix of the two policies (27, 31). The Office has the advantages that its main capital costs are sunk and that aid donors are now willing to pay for the rehabilitation projects. That aid, which is necessary in view of the budgetary situation, is related both to the water security in the Office and to the recent advances there. Such an emphasis on the Office and, in particular, on intensification there, has advantages which other policies (for example, more polder construction in the Delta or greater development of rainfed cereals in southern Mali) do not have. The main one is that it

allows constitution of larger supplies, either for export (if world prices are favorable) or for storage to maintain national self-sufficiency in following, perhaps deficit, years. Development of such supplies, apart from its contributions to self-sufficiency, could also contribute to greater price stability.³⁸

The great dependence on rice of Malian cereals policy has persisted in spite of the facts that rice production involves less than 30 percent of the rural population and that its consumption provides only 15 percent of the national supply of calories. This orientation has derived largely from the hydrologic qualities of the Malian segment of the Niger River and from the legacy of French policy in the Office du Niger, which provide Mali with special advantages in rice production. While those physical bases of policy have differed little from the first regime to its successor, the instruments and results of policy have differed greatly. The adoption of new policies by the second government has enabled it to regain self-sufficiency and even to export rice, but that government now faces secondary problems, especially to limit the costs of securing production and to avoid over production of high-cost rice, which did not exist in the first era.

FOOTNOTES

¹The Sahelian zone is defined as that area which receives between 250 and 500 millimeters of rain annually. When speaking of agricultural seasons, the expression, for example, 1974/75, will be written as 1975-- that is, as the year in which harvests became available for consumption. Populations by ecological zone are shown in Appendix Table 1.

²A 1967 population survey was done in Mali as part of the annual Enquete Agricole and was used for demographic projections in the 1974-78 Five Year Plan. That survey has been used here to estimate changes in population according to ecological zones and rural or urban location.

³The word millet will be used for the words millet and sorghum as a matter of convenience, although they are not the same thing, except when it is necessary that the distinction be made carefully. A time series of area, yield, and production data from 1961 to 1976 is presented in Appendix Table 3.

⁴The control is against too rapid entry and too early recession of flood water. If the flood does not arrive, or if it arrives late, there is no way to get water to the fields. The systems can be adapted to pumping, but it would probably be necessary then to dig secondary canals and drains and to level the fields.

⁵Both rice projects, Operation Riz Segou and Operation Riz Mopti, are financed by external donors. Though the polders in both projects are designed to be filled completely in nine out of ten years, filling rates vary widely between polders and some appear to be badly designed. The

size of the first Mopti project (financed by the International Development Association) was reduced from 31,000 to 26,000 hectares in order to improve the filling rates of some of its polders.

⁶See the history of the Office in John de Wilde (32, pp. 245-300). Cotton cultivation was stopped in the Office as the result of agronomic problems which are discussed in his book. Cotton culture may be started again in the Office in an area which is not now planted to rice. Water is pumped onto the 3,000 ha of sugarcane in the Office.

⁷Yields in the Kolongo sector of the Office have usually been poorer than yields in other sectors because of drainage problems.

⁸Areas cultivated to rice in the Office increased more or less continuously from 1945 to 1961. They stagnated in the 1960s, increased again in 1970 after cotton cultivation was stopped and have been restrained lately as part of a policy to try to reduce the average size of holdings.

⁹Paddy prices vary by quality. The highest price is paid for white paddy, the lowest for red, and there is an intermediate price for mixed red and white. All of the paddy produced in the rice projects, with the exception of a small amount in Mopti, is white.

Project officials complain that the cost price schedules (baremes) do not cover the costs of paddy collection and transport. A national commission is now collecting data from all development projects in order to establish new baremes which may be available for the 1978/79 crop year.

¹⁰Studies of cereals marketing in Mali include (2, 4, 6).

¹¹Even this low share may be an overstatement because rice output statistics are collected with comparative thoroughness while the production of some foods--cassava and yams, for example--is not well surveyed. Table 9 below presents a partial series of rice's share in consumption relative to those of millet and sorghum. The share of rice in consumption has been calculated from data compiled in Appendix Tables 3 and 13. Studies of food demand in Mali are (13, 15, 25).

¹²Mali's international rice trade position is shown in Appendix Table 8.

¹³Accounts of Malian history in this period are in Jones (10), Foltz (5), and Amin (1).

¹⁴The French firm, Compagnie Française pour le Développement des Fibres et Textiles (CFDT), operated the cotton production and marketing under an agreement with the new government. CFDT was the exception to the remark above about the lack of financial and organizational capacity of the marketing agencies.

¹⁵Mali exported rice to Senegal before independence. See Jones (10, pp. 300-01) for a discussion of price policy after independence.

¹⁶However, Mali's record of official purchases of cereals is better than that of the other Sahelian countries. See CILSS (4, Vol. 1).

¹⁷OPAM's losses are noted in Jones (10, pp. 239, 250).

¹⁸The bias observed in the consumer price policy of the first government was intended but it was partly ineffective because OPAM only partly controlled cereals marketings. One important reason for OPAM's inability to control marketings was the lowered producer prices.

Consumers were organized into cooperatives, for which there was a membership fee per family, and each family was allowed a quota of purchases in the cooperatives.

¹⁹The minimum wage and the government's wage paid to its own employees did not increase throughout the eight years of the first regime; retail prices of cereals did increase in that time. See CILSS (4, Vol. 1, p. 136). See Jones (10) for the government's budget deficits.

²⁰Planned expenditures were in all events a good deal larger than actual and the shortfall of spending contributed to the failure of the investment program of the first Plan. Of the 14.3 billion Malian francs (at par with the CFA franc until 1967) scheduled to be spent on agricultural equipment, the flooded rice polders and the Office du Niger, only 8.08 billion were actually spent; 5 billion francs of the shortfall were in the Office. Much of the actual investment in the Office was in cotton and sugarcane, not rice. See Jones (10, pp. 352, 356).

²¹By 1968 there were only 13,535 hectares of millet or sorghum farmed collectively with an average yield of 260 kilograms per hectare, and 16,560 hectares of rice farmed collectively with a yield of 136 kilograms of paddy per hectare. This compares to other farms of 867,000 hectares in millet or sorghum, with yields of 840 kilograms, and 135,000 hectares in rice, with yields of 727 kilograms. See International Bank for Reconstruction and Development (8, Table 11). Mali's first president, Modibo Keita, announced, "...we ask each village to act so that its collective field develops in such a way as to attain in five years at the end of the Plan ((1966)), an area of 1 hectare per family" (10, p. 227).

²²The Malian franc was inconvertible from the time of its creation in 1962 until the time of its 50 percent devaluation in May 1967. It is possible that Malian peanuts were being smuggled to Senegal and bartered there; that type of smuggling, caused by the inconvertibility, might have occurred even if peanut prices had not been higher in Senegal.

²³This argument does not consider the effects of input prices on supply or of the superior commercial organization of CFDT; this second factor seems to have been decisive in CFDT's success. See de Wilde (32, pp. 301-36) for an account of CFDT's work in the early 1960s.

²⁴For the reason the devaluation probably enabled the government to buy more peanuts, see footnote 21 above.

²⁵The c.i.f. value of Malian imports in 1974 was 86.08 billion Malian francs; the c.i.f. value of rice imports (food aid excluded) was 13.26 billion. Sources are the International Monetary Fund (9) and the West African Rice Development Association (28). A complete time-series of imports of rice is shown in Appendix Table 8, and a complete time-series of per capita cereals availability is shown in Appendix Table 13.

²⁶Views of Malian planners from the National Direction of the Plan and from the Institute of Rural Economy in Bamako are contained in the Bilan Cerealier (12), a study used to make projections of cereals supply and demand for the 1974-78 Five Year Plan.

²⁷These assumptions are discussed in the Bilan Cerealier (12), in the text of the Five Year Plan (12) and in an unpublished document (14), circulated within the Institute of Rural Economy discussing Malian cereals policy. It is believed that rice is not more nutritious than millet, at least

in terms of grams of protein and of fats per kilogram of grain. See CILSS (4, Vol. 1, pp. 208-13) for a discussion of this problem. At current product prices, calories of millet are much cheaper than calories of rice.

²⁸The real price of paddy (i.e., the nominal price deflated by the GDP deflator) increased by 75 percent in this period.

²⁹See the CILSS (4) Mali country study for a record of OPAM's recent stockholdings. Stocks were greater than this amount at the end of 1971/72 and 1973/74 seasons, but it is not known if private trade was then made legal.

³⁰Analysis of Malian milling costs, especially those of its large industrial mills, shows that they are substantially lower than costs of similar mills in other West African countries, and that much of the Malian advantage is due to lower average fixed costs.

³¹OPAM's losses in these activities (or, alternatively, the subsidies paid to consumers in outlying areas of the country) are financed out of credits from the Central Bank of Mali, on which OPAM is one of the largest drawers. The analysis of the success or failure of a policy to maintain a unique national price, in view of significant differences in costs of handling and transport, depends upon the weights one attaches to the objectives of regional income distribution and financial equilibrium of state agencies. If one believes regional income distribution considerations to be more important, then the policy has been successful; if one believes OPAM's financial self-sufficiency to be more important, then the policy has been a failure.

³²Effects of changing the producer price of paddy are analyzed in the companion paper to this one, "Resource Costs and Economic Incentives in Malian Rice Production" (20).

³³The difference between the Dakar c.i.f. price and the Bamako c.i.f. price is roughly 25,000 to 30,000 Malian francs/mt. This implies that the band within which domestic prices can change is 50,000 to 60,000 mf/mt, i.e., twice the margin between the c.i.f. Dakar and c.i.f. Bamako prices, or 30 to 50 percent of official retail rice prices in Bamako.

³⁴The incidence of taxes throughout the rice sector is discussed more completely in (20), where it is shown that farmers benefit from subsidies on irrigation works and extension services but that the official paddy price is far below import substitution levels, meaning on the whole that the effective rate of protection on output is significantly negative.

³⁵See (20), where it is shown that Malian rice exports can be competitive in Ivorian markets at a world price (c.i.f. Abidjan) of \$300/mt for 25 to 35 percent broken rice. Malian rice is not competitive in Dakar at a world price of \$250/mt for 80 percent broken rice.

³⁶See (14). Also see Stryker (26) for a general discussion of food security policies in the Sahel.

³⁷See (4) and (26) for criticism of Malian marketing policies, enumeration of some of the inefficiencies of the present system (in Mali and in other Sahelian countries), and proposals for reform.

³⁸See (20) where the intensified Office du Niger technique (described in 28 and 20) is shown to have a net social profitability slightly less than the current technique, but to increase net yields by more than one metric ton of paddy/ha.

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Year	Total	Total		By ecological zone			
		Urban	Rural	Saharan	Sahelian	Soudanian	Guinean
1960 (%)	4,249	324 (7.63)	3,925 (92.37)	1967 ^b 425.1	1,005.6	2,598.8	716.2
1967 (%)	5,051	478 (9.46)	4,573 (90.54)	% 8.9	21.2	54.8	15.1
1976 ^c (%)	6,308	787 (12.5)	5,521 (87.5)	1976 ^c 507.1	1,238.2	3,594.1	968.9
				% 8.0	19.6	57.0	15.4
1960 ^a (%)	3,585	415 (11.58)	3170 (88.42)				
1967 ^b (%)	4,745	384 (8.09)	4,361 (91.91)				
1976 ^c (%)	6,308	787 (12.5)	5,521 (87.5)				

^aDemographic Survey of Mali (1960-61), Fonds d'Aide et de Cooperation. This study was based on the three percent sample of all of Mali except the Office du Niger and the cercle of Ghorma-Rharous. 100,000 people have been added to the total population for the two excluded area, all of whom are assumed to live in rural areas.

^bBilan Cerealier de la Republique du Mali (1972), Institut of Rural Economy). This study was done as part of planning for the 1974-78 Five Year Plan and is said to have been based on surveys. The urban population shown is the number living in the 13 communes (Kayes, Kita, Nioro, Bamako, Katibougou, Koulikoro, Sikasso, Koutiala, Segou, San, Mopti, Gao, Tombouctou).

^cRecensement General de la Population du Mali (1976): Resultats Provisoires. This is the only true census available. The urban population shown is the number of people living in the 13 communes noted above.

^dEcological zones are defined roughly according to the north-south rainfall pattern in Mali. The Saharan zone is that which receives less than 250mm annually; the Sahelian zone receives between 600mm and 250mm annually; the Soudanian zone receives between 600 and 1200mm annually, and the Guinean zone receives more than 1200mm. Populations were apportioned to each zone according to figures given in the sources cited above in (b) and in (c).

Table A-2--Gross Domestic Product

Year	Gross domestic product ((a))		Per capita gross domestic product ((a))		Share in GDP ((a))	
	Current prices	Constant prices	Current prices	Constant prices	Agriculture	Rice
1960	67.5	103.0	15,886	24,241	50.4	na
1961	71.2	105.0			51.1	2.33
1962	73.6	106.8			50.0	2.26
1963	81.0	113.7			50.1	2.58
1964	88.8	117.9			45.4	2.14
1965	90.4	122.8			43.0	2.18
1966	94.6	127.8			42.8	2.14
1967	104.0	131.9	20,560	26,114	47.1	2.45
1968	130.5	136.6			42.0	2.33
1969	135.5	135.5			39.8	1.79
1970	152.6	144.1			40.8	2.57
1971	166.9	149.9			40.3	2.52
1972	176.8	157.9			39.2	2.23
1973	182.7	153.0			39.0	1.20
1974	195.4	154.1			na	1.57
1975	259.0	173.7	42,084	28,224	na	2.79
1976	na	na	na	na	na	na

a 1969 base year. Source is International Bank for Reconstruction and Development, World Tables (Johns Hopkins: 1976).

b Units are 10⁹ Malian francs. Source of GDP data after 1972 is Directorate of Malian Plan

Source is ibid. Units are 10⁹ Malian francs.

c Source is ibid. Population figures are from Recensement General de la Population du Mali (1976): Resultats Provisoires.

d Units are Malian francs.

Source is ibid.

e Ratio obtained by multiplying total farm paddy production (see Appendix Table 3) by prevailing official paddy price and dividing that product by the current price GDP.

Table A-3--Area Planted, Yield, and Production of Major Crops

Year	Rice			Peanuts			Millet and Sorghum			Cotton		
	Area (ha)	Yield (mt/ha)	Production (mt)	Area (ha)	Yield (mt/ha)	Production (mt)	Area (ha)	Yield (mt/ha)	Production (mt)	Area (ha)	Yield (mt/ha)	Production (mt)
1961	170 ^a	1.088 ^a	185 ^a	na	na	122 ^c	na	na	850 ^c	na	na	na
1962	182	1.016	185	na	na	138	na	na	820	na	na	na
1963	200	0.950	190	na	na	167	na	na	870	na	na	na
1964	123	1.341	165	na ^b	na ^d	182	na ^b	na ^d	865	na ^b	na ^d	na
1965	159	0.997	158	144	1.028	148	859 ^b	0.789 ^d	678	89 ^b	0.371 ^d	33 ^c
1966	169	0.959	162	122	1.254	153	830	0.869	721	76	0.237	18
1967	178	0.890	159	129	1.232	159	910	0.810	737	62	0.452	28
1968	198	0.857	169	140	0.850	119	1,035	0.802	830	76	0.487	37
1969	162	0.836	135	129	0.744	96	932	0.598	557	91	0.604	55
1970	133	1.174	157	118	1.152	136	745	0.809	603	76	0.605	46
1971	172	0.977	168	162	0.963	156	725	0.986	715	75	0.747	56
1972	169	1.348	158	174	0.874	152	1,258	0.568	715	79	0.899	71
1973	167	0.527	88	160	0.843	135	900	0.692	623	86	0.849	73
1974	185	0.724	134	na	na	132	na	na	660	69	0.797	55
1975	198	0.914	181	na	na	188	na	na	850	68	1.044	71
1976	224	1.116	250	na	na	205	na	na	865	87	1.149	100

^a Source is West African Rice Development Association, Rice Statistics Yearbook (1975) and Up-date (August, 1976).

^b Source is Center for Research on Economic Development, University of Michigan, Mali Agriculture: Sector Assessment (1976). Crop areas in that study appear to be based largely upon results from Enquetes Agricoles.

^c Source is Center for Research on Economic Development, University of Michigan, and CILSS, Marketing, Price Policy and Storage of Food Grains in the Sahel (1977), Mali Statistical Tables.

^d Yields are calculated from aggregate area and production figures, and should only be taken as indicating orders of magnitude

Table A-4--Modern Inputs into Rice Production

Year	Selected seeds		Fertilizer			Pesticides (mt)
	Rainfed (ha)	Irrigated (ha)	N (mt)	P (mt)	K (mt)	
1961	0	31,894 ^b	na ^c	na ^c	20 ^c	na
1962	0	27,423	..	..	..	..
1963	0	22,900	..	..	..	..
1964½	0	29,306	..	..	..	..
1965	0	28,271	..	..	..	..
1966	0	28,183	..	..	..	..
1967	0	28,630	..	..	..	..
1968	0	29,369	..	..	..	..
1969	0	29,898	..	..	..	..
1970	0	32,826	..	..	..	..
1971	0	39,838	..	..	..	..
1972	512 ^a	38,534	..	..	..	..
1973	2201	45,291	269	..	..	..
1974	2883	70,489	269	..	..	..
1975	3655	82,813	272	..	..	..
1976	4115	90,257	316	..	..	..
1977	4231	91,612	392	100	..	..
1978	5538	na	na	na	..	..

^a Source is Directorate of Operation Riz Pluvial et Bas-Fonds, Sikasso. There was no seed farm associated with this project until 1975-76 when one was established at Dalabani. Before the establishment of that farm improved seeds were provided to the project from a research station and multiplied by farmers hired by the project for that purpose. These figures are maximums and may overstate the areas seeded with improved varieties.

^b Improved seeds are assumed to have always been used at the Office du Niger, although a seed multiplication farm was not established there until 1973. The improved varieties used before 1973 were contaminated with red rice seeds (*O. glaberrima*) and wild rice seeds (*O. Barthii*), so the quality of seeds has probably improved in the Office after the establishment of the farm. Improved seeds predominate in the Mopti and Segou projects after 1974. Sources are Bureau of Economic Affairs, Office du Niger; Annual Reports of Operations Riz Segou and Mopti.

^c Data are from the Bureau of Economic Affairs, the Office du Niger, Segou; and the Annual Reports of Operations Riz Segou, Mopti and Sikasso.

Table A-5--Evolution of Land Development for Rice

Year	Improved Land planted to rice (ha)				Upland ^e	Total
	Improved swamp and rainfed	Controlled flooded	Pump irrigation	Dam irrigation		
1961	0	0	0	31,894 (45,321) ^c		31,894
1962	0	0	0	27,423 (46,341)		27,423
1963	0	0	0	22,900 (49,305)		22,900
1964	0	0	0	29,306 (51,767)		29,306
1965	0	0	0	28,271 (53,260)		28,271
1966	0	0	0	28,183 ..		28,183
1967	0	0	0	28,636 ..		28,636
1968	0	0	0	29,369 ..		29,369
1969	0	3,900 ^a	0	29,898 ..		33,798
1970	0	12,700	0	32,826 ..		45,526
1971	0 ^d	13,600	0	39,838 ..		53,438
1972	512	17,200	0	38,534 ..		55,734
1973	2,201	20,594	0	37,691 ..		58,285
1974	2,883	34,985	0	40,139 ..		75,124
1975	3,655	43,397	0	40,813 ..		84,210
1976	4,115	50,388	0	39,922 ..		90,310
1977	4,231	51,706	874 ^b	39,567 (53,260)		91,273
1978	5,538	54,805	874	na (53,260)		n.a.

^a Annual Reports of Operations Riz Segou and Mopti. Areas are seeded hectarage.

^b Annual Report of Operation Riz Segou. This figure represents the 144 hectares planted to rice in polder San "A" and the 700 hectares planted to rice in polder San "B".

^c Bureau of Economic Affairs, Office du Niger. The figures in parentheses (e.g., 1977 is 53,260) are the total area improved within the Office du Niger's irrigation system, including the areas now devoted to sugarcane.

^d Operation Riz Pluvial et Bas Fonds, Sikasso.

^e Improved upland rice land is included in the "Improved swamp and rainfed" category.

Table A-6--Processing and Marketing of Rice by Public Agencies

Year	Paddy collected (mt)	Paddy milled (mt)	Outturn (%)	Marketable rice (mt)	Marketed rice (mt)
1961	45.2 ^a	n.a.	65%	14.5 ^c	n.a.
1962	26.6	n.a.	-	2.2	n.a.
1963	33.8	n.a.	-	16.4	n.a.
1964	30.8	n.a.	-	19.1	n.a.
1965	27.1	n.a.	-	14.3	n.a.
1966	27.8	n.a.	-	18.3	n.a.
1967	36.6	n.a.	-	23.9	n.a.
1968	39.7	n.a.	-	25.9	n.a.
1969	32.3	n.a.	-	41.4	n.a.
1970	49.3	34,244 ^f	-	45.7	n.a.
1971	42.1	36,993	-	42.4	n.a.
1972	50.5	44,416	-	64.0	35.7 ^e
1973	49.7	41,962	-	28.5	58.4
1974	57.2	42,000 ^e	-	108.3	62.2
1975	83.0	42,000 ^e	-	73.8	48.7
1976	93.0	56,476 ^g	-	60.5 ^d	51.7
1977	93.0 ^b	73,789	65%	n.a. ^d	n.a.

^aIncludes paddy collected in the Office du Niger and in all other areas as well as some very small amounts of rice bought by OPAM. Sources are Bureau of Economic Affairs, Office du Niger; Annual Reports of Operations Riz Segou and Mopti after 1969; records of OPAM Directorate, Bamako.

^bEstimate based on reports from Bureau of Economic Affairs, Office du Niger; Operations Riz Segou and Mopti.

^cMarketable rice is defined as the sum of officially purchased paddy converted to rice at a milling ratio of 0.65 plus imports or minus exports.

^dComplete export data are not available for 1976-77.

^eSource is OPAM Directorate. Part of the discrepancies between the marketable and marketed categories between 1972 and 1976 can probably be explained by changes in stocks (for evidence that OPAM built up its stocks of all cereals during the drought period, see CRED and CILSS, Mali Country Study, p. 20. That study also found large discrepancies in OPAM's records).

^fOffice mills only until 1976.

Table A-7--Milling and Storage Capacity of Public Agencies

Location	Milling capacity (mt paddy/year)		Storage (mt)	
	Theoretical	Real	Paddy	Rice
Kourouba	6,000 ^a	na	na	na
Diafarabé	13,800 ^a	na	na	na
Sevaré	15,000 ^a	15,000	3,500	
Molodo	18,000 ^b	18,000		14,400 ^c
Kolongotomo	12,000 ^b	6,300		9,845 ^c
Kourouma	18,000 ^b	18,000		15,000 ^c
N'Diebougou	18,000 ^b	18,000	na	na

 OPAM's STORAGE CAPACITY (1976)^a

Location	Stores Owned mt	Stores Rented and other mt	Silos mt	Total mt
Kayes	7300	20188	3300	30788
Bamako	27900	35001	12100	75001
Sikasso	8800	12255	--	21055
Segou	14052	19580	--	33632
Mopti	27600	20050	8800	56450
Gao	18070	14311	3300	35681
Total	103722	121385	27500	252607

^a Mimeographed documents at OPAM Directorate, Bamako. Storage capacity is for all cereals.

^b Bureau of Economic Affairs, Office du Niger, Segou.

^c Paddy and rice storage capacity counted together.

Table A-8--Rice Imports and Exports
(quantities (Q) in mt, values (V) in (s))

Year	Imports										Exports	
	Total		(China)		By origin (USSR)		(Other)		By quality		Q	V
	Q	V	Q	V	Q	V	Q	V	Q	V		
1961	0		0		0		0		0		12,582	419
1962	0		0		0		0		0		14,999	513
1963	0		0		0		0		0		5,233	174
1964	0		0		0		0		0		1,115	38
1965	0		0		0		0		0		3,704	127
1966	0		0		0		0		0		0	0
1967	0		0		0		0		0		0	0
1968	0		0		0		0		0		0	0
1969	20,444	1,809					20,444	na	0		0	0
1970	14,500	1,079					14,500	na	0		0	0
1971	15,000	1,083					15,000	na	0		0	0
1972	30,500	2,225					30,500	na	0		0	0
1973	46,000	4,746					40,000 (s)	na	0		0	0
1974	71,000	13,258	18,000		25,000		30,300	na	18,000		0	0
1975	20,000							na			0	0
1976								na			0	0
1977											10,000 ^b	na

^a Values are in millions of Malian francs. Source of data is WARDA, Rice Statistics Yearbook (1975) and Up-date (August, 1976).

^b This is an estimate from WARDA, "Recent Developments in the WARDA Rice Economy," (March, 1978).

Table A-9--Selected Prices of Rice
((a)/kilogram milled rice)

Year	c.i.f.	Retail		Wholesale		Producer, official	
		Official	Market	Official	Market	White Paddy	Milled equivalent
		40 % brokens	40 % brokens	40 % brokens	(quality)		
1961	c	33.3	na ^a	na	na	9 ^a	13.8 b
1962	d	34.2	na	na	..	9	13.8
1963		33.3	44	44	..	11	16.9
1964		34.1	52	52	..	11.5	17.7
1965		34.2	89	89	..	12.5	19.2
1966		na	104	104	..	12.5	19.2
1967		98.7	106	106	..	16	24.6
1968		102.7	106	106	..	18	27.7
1969		91.3	88	88	..	18	27.7
1970		79.3	98	98	..	25	38.5
1971		79.2	111	111	..	25	38.5
1972		81.0	125	125	..	25	38.5
1973		123.6	146	146	..	25	38.5
1974		247.5	159	159	..	25	38.5
1975		280.0	150	150	..	40	61.5
1976		na	146	146	..	40	61.5
1977		na	164	164	na	40	61.5

^a Source is Monthly Statistical Bulletin (various years, Bamako).

^b Calculated from official paddy price at a milling ratio of 0.65.

^c Source is West African Rice Development Association, Rice Statistics Yearbook (1975). Prices between 1961 and 1965 are CIF in export markets, principally in the Ivory Coast. Mali had no recorded rice trade between 1966 and 1968. Prices between 1969 and 1974 are CIF Bamako, calculated by taking the CIF Abidjan price (shown in the Rice Statistics Yearbook) and adding a road transport margin between Abidjan and Bamako. The 1975 CIF price is for 20,000 cons of rice imported from China.

^d Source is Rice Policy in the Ivory Coast, Charles P. Humphreys and Patricia L. Rader (June, 1977 draft) for CIF Abidjan price of Thai 25-30 % brokens. CIF Bamako price is Abidjan price plus road transport costs.

Table A-10--Selected Producer Prices of Major Crops
((a)/kilogram)

Year	MILLET ^a		PEANUTS ^a		COTTON ^a	
	Official	Market	Official	Market	Official	Market
1961	10	na	14	na	34	na
1962	10	na	14	.	34	.
1963	10	18	14	.	34	.
1964	10	23	14	.	34	.
1965	11	47	13	.	34	.
1966	11	56	13	.	34	.
1967	16	46	16	.	34	.
1968	16	42	24	.	34	.
1969	16	48	24	.	40	.
1970	16	42	30	.	40	.
1971	18	49	30	.	45	.
1972	18	72	30	.	50	.
1973	20	121	30	.	50	.
1974	20	83	30	.	50	.
1975	32	73	40	.	75	.
1976	32	69	40	.	75	.
1977	32	na	45	na	75	na
1978	36	na	na	na	na	na

^a Source is Monthly Statistical Bulletin of Mali (various years, Bamako).

49

Table A-11--Selected Retail Prices of Major Foods
((a)/kilogram)

Year	<u>Food Price Index</u>		(food)	(food)	(food)	(food)
	Cooperative	Market				
1963 ^a	100	100	na	na	na	na
1964	na	na	..	..	..	..
1965	117	162	..	..	..	..
1966	122	179	..	..	..	..
1967	148	191	..	..	..	..
1968	155	191	..	..	..	..
1969	162	191	..	..	..	..
1970	169	193	..	..	..	..
1971	188	234	..	..	..	..
1972	196	251	..	..	..	..
1973	218	324	..	..	..	..
1974	273	339	..	..	..	..
1975	316	350	..	..	..	..
1976	351	379	..	..	..	..
1977	na	na	na	na	na	na

^a Mali has no true consumer price index. There was a food consumption study done in Bamako in 1962/63 which established the weights used in the two indices shown here. Indices have been calculated from data in the Monthly Statistical Bulletin of Mali (various years, Bamako) except for 1968 (cooperative) and 1973 (market) for which the source is the International Monetary Fund, Surveys of African Economies: Mali (Washington, D.C.: 1977), 128.

Table A-12--Rice Availability and Consumption
('000 mt, unless otherwise indicated)

Year	Availability				Consumption		
	Production	Changes in stocks	Seed and losses	Net imports	Net availability	per capita (kg) total	per capita (kg) total
1961	120 ^a	na ^b	-24 ^c	-13 ^b	83	19 ^d	
1962	120	.	-25	-15	80	18	
1963	124	.	-20	-5	99	22	
1964	107	.	-21	-1	85	18	
1965	103	.	-21	-4	78	16	
1966	105	.	-22	0	83	17	
1967	103	.	-23	0	80	16	
1968	110	.	-22	0	88	17	
1969	88	.	-17	20	91	17	
1970	102	.	-21	15	96	18	
1971	110	.	-22	15	103	18	
1972	102	.	-21	31	112	20	
1973	57.2	.	-18	46	85.2	15	
1974	87.1	18	-22	71	118.1	20	
1975	118.0	23	-26	20	89.0	14	
1976	163.0	-10	-31	0	142.0	23	
1977	171					na	

Estimated 1976 Consumption, kgs rice per caput

Rural	15
Office du Niger ^e	140
Other principal rice growing areas ^f	100
Other rural	10-15
Urban	65
Bamako ^g	80
Other regional capitals ^h	60
Remaining communes ^h	40

Table A-12. --Rice Availability and Consumption (continued)

^a Source is WARDA Rice Statistics Yearbook (up-date, August 1976). Paddy has been converted to rice at a milling ratio of 0.65.

^b Source is ibid.

^c Seed rate is assumed to be 100 kgs per hectare for all techniques in Mali, and amounts of seed used in any crop year (e.g., 1976) are calculated by multiplying the number of hectares seeded in the following year (e.g., 1977) by 100 kgs. Losses are assumed to be 10 percent of gross yield before seed is subtracted. Hectarage figures are from ibid.

^d Population calculated from Appendix Table 1 by extrapolating from 1976 census figure of 6,308,320 at annual growth rate of 2.5 percent.

^e Office du Niger rice consumption estimated by the following method:

1975/76 total paddy output	89,462 metric tons
- 10 percent field losses	8,846
- marketed total	64,400
- 100 kgs/hectare seed	3,957
<hr/>	
remainder in paddy	12,159
x(0.65) = remainder in rice	7,903
+ Office population	47,460
per caput availability	167

It was then assumed that Office settlers sold some paddy on the parallel market. The difference between the availability shown here and that in Table 12 implies total Office parallel market paddy sales of nearly 2,000 tons.

^f Other principal rice growing areas are Operations Riz Segou and Mopti with farm populations of 150,000 and the traditional rice growing area of the Delta. Estimates of urban inhabitants involved in those two rice projects have been made and subtracted from those populations to avoid double counting when calculating urban consumers.

^g Bamako population is 404,022. OPAM Deliveries to the Bamako area between 1 September 1975 and 31 August 1976 were roughly 65 kilograms per caput. It has been assumed that the parallel market has supplied the difference (about 6,000 metric tons) between a per caput availability of 65 kilograms and one of 80 to a population of that size. Source is 1976 Census cited in Appendix Table 1.

^h Other regional capitals are Kayes, Sikasso, Segou, Mopti and Gao; their population is 241,255. Other remaining communes are Kita, Nioro, Kati, Koulikoro, Koutiala, San, and Tombouctou; their population is 141,723. Source is 1976 Census cited in Appendix Table 1.

Table A-13.--Estimated Total Cereals Availability, 1961-76*

	1961	1962	1963	1964	1965	1966	1967	1968
<u>Rural</u> ^a	863	862	892	918	755	725	881	790
<u>Rice</u> ^b	67	79	82	66	64	65	56	62
Corn	46	59	60	92	79	64	54	59
m/s ^c	750	724	750	760	612	596	771	669
Population ^d	4,013	4,103	4,194	4,287	4,381	4,477	4,573	4,673
Per caput	215	208	213	213	171	161	193	168
<u>Official urban</u> ^e	16.8	28.6	42.8	35.4	31.3	51	81	86
Rice	16.8	8.6	16.8	19.1	13.9	18	24	26
Corn	0	0	0	0	0	0	0	0
m/s	0	20	26	16.3	17.4	33	57	60
Population ^f	342	361.5	382.1	403.9	426.9	451.2	478	504.1
Per caput	49	79	112	88	73	113	169	171
<u>Trade</u>	-8.3	-8.7	2.1	2.8	16.7	19	20	2
Rice ^g	-12.6	-15	-5.2	-1.1	-3.7	0	0	0
Corn	0	0	0	0	0	0	0	0
m/s ^h	0	0	-2.4	0	0	7	10	-8
Wheat flour ⁱ	4.3	6.3	9.7	3.9	20.4	12	10	10
<u>Total availabilities</u>	884	890	937	956	803	795	984	878
Rice	84	81	94	84	74	84	80	88
Corn	46	59	60	92	79	64	54	59
m/s	750	744	774	776	629	636	838	721
Wheat flour	4.3	6.3	9.7	3.9	20.4	12	10	10
Population	4,355	4,464	4,576	4,691	4,808	4,928	5,051	5,177
Per caput	203	200	205	204	167	161	195	170

53

Table A-13.-- Estimated Total Cereals Availability, 1961-76* (continued)

	1969	1970	1971	1972	1973	1974	1975	1976
<u>Rural^a</u>	90	811	722	701	545	638	830	861
Rice ^b	49	49	60	49	7	29	38	71
Corn	59	68	52	65	40	57	75	81
m/s ^c	482	694	610	582	538	552	717	709
Population ^d	4,774	4,877	4,983	5,036	5,192	5,301	5,410	5,521
Per caput	123	166	145	137	113	120	153	156
<u>Official urbane</u>	29	58	39	62	42	45	102	118
Rice	21	32	27	33	33	35	54	61
Corn	0	0	0	0	0	0	0	0
m/s	8	26	12	29	9	10	48	57
Population ^f	532.9	563.3	595.4	629.3	665.2	703	744	787
Per caput	54	103	66	99	65	64	136	152
<u>Trade</u>	44	17	49	66	153	223	97	49
Rice ^g	20	15	15	31	46	71	20	0
Corn	0	0	5	5	25	46	28	0
m/s ^h	17	-15	12	13	61	91	0	0
Wheat flour ⁱ	7	17	17	17	21	15	49	49
<u>Total</u>	663	886	810	829	780	906	1,029	1,028
Rice	90	96	102	113	286	135	112	132
Corn	59	68	57	70	65	103	103	81
m/s	507	705	634	629	608	653	765	766
Wheat flour	7	17	17	17	21	15	49	49
Population	5,307	5,440	5,578	5,715	5,857	6,004	6,154	6,308
Per caput	125	163	145	145	133	151	167	163

Table A-13. --Estimated Total Cereals Availability, 1961-76* (continued)

* Population data are from Recensement General de la Republique de Mali: Resultats Provisoires (1976). Rice production and trade data are from The West African Rice Development Association, Rice Yearbook (update, August, 1976). Millet/sorghum production and trade data are from Comité Inter-état de Lutte contre la Sécheresse Sahelienne (CILSS), Club du Sahel, Working Group on Marketing, Price Policy, and Storage, "Mali Country Study, " Marketing, Price Policy and Storage in Food Grains in the Sahel - A Survey, by Center for Research on Economic Development, University of Michigan, Ann Arbor, August, 1977, Volume 2. Wheat import data are from FAO Trade Yearbooks, various years. Corn import data are from FAO Trade Yearbooks, various years, and corn production data are from Agricultural Surveys of Mali, Bamako, various years. Totals may not sum because of rounding errors.

^aRural is defined to include all sources of crop production: Private holdings, state farms, collective farms, official development projects and the Office du Niger. Known officially marketed production including sales of paddy to the Office du Niger and purchases of other cereals by OPAM, has been subtracted from the Farm total. Official purchases of corn and wheat are negligible.

^bPaddy is seeded at 100 kilograms/hectare and there are 10 percent field losses. Paddy is converted to rice at a milling rate of 0.65.

^c"m/s" is millet/sorghum. It is assumed that they are seeded at 10 kilograms/hectare and that there are 10 percent field losses.

^dRural population is the difference between total population and estimated urban population, and it includes rural non-agriculturalists.

^eThis category includes all purchases of cereals by OPAM and all purchases of rice (converted from paddy) by the Office du Niger.

^fThis is urban population, defined as those living in the commune category of the 1976 national census.

^gA negative sign (-) means net exports.

^hA negative sign (-) means net exports.

ⁱIncludes wheat converted to flour at the ratio of 0.72.