DEMOCRATIC REPUBLIC

OF

SOMALIA

MOGANBO IRRIGATION PROJECT

FEASIBILITY STUDY

APPENDICES VOLUME 3

PART VII: MARKETS AND PRICES

PART VIII: SOCIOLOGICAL AND SETTLEMENT CONSIDERATIONS

PART IX: ECONOMIC ANALYSIS

Prepared for the:

State Planning Commission
and
Kuwait Fund for Arab Economic Development

Tippetts-Abbett-McCarthy-Stratton - New York

Financial and Technical Services - Cairo

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APPENDICES, VOLUME 3

PART VII: MARKETS AND PRICES

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Table VII-1

ADC Commodity Prices 1971-77

Farmgate and Retail

(SoSh. per quintal)

Crop	1971		1972		1973		1974		1975		1976		1977	
	F	R	F	R	F	R	F	R	F	R	F	R	F	R
Maize	40	68	45	73	45	73	50	78	55	83	60	90	75	na
Sorghum	35	63	40	68	40	68	45	73	55	83	60	90	na	na
Sesame	150	200	155	200	155	200	180	220	200	270	200	270	240	na
Groundnuts	100	140	100	140	100	140	100	140	100	140	100	140	na	na
Sunflower	100	140	100	140	100	140	100	140	100	140	100	140	na	na
Cotton Seeds	20	40	20	40	20	40	20	40	20	40	20	40	20	40
Cotton I*	130	-	130	-	130	-	130	-	200	-	200	-	270	na
II	120	-	120	-	120	-	120	-	160	-	160	-	220	na
III	100	-	100	-	100	-	100	-	120	-	120	-	na	na
IV	70	-	70	-	70	-	70	-	70	-	70	-	na	na
Rice (milled)	-	-	-	-	-	-	-	-	250	300	250	440 (upland)		na
												310 (paddy)	350	na

* Resold exclusively to Somaltex at cost.

Livestock Marketing

3 A large proportion of cattle marketing is conducted in simple, registered, market places. Most of the transactions involve only one or two middlemen between producer and purchaser. Small auctions are held by licensed auctioneers ("braku") for a 2.5% commission. Prices per head are highest in July to November, when cattle quality and weight are at their best.

4 An important recent development is that the LDA (Livestock Development Agency) now controls and supervises a number of markets where selling is done on the basis of liveweight in the presence of the producers. Sixty per cent of total purchases are from traders, reflecting the agency's high fixed prices (around SoSh. 2.5/kg liveweight) and the demand for heavier animals. The activity of traders in the local markets, where purchasers now are mainly retail butchers and private individuals, has decreased. The conditions that govern the marketing of cattle in the Lower Juba are improving considerably. With improved facilities and procedures, and holding grounds being run by LDA and the Trans-Juba Livestock Development Project, the export of live animals through Kismayu Port will be eased.

5 The meat factory at Kismayu is buying cattle itself rather than through LDA. The factory pays SoSh. 2.0 which is invariably above the free market level.

Import/Export Situation

6 Since 1960, the deficit in the country's balance of trade has been steadily deteriorating. The deficit, which was around SoSh. 200 million in 1971, increased to over SoSh. 500 million in 1974, representing one-third of the GNP. Agricultural imports constitute a relatively large share of this deficit.

7 Somalia's balance in trade in agricultural crops has traditionally been negative. The deficit was SoSh. 90.8 million in 1973, worsening to an estimated SoSh. 260-300 million in 1974 and SoSh. 300-350 million in 1975.* The Government aims at reducing import levels through substitution of domestic production for imports. Somalia could enter markets for a number of crops including cereals, especially maize, and sugar, oil crops, pulses and fruits.

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* Recent Economic Developments and Current Prospects - Somalia, IBRD, 1976

8 Somalia can be considered self sufficient in maize and sorghum when rainfall is adequate. It is a net importer of grains , and of rice, sugar, and vegetable oils. Imports of wheat, tea and pasta products were drastically reduced in 1973 to ease balance of payment difficulties and further reductions were expected in other commodities, including rice and sugar. Somalia's only true export crop is bananas. Other exports are some fresh fruits, incense and myrrh.

9 With its 1974-78 Five-Year Development Program, the Government of Somalia has embarked on a policy to reduce the gap in its balance of trade in the agricultural sector. One of the major objectives of the plan is the achievement of self sufficiency in sorghum, maize, oil-seeds and vegetables and a substantial reduction of national dependency on imported wheat and rice. The country has the potential resources to increase local production to substitute for the import of these commodities.

10 In a meeting with officials of the State Planning Commission directives were received that the crops to be grown on the proposed Moganbo Irrigation Project should conform to the objectives of the Five-Year Development program, with particular focus on the sub-sitution of imports on which the country has become increasingly dependent in recent years. Table VII-2 shows the volume and value of imports from 1971 to 1974.

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Table VII-2

Volume and Value of Selected Project Crops

(1971 - 1974)

	Maize	Rice	Edible Veg.oil	Cotton	Pulses
1971					
Volume	27,532	36,171	5,546	53	45
Value	19,844	36,717	15,614	116	63
1972					
Volume	1	26,625	5,914	606	42
Value	1	24,343	14,723	2,021	36
1973					
Volume	2	29,776	2,796	21	16
Value	2	40,111	7,892	56	18
1974					
Volume	1	16,876	2,674	4	12
Value	-	53,283	12,769	21	21

NB: Volumes in tons and values in 000 SoSh.

11 The export of live animals is controlled by LDA which also has the responsibility for raising and maintaining veterinary standards. The majority of the live exports pass through Berbera port. Kismayu has an important cattle population in its hinterland and its port has the free capacity for increased live exports.

12 The Government has set a minimum export price per head for the purpose of foreign exchange control (US $180 for cattle). One consequence of the minimum price policy is that it has prevented the export of immature cattle, whose lighter than average weights represent a sales price below the permitted minimum. The export or slaughter of productive females is discouraged.

13 The export of meat products is centered in Kismayu where the government has a meat factory.

14 A detailed study of potential livestock markets was made in connection with the design studies on the Trans-Juba Development Project carried out by Hunting and Gunn. The findings amply justify the development of feedlots to improve quality and increase weights. Somalia's position in its traditional markets would be more secure in the face of competition from such countries

as Australia and Argentina, and new markets would open up in response to increased availabilities of high quality meat (e.g. Libya, Egypt, etc.).

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Table VII-3

Exports of Live Animals from Somali Ports

Port	% Goats	% Sheep	% Camels	% Cattle
Berbera	93.4	92.6	83.0	90.3
Mogadishu	0.2	0.3	11.8	2.8
Kismayu	--	--	3.2	6.9
Small ports	6.4	3.1	--	--

Source: Recent Economic Developments and Current Prospects - Somalia, IBRD, 1975

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Table VII-4

Project Production as a Percentage of 1974 Imports, of Estimated 1975 Needs and Projected 1990 Needs

(in 000 tons)

	1975* Demand	1990* Demand	Volume** imports 1974	Project Production	Project Prodn. as % of imports	Project Prodn. as % of national demand 1975	1990
Maize	295.0	494.0	0.7	12.0	-	4	2.5
Rice	26.5	66.9	16.9	3.9	23	14	5.7
Edible oils (40% extraction)	5.7	15.4	2.7	.6	22	10	4
Cotton lint (40% seed cotton prodn)	4.0	6.5	3.5	1.2	34	30	18
Pulses	26.0	49.0	12.1	7.8	64	30	16

*Juba Valley Development Program, Technital for EEC, 1976

**Foreign Trade Returns, Central Directorate of Planning, Mogadishu, 1975

B. Project Crops and Cattle Fattening Prospects

15 A brief summary of market information on the Project crops and the contemplated production of well finished cattle is given hereafter. The anticipated contribution of the Project to national needs is summarized in Table VII-4 overleaf.

16 Maize is a major staple commodity in Somalia and the second field crop after sorghum. It is grown mainly by smallholders on widely scattered plots. Private trading in maize is prohibited. Current legislation requires all surpluses to be sold to the State. Growers are allowed to keep the equivalent of 100 kgs of grains (maize, sorghum, rice, etc.) per year for family use but this provision is reportedly not enforced.

17 Fluctuations in production and yields are extreme, due to the variability in the weather. These are clearly reflected in the share of the crop purchased by the ADC between 1971 and 1974:

August 1,	1971 -	July 31,	1972:	54,500 Tons*
"	1972 -	"	1973:	60,420 Tons
"	1973 -	"	1974:	18,080 Tons

*Recent Economic Developments and Current Prospects - Somalia, IBRD, 1975.

18 In order to promote the expansion of maize cultivation, the ADC has been steadily increasing its producer price. The following Table VII-5 shows the trend of farmgate and retail prices between 1971 and 1976. The farmgate price for maize was increased to SoSh. 750 per ton early in 1977.

Table VII-5

	Farmgate SoSh./quintal	Retail in the Area SoSh./quintal
1971	40	68
1972	45	73
1973	45	73
1974	50	78
1975	55	83
1976	60	90

19 Maize is resold to the growers in the areas of production for SoSh. 90/quintal (1976). To the public outside of the production areas, it is sold for SoSh. 110, which is also the price of sales of imported maize. The price for imported maize was about SoSh. 960 per ton in 1974, 2100 in 1975 and 1490 in the first six months of 1976.* This means that imported maize was sold at subsidized prices in 1975 and 1976.

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* Juba Valley Development Program, Technital for the EEC, 1976

20 Under normal climatic conditions maize production meets domestic requirements. However, in periods of drought, the country becomes heavily dependent on outside markets. In 1971, for example, Somalia had to import 27,532 tons* and about 44,740 tons were imported in 1975. Taking into consideration demographic growth, higher anticipated standards of living and the expected substitution effect of maize with rice that would follow, Technital in its report to the EEC has forecasted the expected future domestic demand for maize, as shown in the following table of the total and per capita demand for maize in 1975, 1980 and 1990.

Table VII-6

Year	Per Capita kg	Total Demand, Tons	
		Lower Juba	Somalia
1975	98.3	76,600	295,000
1980	104.0	103,400	353,000
1990	112.0	144,000	493,700

21 These quantities will have to be imported in the future unless local production is increased. This becomes even more crucial when we consider that the unit values of imports have been steadily rising on the world market .

*Recent Economic Developments..., IBRD, 1975

22 The expected production of maize on the Project will reach 2.4% of the total 1990 domestic demand and will represent 8% of the demand for maize in the Juba Valley.

23 Cotton has been grown for a long time in Somalia, mainly a short-staple variety to supply a traditional hand spinning and weaving industry. Commercial production for export was begun early in the colonial period by the Italian Company, La Società Romana di Colonizzazione, in the Juba Valley in 1910.* Cotton production for export expanded rapidly until the 1929 world depression made the Italian growers turn to other crops, first to castor beans, then groundnuts and finally to bananas. A revival in cotton production took place during the Korean war boom. Crop areas reached a record of 25,000 hectares in 1952 and again in 1959, then the end of the war-time boom provoked a steep decline in production and exports. Exports declined from 1073 tons in 1954 to 247 tons in 1963, but Somalia remained a net exporter of cotton until 1973 when 148 tons were exported.** Since then the country has been a net importer.

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*Report to the Govt. of Somalia No. 2088, FAO, Rome, 1965

**Recent Economic Developments..., IBRD, 1975

24 At the present time, only about 2000-3000 hectares are under cotton cultivation. The expansion of cotton cultivation is hampered by production and marketing problems; farmers do not receive sufficient technical advice; seeds are not distributed at the proper time and not enough is available; and there is inadequate protection against insects and diseases. Production fluctuates greatly from year to year, primarily due to weather conditions. With an average yield of two to three quintals per hectare, the 2000-3000 hectares under cultivation produce an average of about 800 tons per year (estimated).

25 Farmers are obliged to sell their production to the ADC at predetermined prices. The following table shows the prices for different grades of cotton paid by the ADC form 1971 to 1976, in SoSh. per quintal.

Table VII-7

Year	I	II	III	IV
	Cotton Grade, SoSh/quintal			
1971	130	120	100	70
1972	130	120	100	70
1973	130	120	100	70
1974	130	120	100	70
1975	200	160	120	70
1976	200	160	120	70

The average price for 2/3 Grade I and 1/3 Grade II was set at SoSh. 2533 per ton early in 1977.

26 The ADC in turn sells the ginned cotton at cost to Somaltex, the government-owned textile factory. At full production, the factory requires about 4000 tons of cotton lint annually. Unless local production is expanded accordingly the deficit must be imported. The Moganbo project, when in full production, is expected to produce an average of 2600 tons seed cotton, or about 900-1000 tons cotton lint annually, representing 25% of the Somaltex factory requirements.

27 The national demand for cotton lint will reach 7000 tons by the year 2010, or an increase in production from the present level by 6200 tons in 30 years. The increase in domestic production of cotton would not only substitute for import, but also generate employment in the textile, ginning and oil extraction industries.

28 Sesame is the main oilseed crop in Somalia, used for making the cooking oil preferred to other less expensive vegetable oils. The area under sesame cultivation has varied considerably from year to year. An average of about 26,000 tons os sesame is grown domestically. Production must be sold to the ADC, whose annual purchases vary between 10,000 and 12,000 tons. The following table shows the producer price and retail prices fixed by the ADC between 1971 and 1976. The price was raised to SoSh. 2400 per ton early in 1977.

Table VII-8*

Year	Farmgate SoSh/qtl	Retail SoSh/qtl
1971	150	200
1972	155	200
1973	155	200
1974	180	220
1975	200	270
1976	200	270

*Ministry of Agriculture Statistics

29 Other oilseeds, such as groundnuts and castor beans, are grown, yet the country has to import substantial amount of edible oils to satisfy its requirements. The import bill for edible oils is expected to rise sharply in the future unless domestic production is substantially increased. The amounts and values of imported vegetable oils, mainly coconut oil, between 1970 and 1974 are shown below.

Table VII-9*

Year	Amount Tons	Value 000 SoSh.
1970	6308	16,217
1971	5545	15,614
1972	5914	14,723
1973	2796	7,892
1974	2674	12,781

*Foreign Trade Returns, Central Department of Statistics

30 The forecast demand for edible oils in Somalia and in the Lower Juba area is shown in the following table for 1975, 1980 and 1990.

Table VII-10*

Year	Per Capita kg	Consumption, edible oils (tons) Lower Juba	Somalia
1975	1.9	1,500	5,700
1980	2.2	2,200	7,500
1990	3.5	4,500	15,400

*Juba Valley Development Program, Technital for EEC, 1976

31 Somalia has the capacity to meet its own demands for edible oils through domestic production. When in full production, the Moganbo project would produce 1445 tons of sesame, corresponding to 575 tons of sesame oil (40% extraction rate). This represents 4% of total needs for all Somalia in 1990.

32 It should be noted that the project would also produce cotton seed that can be processed into edible oil.

33 Rice is a major staple food in Somalia but present domestic production is quite limited. Rice was grown commercially in the 1940's but its cultivation

was discontinued when the banana exports were resumed after the World War. There were 458 hectares under cultivation in 1944, producing 6436 tons of rice, but in 1950 the cultivated area had dropped to only 53 hectares, producing 570 tons.* Re-introduction and expansion of rice cultivation has been hampered by malaria and tsetse infestation in suitable rice-growing areas. In 1974, only 800 hectares were under rice cultivation.**

34 The dependency of Somalia upon rice imports may be seen from the following table, which also shows how rapidly the unit values have been rising. The heavy drain on foreign currency resources caused by rice imports will increase unless local production can be increased.

Table VII-11***

Year	Total metric tons	Total Value 000 So Sh.	Value/Ton
1970	23,270	26,538	1140
1971	36,172	36,717	1015
1972	26,625	24,343	914
1973	29,776	40,111	1347
1974	16,875	53,282	3157
1975	19,680 (mission estimate)	--	--

*Report to the Gov't of Somalia, FAO, Rome, 1965

**Recent Economic Developments...Somalia, IBRD, 1975

***Ibid.

35 Since 1975, rice production has had to be sold to the ADC, which paid a farmgate price of SoSh. 2500/ton for milled rice, as compared to SoSh. 1400/ton in 1973. This prices was also offered in 1976. The ADC has increased its retail price to the consumer from SoSh. 3000/ton in 1975 to SoSh 4000/ton in 1976 (4400/ton for upland rice, 3100/ton for paddy rice). At the beginning of 1977, the ADC raised its farm gate price for paddy rice to SoSh. 3500 per ton.

36 The estimated total domestic demand for rice in 1980 and 1990 is as follows:

Table VII-12*

	Per Capita	Total Demand (metric tons)	
Year	kg	Lower Juba	Somalia
1975	8.7	6,800	26,500
1980	10.4	10,300	35,300
1990	15.2	19,600	66,900

*Technital, Report to the EEC

37 In view of the heavy bill paid for rice imports and of the unreliability of surplus on the world markets, an interim objective of partial import subsitution is highly justified to alleviate the large deficit in the balance of trade represented by rice imports. The Moganbo project, when in full production, would

produce 3820 tons of unmilled rice, representing about 10% of the expected total consumption in 1980 and 5.7% of consumption in 1990. This would correspond to 38% of the expected consumption in the Lower Juba area in 1980 and about 20% in 1990.

38 Pulses are grown throughout Somalia, mainly for self consumption. The expected demand is 49,000 tons by 1990. Project production would account for 16% of this demand. Pulses are sold freely at a retail price (1976) of SoSh. 4/kg. A farmgate price of SoSh. 2.5/kg has been assumed for 1977.

39 Forage is not commercially grown in Somalia. A farmgate price of SoSh. 250/ton for alfalfa or peanut hay was reported in the IBRD Appraisal report on the Northwest Region Agricultural Development Project (May 1976). This price was adopted to calculate the value of the project's clover crop. It was found to be equal to the value of fertilizers replaced by the manure from the cattle feedlot.

40 In summary, the project crops include the major target food crops and cotton which are in short supply. Consideration should be given to the possible export of maize and pulses as well as to the growing of long-staple cotton for export, while continuing to import the less expensive short-staple lint for Somalitex.

Livestock

41 The proposed feedlot to be integrated with the Moganbo Irrigation Project would finish 28,500 head (net) of cattle per year. Half would be exported live through Kismayu port and the remainder would be sold to the Kismayu Meat Factory for processing as chilled or frozen meat. Virtually no live export of cattle is being done through the port at the present time although it has the necessary capacity. The higher quality and heavier weights of the Project's fattened animals would command premium prices in comparison to existing national live-animal exports.

42 Countries of the Arabian Gulf such as Saudi Arabia, Kuwait, and South Yemen have always been the traditional market for exports of live animals from Somalia. Exports in the past have been made on a haphazard basis due to a number of constraints, the important one being the irregularity of Somalia's supply of good quality cattle. With the improvement of marketing arrangements, including the holding grounds and shipping facilities being created in view of planned development projects, the export of live animals will be greatly facilitated.

43 On the other hand, Kismayu Meat Factory (Annex IX) has a slaughtering capacity of 60,000 head per year which

it is processing into stewed meat and corned beef. Its canning facilities will be doubled under the current plan to a capacity of 120,000 head per year.

44 Furthermore, the export of chilled and frozen beef may become one of the factory's major activities in view of the expected increase in numbers of higher quality fattened cattle from feedlot operations in the Lower Juba area. The Government of Somalia intends to expand the factory's existing cold storage capacity from 360 to 1000 tons.

45 The Moganbo feedlot would be able to provide Kismayu Meat Factory with 15,000 head of fattened cattle (equivalent to 2700 tons of carcass meat) annually. Veterinary standards in Somalia have been improved to a level acceptable to several countries in addition to its traditional markets in the Arabian Gulf.

46 The Trans-Juba feedlot would produce about 30,000 head of finished cattle per year for delivery to the Kismayu factory. This leaves ample free canning capacity. The proposed Moganbo production of 15,000 head or 2700 tons of carcass meat for processing is well under the planned increase in annual capacity of the factory's cold storage facilities.

47 At the present time, the factory is buying its animals directly from the range. It is expected that it will turn to the feedlots for its supplies in the future to take advantage of the higher meat quality and heavier weights.

Prices

48 The LDA is buying animals for export at SoSh 2.5 per kg liveweight, and this has been adopted as the price for cattle purchases for the calculations of feedlot operating costs.

49 The By-Products Utilization Project at Km-7 near Mogadishu is obtaining SoSh 3.5 kg liveweight for its finished cattle and this has been adopted for the sales price to the Kismayu Meat Factory.

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PART VIII

SOCIOLOGICAL AND SETTLEMENT CONSIDERATIONS

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PART VIII

SOCIOLOGICAL AND SETTLEMENT CONSIDERATIONS

I DEMOGRAPHIC SITUATION

A. SOMALIA

1 For several years, the Somali Government, acting acting through the Central Statistical Office in the Ministry of Planning and Coordination, has been arranging for a nationwide census of the population. The Statistical Department made a number of field tests in preparation for the national census. The complete national census was finished in 1976 but has not yet been declared.

2 An estimated population of 2.7 million was declared in 1968, with an estimated annual growth rate of 2.9%. In 1970 the ILO estimated the population at 3.171 million, as indicated in Table VIII-1. The most recent estimation, yet unofficial, was 3.5 million for 1975-76.* The most recent estimates from government sources (as yet unofficial) put the population figure close to 4 million.

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*Dept. of Statistics, Kismayu, July 1976.

Population Distribution

3 Seventy-four per cent of the total population resides in the six southern administrative regions. The most inhabited region is Benadir where the capital city of Mogadishu and most of the populous towns are located. The region contains 23 per cent of the country's population.

4 The neighboring Juba Region is the second most populated area of Somalia. About 21 per cent of the national population live in this farming region between the Juba and Shabelli Rivers. Population density in the Benadir and Juba regions is about 11 persons per square mile.

Occupational Structure

5 Most of the people in Somalia are nomads. They raise camels, cattle, sheep and goats which provide food and transport as well as the means of exchange for other necessary commodities. One-third of the population is engaged in sedentary agriculture or occupied in commerce, industry, fishing and government service. Roughly 20 per cent of the population are farmers, chiefly on the arable lowlands between the Juba and Shabelli Rivers.

Labor Force

6 The 1962-64 manpower survey revealed a labor force equal to about 58 per cent of the total population. Children below the age of 15 accounted for about 37 per cent of the inhabitants, and 5 per cent were over 60. Although the potential labor force compared favorably with the United Nations estimated average for all of Africa, only 6 out of 10 Somalis of working age were employed in jobs outside the subsistence economy. This factor reduced the actual labor force to about 38 per cent of total population, i.e. approximately 879,000 persons (Table VIII-2).

7 The low participation rate of the potential labor force may be attributed to the low levels of education, a shortage of skilled workers, and a lack of adequate job opportunities. Traditionally, nomadic Somalis have had strong prejudices regarding certain occupations, such as farming, considered fit only for inferior persons. In 1953, roughly 71 per cent of the population raised livestock and 19 per cent were farmers. Table VIII-3 shows projected data of the 1971-72 manpower survey, while Table VIII-4 shows the distribution of labor force by industry groups, derived from the same survey.

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Table VIII-3

Projected Occupational Structure

1976

Category	Percentage Distribution	Total Number(1000)	Active Population
Purely nomadic	35-40	1150-1300	450-500
Semi nomadic	25-30	800-1000	300-400
Sedentary in rural areas (especially in the South)	15-20	500-650	200-250
Urban	20	650	250
Total:		3300	1300

Source: 1971/72 Manpower Survey

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Table VIII-4

Distribution of Labor Force

by Industry Group, 1960-1980

	Agriculture Animal husbandry		Industry		Services		Total
Year	000	%	000	%	000	%	000
1960	812	87.85	41	4.56	71	7.70	924
1970	897	82.75	70	6.46	117	10.79	1084
1975	1006	80.00	87	7.10	150	12.90	1234
1980	1115	78.80	109	7.70	191	13.50	1415

Source: Derived from the Manpower Survey Project for Somalia, 1971-72.

B. Lower Juba Region

8 According to available information, in particular the Multi-purpose Survey of Giamama District, most of the settled farmers in the lower Juba region are in the Giamama and Gelib districts. These districts, with a high percentage of land suitable for cultivation and relatively favorable rainfall (average 414 mm), form one of the major dryland farming areas in the country. The total population of Giamama town was estimated at 5408 persons in 1969. The smaller villages selected for the survey (11 out of 42 villages) had a total population of 5957 persons. Those in the working age group (15-59) represent 47% and 48% of the total population, respectively, in Giamama and the selected villages.

9 The economic activity analysis showed that 53% of the households in the town but only 26% of those in the selected villages had no property, whether livestock or agricultural. This is explained by the fact that most of the households in the town are engaged in activities outside agriculture and livestock sectors, such as retail trade, transport, government service, etc. Households having agricultural activity only, were 17% and 49% respectively in the town and the selected villages (Table VIII-5).

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Table VIII-5

Economic Activities, Selected Combinations

(Giamama and Selected Villages)

Activity	Giamama Town		Selected Villages	
	No. of Households	%	No. of Households	%
Having neither agriculture nor livestock	610	53	361	26
Having agriculture and livestock	182	16	293	21
Having agriculture but not livestock	201	17	678	44
Having livestock but not agriculture	164	14	45	3
Total	1157	100	1377	100

Source: The Multipurpose Survey of Giamama District, Statistical Department, Ministry of Planning, Mogadishu, August, 1969.

C. Project Area Villages

Population Characteristics

10 The project site is located in Giamama District on the western bank of the Juba River. Along the eastern boundaries of the project, i.e. along the western river bank, there are more than twenty villages and hamlets. Twelve of these were surveyed to estimate their population (Table VIII-6). The four largest villages (200-600 families) are Moganbo, Shekh Cambul, Mana Mafo and Koban, which have a total population of 7430 people. Koban is located on the southern boundary of the project and Mana Mafo is about 15 km to the north. Shekh Cambul is 7 km north of Mana Mafo and Moganbo is located on the northern boundary of the project site.

11 The four largest villages function as centers for a number of smaller surrounding villages. The population structure of each center and its satellites is shown in Table VIII-7. These figures result from interviews with village leaders who estimated population, number of households, families, cows and their owners, laborers available and the percentage of

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Table VIII-6

Population of 12 Selected

Villages Near Project Site

Village Name	Families no.	Male	Female	Total Population
Moganbo	335	776	755	1531
Bulo Yag	128	275	309	584
Taugagungo	89	182	143	325
Sheekh Cambuul	257	590	524	1114
Boorini Muniyo	72	151	177	328
Boorini Ginis	63	125	92	217
Mana Mafo	438	1122	811	1933
Bola Farxaan	120	292	287	579
Beled Raxwa	260	462	424	886
Koban	604	1417	1435	2852
Araara	107	261	242	503
Tansaniya	65	125	127	252

Source: February-1975 Survey, Statistical Dept.

Table VIII-7

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Population Structure of Four Main

Central Villages and their Satellite Villages

Name of Village	Satellite Village	Popu-lation	No. of House-holds	No. of families	% of Newcomers	No. of Cows	No. of Laborers 18-25 yrs
Koban		3,000		460			1,500
	Osman Motto }						
	Bmbilla }						
	Bangani }	1,150			30	2,000	
	Dayobo }						
	Total	4,150					
Mano Mafo		2,000		400			
	Dayobo (another)	500					
	Maadami	200			50	500	
	B/Farxan	700					
	Total	3,400					
Sheekh Cambul							
	Bourini B/garras }						
	Makoma Sarnali }						
	B/Fikiro,Wa Berry }			390		1,500	
	Karkamaray }						
	B/Barwakoo }						
	Total	2,184					
Moganbo		1,814	500 }			500	500
	Mashaka	800	200 }				
	Masagerow	600	150 }				
	B/Yaag	800	200 }				
	Tagunga	400	100 }	3,600			500
	B/Mamino	600	150 }				
	Kulmiss	400	100 }				
	Total	5,414	900 }				

Source: Interviews of village leaders.

newcomers to the village. Some of these figures are missing due to lack of information or reluctance of local leaders to release it.

12 Inside the project area there are six small hamlets, the two largest of which are Karkamaray (43 households), located on the southeastern boundary of the project, and Dayobo (18 households), located between cut-lines K and L, more or less in the middle-western part of the project site. The rest of the indigenous population who are practicing subsistence cultivation are living in isolated houses. The population of the project site has been estimated at 500 families. The total cultivated area has been estimated at about 1000-1500 hectares and farmed areas at 2-3 hectares per family.

Schools and Other Institutions

13 There is a primary school for 180 students and a mosque at Shekh Cambul, but no veterinary center or clinic or market. Moganbo has a primary school for 500 students up to the fourth grade, a mosque and a clinic with a nurse, but has no veterinary center. Koban has a primary school for 270 students, a clinic, a specialized market for meat and another for fruits

and vegetables. The village has no veterinary center. Mana Mafo has a small primary school but is without a clinic or veterinary center. However, it has the highest religious prestige among the local villages and the largest mosque named after a famous religious leader (Sheikh Moorgan), a descendant of whom is the village leader.

Livestock

14 In Koban, an estimated 2000 cattle are owned by an unspecified number of people. In Mana Mafo 1500 are owned by approximately 100 people. About 1500 head are owned by 202 persons in Sheikh Cambul, and in Moganbo village 500 head are owned by a small number of people.

II HUMAN RESOURCES

A. The Manpower Problems of Somalia

15 Most developing countries like Somalia are confronted simultaneously with two persistent yet seemingly diverse manpower problems:

i) a continuing shortage of qualified and trained manpower in relation to development needs; and

ii) surplus labor in both modern and traditional sectors.

16 The shortage of well-trained managerial and supervisory personnel is critical and chronic. Since there are no rigid recruitment standards for this category the problem is sometimes superficially overcome by promoting those who are inadequately trained.

17 The fields in which skilled workers are in great shortage are the following: Electronics; mechanics and building operations supervision; supervision of various production processes such as gypsum, cement, food processing; foundaries, smelting, forging, pattern making; diesel engine mechanics; metal fitting; telecommunications; instrument mechanics.

18 The over abundance of unskilled labor is, in most development countries like Somalia, as serious a problem as the shortage of skills. In Somalia, the supply of unskilled and untrained manpower in the urban areas exceeds the available employment opportunities. The main cause of this problem has been an ever-increasing flow of persons, especially the young, from the rural areas to the cities in search of employment.

B. Current Training Programs

19 In three farmer training centers, at Genale, Bonka and Aborein, farmers are trained during short courses (2-3 weeks) in the methods and basic techniques of cultivation. In a second course (three months) they are exposed to all the problems and possible solutions that may be encountered during a full crop cycle. In both courses, farmers are oriented toward the concept of agricultural cooperation and community leadership, with a view to fostering cohesiveness and mutual assistance among farm communities.

20 The time distribution of the courses at these training centers, scheduled to correspond to the main

cropping periods of the center's area, was also designed to allow the centers and the Agricultural Extension Service opportunities for (i) review and evaluation of course effectiveness; (ii) adjustments to be made; and (iii) planning for future training activities for farmers.

Tractor Driving Training

21 Several official as well as autonomous and semi-autonomous organizations are going more and more into mechanization of agriculture. For this reason it was decided to organize a tractor driving training course in the Farmer Training Center at Genale. An outline for a 40-day training course on tractor driving and maintenance was prepared by an FAO Agricultural Extension Expert and adopted by the Head of the Department of Agriculture for teaching the course.

III THE PROJECT

A. Organization and Management

22 The project is planned to operate as a State Farm under the direction of a Farm Manager. Although the project should organizationally be placed in the Ministry of Agriculture it should have an autonomous status. The organization structure of the project is based on the principle that machinery will be used to optimize production, but all work that can be done efficiently by hand labor will be so assigned. Project organization and management has been planned along the lines suitable for a production-oriented, profit-making corporation. A suggested organization chart is included as Figure VIII-1 (Page 22).

23 The Farm Manager would have direct respnsibility for the successful operation of the project, including the marketing of produce therefrom. He should be trained by education and experience in the details of crop production and must have a sound managerial background. He would be assisted by four village managers, a feedlot manager, and an irrigation systems manager. He should also be assisted for five years by an expatriate advisor in farm management.

24 The village managers will each be responsible for crop production on an assigned segment of the project. Their areas of responsibility would be determined on the basis of a 3-km maximum walking distance from the village, eliminating the need for transport. They should have an educational background at least equivalent to that of an agricultural extension agent and they should have the maturity and ability to schedule the work of 500 laborers through 25 foremen. There should be one expatriate advisor to the village managers who would aid them in developing farming practices suitable to the project area.

25 The feedlot manager would be directly responsible to the Farm Manager for the production of fattened cattle from the feedlot. He would work directly with the village managers in providing manure to them from the feedlot. He should have experience in cattle buying, feeding, disease control, and marketing. On occasion it may be necessary to supplement project by-products with feed purchases outside the project. The project procurement officer would assist when this is necessary. An expatriate export should be employed for three years to aid the feedlot manager.

26 The irrigation system manager would have the responsibility for delivering water to the respective

village managers at their demand. He should have education and background experience in water management and maintenance of systems. He would also supervise the central machine workshop for the entire project as well as the maintenance of canals and ditches, roads, pumping and power plant. An expatriate hired for three years would help the irrigation manager develop proper methods of operation. An expatriate master mechanic is also desirable, to help set up and operate machinery maintenance shops. Pumping plant operation could be established by an expatriate advisor in two months. This advisor could be provided by the equipment manufacturer.

27 Table VIII-8 shows total project personnel requirements by project years. During the early years, the proposed personnel requirements are fairly heavy to permit training and allow staff to acquire experience. An assistant manager in charge of training and two training officers have been provided to teach foremen and laborers optimal production procedures. The management is completed by an assistant manager for administration, bookkeeper, procurement officer and clerk typist.

28 Management staff and vital technical personnel should be recruited under contracts for a minimum of 3-5 years in order to provide a certain degree of stability. Many projects in the past have suffered from excessive staff turnover.

Table VIII-8

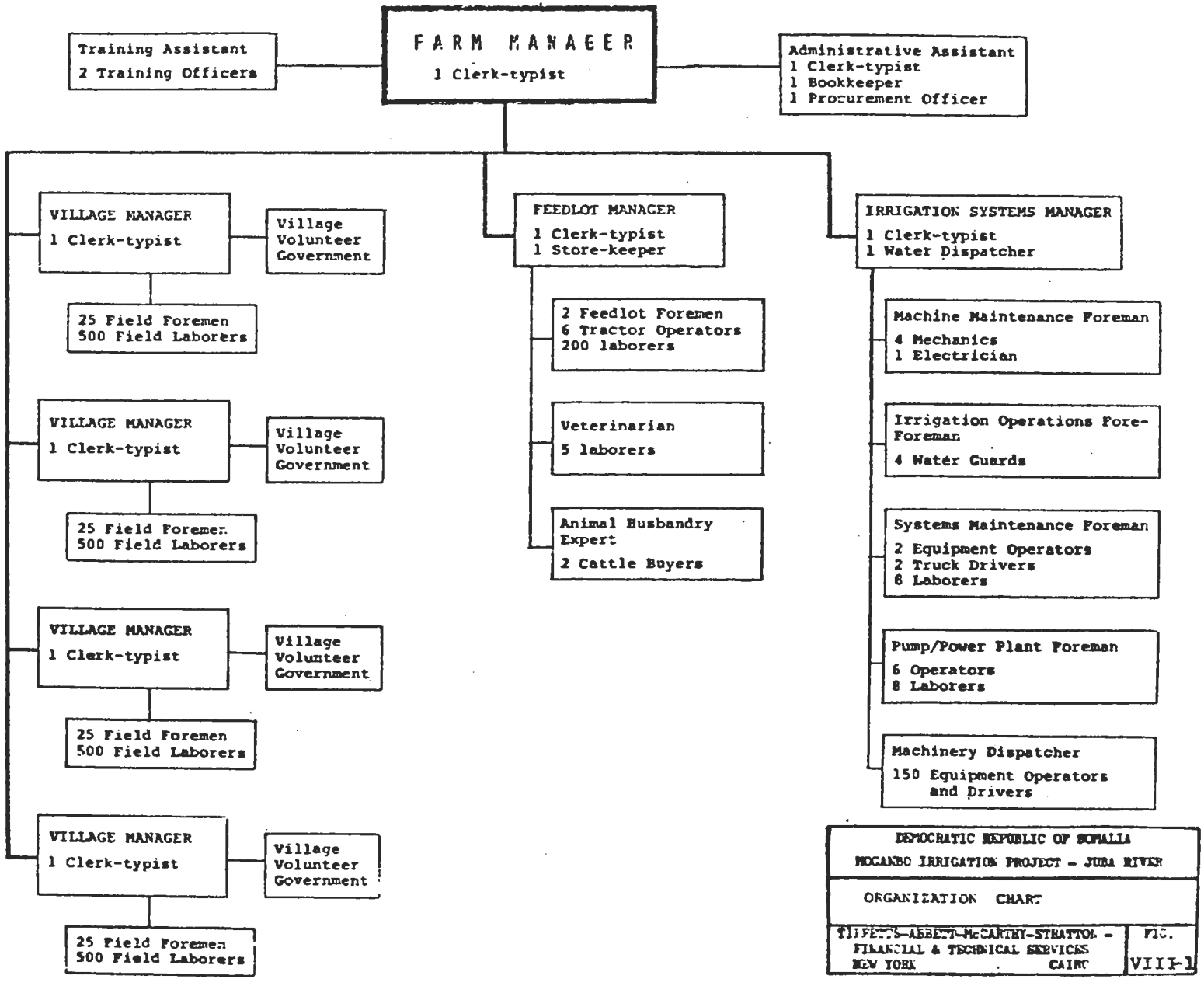
SOMALIA

MOGANBO IRRIGATION PROJECT

Total Personnel Requirements and Costs by Project Years

	AMOUNT	TOTAL		YEAR I		YEAR II		YEAR III		YEAR IV		YEAR V		YEAR VI		YEAR VII		YEAR VIII	
	SALARY	NO	COST	NO	COST	NO	COST	NO	COST	NO	COST	NO	COST	NO	COST	NO	COST	NO	COST
Farm Manager	24	1	24	1	24	1	24	1	24	1	24	1	24	1	24	1	24	1	24
Expatriate Assistant Manager	378	1	376	1	378	1	378	1	378	1	378	1	378	-	-	-	-	-	-
Administrative Assistant Manager	18	1	18	-	-	1	18	1	18	1	18	1	18	1	18	1	18	1	18
Bookkeeper	15	1	15	-	-	1	15	1	15	1	15	1	15	1	15	1	15	1	15
Procurement Officer	15	1	15	-	-	1	15	1	15	1	15	1	15	1	15	1	15	1	15
Training Assistant Manager	18	1	18	-	-	1	18	1	18	1	18	1	18	1	18	1	18	1	18
Training Officer	15	2	30	-	-	-	-	1	15	1	15	1	15	2	30	2	30	2	30
Village Manager	18	4	72	-	-	-	-	1	18	1	18	2	36	2	36	3	54	4	72
Feedlot Manager	18	1	18	-	-	-	-	1	18	1	18	1	18	1	18	1	18	1	18
Feedlot Storekeeper	12	1	12	-	-	-	-	1	12	1	12	1	12	1	12	1	12	1	12
Irrigation System Manager	18	1	18	-	-	1/2	9	1	18	1	18	1	18	1	18	1	18	1	18
Water Dispatcher	12	1	12	-	-	-	-	1	12	1	12	1	12	1	12	1	12	1	12
Veterinarian	15	1	15	-	-	-	-	1	15	1	15	1	15	1	15	1	15	1	15
Animal Husbandry	15	1	15	-	-	-	-	1	15	1	15	1	15	1	15	1	15	1	15
Foreman	12	106	1272	-	-	-	-	10	120	20	240	40	480	66	792	86	1032	106	1272
Livestock Buyers	12	2	24	-	-	-	-	1	12	1	12	2	24	2	24	2	24	2	24
Mechanics	10	8	40	-	-	-	-	2	20	3	30	4	40	6	60	7	70	4	40
Electrician	10	1	10	-	-	-	-	1	10	1	10	1	10	1	10	1	10	1	10
Water Guards	10	4	40	-	-	-	-	1	10	1	10	1	10	2	20	3	30	4	40
Power and Pumping Plant Operator	10	6	60	-	-	-	-	1	10	2	20	3	30	4	40	6	60	6	60
Equipment Operator and Drivers	6	160	960	1	6	3	18	20	120	40	240	60	360	90	540	120	780	160	960
Laborers	3	2221	6663	-	-	10	30	320	960	500	1500	800	2400	1300	3900	1800	5400	2221	6663
Expatriate Training Assistant	315	1	315	-	-	1/2	158	1	315	1	315	1/2	158	-	-	-	-	-	-
Village Manager Adviser (expatriate)	315	1	315	-	-	1/2	158	1	315	1	315	1/2	158	-	-	-	-	-	-
Feedlot Manager Adviser (expatriate)	315	1	315	-	-	-	-	1	315	1	315	1	315	-	-	-	-	-	-
Irrigation System Mgr. Adviser (expatriate)	315	1	315	-	-	1	315	1	315	1	315	-	-	-	-	-	-	-	-
Master Mechanic (expatriate)	315	1	315	-	-	-	-	1	315	1	315	1	315	-	-	-	-	-	-
Power & Pumping Adviser (expatriate)	315	1/6	53	-	-	1/6	53	-	-	-	-	-	-	-	-	-	-	-	-
Clerk - Typists	10	8	80	-	-	1	10	5	50	5	50	6	60	6	60	7	70	8	80
		TOTAL:		3	408	22 2/3	1219	380	3478	592	4278	935	4969	1492	5692	2058	7740	2533	9391

Note: The total personnel cost for year VIII shown in Table XVII-1 is SoSh. 9,361,000. With the planned crop rotation, it is expected to average SoSh. 7,821,000 per year.


FARM MANAGER
1 Clerk-typist
Training Assistant
2 Training Officers
Administrative Assistant
1 Clerk-typist
1 Bookkeeper
1 Procurement Officer
VILLAGE MANAGER
1 Clerk-typist
Village Volunteer Government
25 Field Foremen
500 Field Laborers
VILLAGE MANAGER
1 Clerk-typist
Village Volunteer Government
25 Field Foremen
500 Field Laborers
VILLAGE MANAGER
1 Clerk-typist
Village Volunteer Government
25 Field Foremen
500 Field Laborers
VILLAGE MANAGER
1 Clerk-typist
Village Volunteer Government
25 Field Foremen
500 Field Laborers
FEEDLOT MANAGER
1 Clerk-typist
1 Store-keeper
2 Feedlot Foremen
6 Tractor Operators
200 laborers
Veterinarian
5 laborers
Animal Husbandry Expert
2 Cattle Buyers
IRRIGATION SYSTEMS MANAGER
1 Clerk-typist
1 Water Dispatcher
Machine Maintenance Foreman
4 Mechanics
1 Electrician
Irrigation Operations Fore-Foreman
4 Water Guards
Systems Maintenance Foreman
2 Equipment Operators
2 Truck Drivers
8 Laborers
Pump/Power Plant Foreman
6 Operators
8 Laborers
Machinery Dispatcher
150 Equipment Operators and Drivers
DEMOCRATIC REPUBLIC OF SOMALIA
MOGAMBO IRRIGATION PROJECT - JUBA RIVER
ORGANIZATION CHART
TIPPETTS-ABBETT-McCARTHY-STRATTON - FINANCIAL & TECHNICAL SERVICES
NEW YORK . CAIRO
FIG. VIII-1

B. Training

29 Successful project development will depend on recruitment of a well qualified manager and an equally well qualified technical supporting staff. These need to assemble both semi-skilled and unskilled hired labor to work on the State Farm. As indicated earlier in paragraph 6, there is a surplus of labor in Somalia. A review of Table VIII-7 indicates that there are not sufficient unemployed people in the immediate vicinity of the project site to fill the ultimate requirement of about 2200 laborers. It is equally true that there is a deficiency of semi-skilled workers such as equipment and truck operators. Foremen may be recruited from state training centers.

30 The manager and supporting staff should be assisted by expatriate advisors to help them develop the best management techniques. The expatriate staff may also assist in setting up a training program for semi-skilled and unskilled workers. Use of farmers who are now located within the project area in the early stages of project operations should provide a nucleus for future expansions.

31 A program to train new foremen in the best methods of irrigation, application of fertilizer, use of herbicides and other farming practices is fundamental to obtaining high yields. Training should combine theory and practical application of the various skills. Table VIII-9 shows a suggested distribution of a foreman's time while in training.

32 In order to fulfill the objectives of the project, laborers should be trained in the most efficient method of doing even menial tasks. Much of the training should take place during the day-to-day farming operations, but some formal indoctrination is needed. The training staff should organize a program whereby each laborer is given one-or-two weeks of intensive training.

33 Since there will be considerable expense involved in expatriate advice to the management staff and in training of semi-skilled and unskilled labor, there should be some assurance that these employees will remain on the state farm for a period of at least three years. One inducement for unskilled labor to remain is the provision of housing in organized villages.

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Table VIII-9

Suggested Guide for Training Farmers

by Crops and Days

Subject		No. of actual working days		
		Theory	Practical	Total
I.	Introduction	3		3
II.	Grain crops	3	15	18
III.	Fiber crops	3	15	18
IV.	Oil crops	3	12	15
V.	Vegetable crops	3	15	18
VI.	Other activities (plowing, soil treatment, irrigation, land leveling, general management)	2	35	37
		17	92	109

C. Incentive System for Laborers

34 The primary function of project management is to secure the greatest possible production of the selected crops under the prevailing physical conditions. One way of assuring high production is to provide special incentives to the personnel of the project.

35 A general method might be a distribution of profits over and above a norm. Such distribution may go to all people in proportion to their annual earnings.

36 A more specific method applicable to some field workers would consist of the minimum wage, and additional payment on a work unit basis (piece work). Similarly, payment could be made in food products for production over a certain norm.

37 Some employees, such as truck and equipment operators, have no standard against which their work can be measured. The awarding of incentive payments should then be a judgment determination by their supervisors, based on guidelines established by management.

38 As an incentive to permanent settlement, housing would be provided in villages and equipped with drinking water and sanitary facilities. Laborers might also be allocated garden plots to be cultivated in their spare

time for their own consumption. The project may provide water and certain inputs for such plots.

39 A detailed incentive program should be drawn up during the design phase and empirically updated as the project develops and the success of the measures adopted is evaluated.

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APPENDICES, VOLUME 3

PART IX: ECONOMIC ANALYSIS

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SENSITIVITY ANALYSES

FINANCIAL

SENSITIVITY ANALYSES

ECONOMIC

PAYBACK PERIOD

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APPENDICES, VOLUME 3

PART IX

ECONOMIC ANALYSIS

Introduction

1 The proposed project covers a total area of 6260 hectares on the west bank of the Juba River north of Kismayu. The description of the project components is given in Parts III, IV and V of the Appendices, Volume 2. The detailed economic analysis is presented hereafter. Summary tables are numbered IX-A, IX-B, etc. The detailed tables, number IX-1, IX-2, etc. are grouped at the end of each chapter.

I VALUE OF EXISTING PRODUCTION

2 About 20% of the project area is cultivated for subsistence by approximately 500 households. Production is rainfed or flood irrigated, no agricultural inputs except family labor are applied and yields are low. Maize is virtually the only crop with some intercropped sesame and some tobacco. Other crops such as sorghum, cotton groundnuts and beans, mentioned in FAO's Agricultural and Water Survey,* were not found.

Agricultural and Water Survey-Somalia, Final Report, Vol. IV, Livestock and Crop Production, FAO, Rome, 1968, p. 22.

3. Assuming a cultivated area of 1200 hectares cropped in maize, with a yield of 400 kg per hectare, the value of existing production was calculated at SoSh. 360,000 on the basis of the 1977 ADC* farmgate price of SoSh. 75 per quintal. No account was taken of sesame or tobacco production as these were insignificant and no opportunity costs were assumed since only family labor was involved.

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*Agricultural Development Corporation (see Part VII, Appendices Volume 3)

II EVALUATION OF COSTS

A. Capital Costs

Land Development, Irrigation and Drainage Systems

4 Land reclamation and the construction of the irrigation systems will be phased over a seven-year period. The cost of bush clearing and leveling were estimated at about SoSh. 62,230,000 or approximately SoSh. 9940 per hectare (equivalent to $1580/ha). The irrigation and drainage system has been costed at approximately SoSh. 42,928,000 or about SoSh. 6858 per hectare, equivalent to $1089/ha. This includes some subsurface drainage works which, if circumstances prove them needed, will be carried out most likely between Project Years X and XV. The total cost for land reclamation and the irrigation and drainage system has been estimated at approximately SoSh. 105,158,00, representing an average cost of SoSh. 16,798 per hectare (equivalent to $2666/ha). The foreign currency component for these operations is around 65% of the total cost (Table IX-1).

Roads

5 The cost of the construction of the required Project roads would be approximately SoSh. 13,370,000, representing an average cost of SoSh. 2136 per hectare (equivalent to $ 339/ha). The foreign component is equal to about 20% of the total cost (Table IX-2).

Buildings and housing

6 Buildings and housing facilities, including feedlot construction, have been costed at about SoSh. 36,000,000 or SoSh. 5751 per hectare, equivalent to $915/ha. The foreign component for this sector is around 51% of the total cost (Tables IX-2 and IX-3).

Machinery and Equipment

7 The estimated cost of machinery and equipments are as follows:

Irrigation and drainage system, SoSh. 1,106,000;
Crop production, about SoSh. 22,973,000;
Feedlot, SoSh. 2,336,000.

The total machinery and equipment cost would amount to SoSh. 26,415,000, representing a cost of SoSh. 4220 per hectare (equivalent to $ 670/ha). The itemized lists of machines and equipment are shown in Tables IX-4,5,6.

8 Table A below summarizes the capital costs and shows cost per hectare and the foreign component. The total capital investment needed for the Project amounts to SoSh. 180,938,000,representing an average cost of SoSh. 28,904 per hectare, equivalent to $4588 per hectare.

Table IX-A

SUMMARY: CAPITAL COSTS

Capital Investment	Total Cost SoSh. millions	Cost per hectare SoSh.	Foreign Component million SoSh.	Foreign Component % of Total
Land reclamation, leveling, irrigation and drainage	105.158	16,798	67,954	65
Roads	13.370	2,136	2.674	20
Buildings, housing	35.995	5,751	18.225	51
Machinery, equipment				
- Irrigation systems	1.106	177	.995	90
- Crops production	22.973	3,670	20.390	89
- Feedlot	2.336	373	2.103	90
Total Capital Investment	180.938	28,904	112.344	62

Table IX-1

Cost Estimate

Irrigation and Drainage System

Item	Total	Local	000 SoSh. Foreign
Main canal	7,017.1	2,175.3	4,841.8
Laterals	7,235.5	2,532.4	4,703.1
Pumping Plant (irr.)	2,257.4	225.7	2,031.7
Power Plant	1,897.6	189.8	1,707.8
Drains	12,854.5	3,856.3	8,998.2
(Future drains)	(10,019.5)		
Bulo Yag Floodway	157.5		
Land Development	45,551.5	18,220.6	27,330.9
Subtotal:	76,971.1	27,231.6	49,739.5
Contingencies 15%	11,545.7	4,084.7	7,461.0
Subtotal:	88,516.8	31,316.3	57,200.5
Eng. & Super. 8%	7,081.3	2,505.2	4,576.1
Subtotal:	95,598.1	33,821.5	61,776.6
Admin. & Overhead 10%	9,559.8	3,382.1	6,177.7
TOTAL:	105,157.9	37,203.6	67,954.3

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MOGANBO IRRIGATION PROJECT

Table IX-2

Estimated Cost of Infrastructures

Roads, Buildings and Housing

Item	Total 000 SoSh.		
		Local	Foreign
Project Roads			
Coral	13,370	10,696	2,674
Buildings and Housing, Village Infrastructures			
Office building, furn.	410	250	160
HQ warehouse	1250	625	625
Machine shop, equip'd	1250	500	750
Village storehouse	1640	820	820
Type A Houses	2250	1125	1125
Type B Houses	1840	920	920
Type C Houses	15580	7790	7790
Type D Houses	2560	1280	1280
Streets and sanitation systems	7760	3880	3880
Total Buildings, etc.	34,540	17,190	17,350
TOTAL, Infrastructures	47,910	27,886	20,024

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Table IX-3

Feedlot Construction

Item	Total 000 SoSh.	Local 000 SoSh.	Foreign equiv.000 SoSh.
Feed troughs	225	113	112
Sheds: cattle	90	45	45
Water troughs	75	38	37
Concrete	360	108	252
Fences	180	54	126
Scales (5)	100	50	50
Cattle squeezers (5)	25	13	12
Water reservoir	140	42	98
Cattle dip with yards	40	20	20
Shed: concentrates	25	13	12
Shed: crop residues (2)	50	25	25
Shed: feed mill	50	25	25
Shed: tractors, vehicles	25	13	12
Veterinary laboratory	20	6	14
Molasses tanks (cement)-2	50	15	35
Total	1455	580	875

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Table IX-4

Maintenance Equipment

Item	Units: Total	1000 SoSh. Local	Foreign
Radio communications system	50.4	5.0	45.4
Tractor,D-6 or equiv., dozer	113.4	11.4	102.0
Tractor, rubber-tired, 50hp	50.4	5.0	45.4
Motor grader, 56 hp	126.0	12.6	114.4
V-Ditcher	15.7	1.6	14.1
Carry-all scraper, 7.5m^3	31.5	3.1	28.4
Dragline-0.6m^3, 120 hp	189.0	18.9	170.1
Mower, tractor-mounted	18.9	1.9	17.0
Weed burner and sprayer	18.9	1.9	17.0
Trucks, 2-ton (2)	126.0	12.6	114.4
Land Rover pickup (2)	50.4	5.0	45.4
Land Rover station wagon (1)	31.5	3.2	28.3
Motorcycles (4)	37.8	3.8	34.8
Concrete mixer, 1 sack, wheeled	12.6	1.3	11.3
Pump, 5 cm discharge pipe	6.3	0.6	5.7
Small hand tools	25.2	2.5	22.7
Subtotal:	904.0	90.4	813.6
Contingencies 10%:	90.4	9.0	81.4
Subtotal:	994.4	99.4	905.0
*Spare parts 20%:	10.8	1.0	9.8
Subtotal:	1005.3	100.4	904.9
Administrative Costs 10%:	100.5	10.0	90.5
Total:	1105.8	110.4	995.4

*Excluding those of trucks and tractors, costed in capital costs

Table IX-5

SOMALIA

MOGANBO IRRIGATION PROJECT

Capital Costs - Farm Machineries

Item	No.	000 So. Sh. Total	Local Currency	Foreign Exchange
Heavy duty tractor , 70-90 hp	40	4080.0	408.0	3672.0
Wheel tractor,45-60hp	80	4160.0	416.0	3744.0
3-furrow mounted mold-board plow	33	300.0	30.0	270.0
Mounted(20-)disc harrow	17	233.0	23.3	209.7
3/4-furrow mounted nidger	22	200.0	20.0	180.0
Land leveler, trailed wheel tractor	7	289.0	28.9	260.1
Tractor-mounted fertilizer spreader	11	67.0	6.7	60.3
Reo tractor or mounted steering disc	28	212.0	21.2	190.8
Pesticide sprayers, tractor trailed	33	549.0	54.9	494.1
Row planters	22	466.0	46.6	419.3
Seed drill	11	135.0	13.5	121.5
Ditcher	7	42.0	4.2	37.8
Combines	7	1649.0	164.9	1484.1
Baler	7	148.0	14.8	133.2
Mower (1.6m)	10	45.0	4.5	40.5
Trucks (8-10 ton)	22	6035.0	603.5	5431.5
Trailer	22	266.0	26.6	239.4
Cottonseed delinter	3	34.0	3.4	30.6
Organic manure spreader	11	660.0	66.0	594.0
Subtotal:		19570.0	1957.0	17613.0
Contingencies 10%:		1957.0	195.7	1761.3
Subtotal:		21527.0	2152.7	19374.3
Spare parts[1] :		1446.0	430.3	1015.7
Subtotal:		22973.0	2583.0	20390.0

[1]excluding tractor and truck spare parts

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Table IX-6

Feedlot Machineries and Equipments

Item	Total 000 SoSh.	Local 000 SoSh.	Foreign equiv. SoSh.
Complete feed mill with pelleting machine	360.0	36.0	324.0
Green chop loader (2)	80.0	8.0	72.0
Two-wheel trailers (10)	120.8	12.0	108.8
Two-wheel molasses tankers (5)	75.0	7.5	67.5
Trucks, 10-ton (including spare parts)	1371.5	137.2	1234.3
Subtotal	2007.3	200.7	1806.6
Contingencies 10%	200.7	20.0	180.7
Subtotal	2208.0	220.7	1987.3
Spare parts 20% (excluding trucks)	128.0	12.3	115.7
SUBTOTAL	2336.0	233.0	2103.0

B. Running Costs

Summary

9 The total annual operating costs, when the Project is in full production, amounts to SoSh. 48,423,300. The relative importance of the different cost items in the total annual operating costs is shown in Table IX-B. The cost of the cattle purchased represents more than 31 per cent of the total annual project operating costs and the purchase of cattle feed represents close to 20 per cent of the total. The cost of fertilizers represents more than 13 per cent of the total annual operating cost. Labor is another major annual cost item representing about 11 per cent of the total annual operating cost. The wage bill for the crop production sector accounts for more than 87 per cent of the Project's total annual wage bill. Finally, Table IX-B shows that the operation and maintenance costs for machines and equipments, and the average annual replacement costs, are of relative importance, representing 8 and 7 per cent respectively of the total annual operating cost.

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Table IX-B

Summary of Operating Costs

at Full Development

		000 SoSh.		
		Cost	Total Cost	% of Total
I	Personnel		7,861.0	16.2
	Staff (excl. expatriates)	2,768.0		
	Labor (unskilled)	5,093.0		
	Crops [4,430.0]			
	Livestock [615.0]			
	Irrigation [48.0]			
II	Inputs		33,502.2	69.2
	Crops	8,954.7		
	Seeds [912.3]			
	Plant protec. [658.7]			
	Fertilizers [7,338.7]			
	Livestock	24,547.5		
	Feed purchase[9,247.5]			
	Cattle " [15,000.0]			
	Dipping fluid[300.0]			
III	Operation and Maintenance		3,619.1	7.5
	O&M,machinery & equipment	3,154.1		
	Maintenance			
	Gravel Roads	392.0		
	Feedlot facilities	73.0		
IV	Replacements		3,441.0	7.1
			48,423.3	100.0

Personnel

10 The complete list of technical and administrative personnel required for the project and their respective salaries, including insurance and social charges, is shown in Table IX-7. From Project Year VIII onwards, when the total area of the Project will have been brought under cultivation, the total salary cost for the required staff, not including laborers, will be SoSh 2,768,000 per year.

Expatriate Staff

11 The services of a number of expatriate advisors would be required during the early years of the Project for periods varying between two months and five years. The required staff of expatriates and the duration of their services is summarized overleaf.

Expatriate Staff

Expatriate Advisor	Required man/months	Annual Salary 000 So.Sh.	Total Cost to Project 000 So.Sh.
to Farm Manager	60	378	1890
to Training Manager	45	315	945
to Village Managers	45	315	945
to Feedlot Manager	45	315	945
to Systems Manager	45	315	945
to Machine Workshop	45	315	945
to Pump/Power Plant	2	315	53
Total Cost, Expatriates			6,668

12 The total salaries to be paid for the services of expatriates as shown in the above table amount to SoSh. 6,668,000, equivalent to $1,058,400.

Labor

13 Although extensive use is made of machinery in the crop production sector, provisions are made in the Project for a number of agricultural operations, such as for harvesting, weeding, etc. to be undertaken through the use of manual labor. As a consequence the crop production sector will provide a source of employment for a labor force estimated at about 553,670 man days per year (Tables IX-10 and 11). The livestock sector will necessitate 73,800 man days per year and the irrigation system will require 5760 man days per year. This gives a total labor requirement of 633,230 man days per year for the Project.

14 The labor profile for the crop production sector shows a peak labor demand during the month of November when an average of 3400 laborers per day will be required. This corresponds to the harvesting period for both cotton and legumes. The lowest demand for unskilled labor occurs during the months of January and February. In general, a labor force numbering 1500 could find full employment in the crop production sector, including land preparation, extraordinary systems maintenance, etc., throughout the year.

15 For the irrigation system, permanent employment would be given to 16 laborers throughout the year and for the livestock sector, the permanent labor force required will amount to 205.

16 In calculating the wage bill for agricultural labor, the official minimum wage rate of SoSh. 8 per laborer per day was adopted. This wage is considerably higher than the current local levels of SoSh. 2.5-3.5 per day paid on the adjoining banana plantations and by labor contractors who furnish workers to agricultural projects elsewhere in the country. For permanent labor the wage rate adopted was SoSh. 3000 per year, which is higher than the minimum wage.

17 When the total area of the project will have been brought under cultivation, i.e. Project Year VIII, the total wage bill for the crop production sector will amount to SoSh. 4,430,000,* representing about 87% of the total wage bill for the Project. For the irrigation system it will amount to SoSh. 48,000 and for the livestock sector the wage bill will be around SoSh. 615,000 per year. The total Project wage bill would thus be SoSh. 5,093,000 per year.

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*See Table IX-11

Agricultural Inputs

18 The inputs required to secure optimal production are itemized in Working Document V - Agricultural Crops, and are shown in Table IX-8.

19 Seeds would be obtained through the ADC. The unit price has been estimated at an average of 25% above the farmgate price for the various project crops. The total cost of seeds at full development amounts to SoSh. 912,000 per year.

20 Fertilizers would be imported free of duty. The fertilizers requirements were calculated considering that about 150,000 tons of manure produced on the Project's feedlot would also be used as organic fertilizer. The inclusion in the crop rotation of clover, legumes and pulses would also contribute to soil enrichment in nitrogen. The calculations were based on CIF prices, plus handling and other charges:

Urea: SoSh. 2000 per ton

Superphosphate: SoSh. 2400 per ton

The total cost for the input of fertilizers for the different crops when the Project reaches full production will be approximately SoSh. 7,384,000 per year.

21 Insecticides, fungicides and herbicides would be imported. Payment of an ad valorem duty of 10% has been foreseen. The total value for weed, pest and insect control at full production would amount to SoSh. 659,000 per year.

22 Machinery operation and maintenance: All machine fuel is imported. The fuel costs include import duties amounting to SoSh. 0.91 per liter for gasoline and SoSh. 0.61 for diesel oil. The unit costs per liter are thus:

Gasoline: SoSh. 1.865

Diesel : SoSh. 1.100

23 The operating cost for tractors, not including drivers' salaries, has been calculated on the basis of costs per hour, taking into consideration the useful power of the different machines. The costs were increased by 25% to cover oil and lubricants, then by another 20% to cover the purchase of spare parts. Accordingly, the average unit cost for operating the tractors, dragline and combines comes to about SoSh. 17 per hour. The cost of operating the scraper has been calculated at about SoSh. 7 per hour.

24 The operating costs for vehicles and motorcycles, not including salaries, were calculated on a kilometer basis. The following unit costs include fuel, lubricants and oil, and spare parts:

Trucks: SoSh. 1.1/km
Landrovers: SoSh. 0.9/km
Motorcycles: SoSh. 0.3/km

25 It has been estimated that on the average, each truck will cover 12,000 km per year, each Landrover 16,000 km per year, and each motorcycle 12,000 km per year.

26 Fuel consumption of the power plant when the Project is fully operational has been estimated at 496,000 liters per year and for the drain pumping plant, at 96,000 liters per year. Maintenance costs for both the pumping/power plant and the drain pumps have been considered to be 10% of the fuel cost.

27 The total cost for the operation and maintenance of all machineries comes to SoSh. 3,154,000 per year.*

28 Road maintenance: The cost for yearly and periodic maintenance for gravel (coral) roads averages SoSh. 392,000 per year, based on the estimated cost of materials for replacement of gravel surfacing.

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*See Table IX-9

29 Replacement costs: The renewal of machines and equipments has been based on the average lifetimes, as shown below.

Pumping plant	over 50 years
Power plant	over 50 years
Tractors	8 "
Combines	10 "
Vehicles	6 "
Trucks	6 "
Green chop loader	10 "
Wheeled trailers	10 "
Wheeled molasses tanker	15 "
Sprayers	8 "
Baler	10 "
Mower	10 "
Irrigation equipment	6 "
Other agric. equipment	15 "

(See Tables IX-12 and IX-13)

Feedlot Inputs (Working Document VI-Livestock Sector)

30 Cattle purchase: A total of 30,000 head of cattle would be purchased per year for fattening in the Project feedlot. A unit cost of SoSh. 2.50 per kg was adopted, as this is the current LDA price. The average cost of purchase is SoSh. 500 per head, assuming an average weight of 200 kg. The total cattle purchase cost thus comes to SoSh. 15,000,000 per year.

31 Animal feeds: The cattle would be fattened on crop residues and clover grown on the farm. No value has been given to the clover as it can be safely assumed

that the value of clover is offset by the value of manure. To supplement this ration additional feed has to be purchased. The total bill for purchased feed when the Project is in full production would amount to SoSh. 9,247,500 per year.

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Table IX-7

Summary of Staff and Labor Requirements

	Salary*	No.	Cost*
Farm Manager	24	1	24
Administrative Assistant Manager	18	1	18
Bookkeeper	15	1	15
Procurement Officer	15	1	15
Training Assistant Manager	18	1	18
Training Officers	15	2	30
Village Managers	18	4	72
Feedlot Manager	18	1	18
Feedlot Storekeeper	12	1	12
Irrigation System Manager	18	1	18
Water Dispatcher	12	1	12
Veterinarian	15	1	15
Animal Husbandry Expert	15	1	15
Foremen	12	106	1272
Livestock buyers	12	2	24
Mechanics	10	4	40
Electrician	10	1	10
Water guards	10	4	40
Power/Pump Plant Operators	10	6	60
Clerk-Typists	10	8	80
Equipment operators, drivers	6	160	960
Laborers			
Feedlot	3	205	615
Systems	3	16	48
Crops (553,670 mandays @ SoSh 8/day)	-		4430
- Expatriates -			
Advisor to Farm Manager	378	1	378
Advisor to Training Manager	215	1	315
Advisor to Village Managers	315	1	315
Advisor to Feedlot Manager	315	1	315
Advisor to Irrigation System Manager	315	1	315
Master Mechanic	315	1	315
Power/Pumping Plant Advisor	315	1/6	53

*000 SoSh.

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Table IX-8

Summary of Unit Criteria for Calculation of Crop Production Costs

	kg/ha	Fertilizers, kg/hectare	
	Seeds	Urea	Superphosphate
Rice	100	130	200
Berseem	20	43	120
Cotton	40	107	200
Maize	20	130	200
Sesame	15	65	80
Legumes	40	43	120

Plant Production

Cotton	
Insecticides (2 applications)	SoSh. 126/ha
Fungicide	SoSh. 21/ha
Maize insecticide (2 applications)	SoSh. 42/ha
Rice herbicide	SoSh. 252/ha
Maize herbicide	SoSh. 42/ha

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Table IX-9

Summary of Unit Criteria for Calculation of Machinery O & M Costs

Tractors and combines: SoSh. 17 per hour

	Requirements per hectare	
	Tractor	Combines/movers
Rice	6.0	2.5
Berseem	7.5	-
Cotton	8.0	-
Maize	9.0	-
Sesame	7.5	2.5
Legumes	7.0	2.5

Vehicles and motorcycles

Trucks: 12,000 kms per year at SoSh. 1.1/km
Landrovers: 16,000 kms per year at SoSh. 0.9/km
Motorcycles: 12,000 kms per year at SoSh. 0.3/km

Pump/Power Plant

Intake: 592,000 liters diesel fuel
Diesel fuel price: SoSh. 1.1/liter
Maintenance (10% of fuel cost)

Systems Maintenance Equipment

Tractors: 2000 hours/year
Dragline: 1200 hours/year SoSh. 17/hr
Scraper: 1000 hours/year SoSh. 7/hr

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Table IX-10

Labor Requirements: Crop Production

(Mandays per hectare by crop)

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Cotton						2	5	12	12	3	34	32	100
Maize	1	4	10	9	2	14	14						54
Clover*	1	3	3	4	2	2							15
Clover*							1	3	3	4	2	2	15
Sesame						1	4	3	7	8	2		25
Rice						2	4	3	13	23	13	2	60
Legumes*	1	2	3	13	15	2							36
Legumes*							1	2	3	13	15	2	36

*Double-cropped

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Table IX-11

Total Annual Labor Requirements

for Crops Production

Crop	Total Annual Cropped Area hectares	Total Man Days per hectare	Total Man Days per crop	Total Cost 000 SoSh.*
Cotton	1450	100	145,000	1160
Maize	2405	54	129,870	1039
Berseem	1910	15	28,650	229
Sesame	1450	25	36,250	290
Rice	955	60	57,300	458
Legumes	4350	36	156,600	1253
	12,520		553,670	4429

*SoSh. 8/man/day

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Table IX-12

Machinery Replacements

for Irrigation and Drainage Systems

Machinery and equipment replacements to be made in Project Years 9, 15, 21 and 27 (not cumulative)

	000 So.Sh.
Communication system	50.4
Tractor D-6 or equiv., with dozer	113.4
Tractor, rubber-tired 50 h.p.	50.4
Motor grader 56 h.p.	126.0
V-ditcher	15.7
Carry-all scraper, 7.5m^3	31.5
Dragline 0.6m^3 120 h.p.	189.0
Mower for mounting on tractor	18.9
Weed burner and sprayer	18.9
Trucks, 2-ton (2)	126.0
Land Rover pickup (2)	50.0
Motorcycles (4)	31.5
Concrete mixer, 1-sack on wheels	37.8
Pump 5 cm. discharge pipe	6.3
Small hand-tools	25.2
Subtotal	904.1
Contingencies 10%	90.4
Subtotal	994.5
Spare parts 20%	10.8
Subtotal	1005.3
Administration cost 10%	100.5
TOTAL	1105.8

Table IX-13, page 1

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MOGANBO IRRIGATION PROJECT

Crops Production

Machinery and Equipment Replacement Costs by Year

Agricultural Machinery	Project Year 9	10	11	12	13	14	15	16	17	000 So.Sh. 18	19
Heavy-duty tractor (70-90hp)	-	-	816.0	816.0	816.0	816.0	816.0	-	-	-	816.0
Wheel tractor (45-60hp)	832.0	832.0	832.0	832.0	832.0	-	832.0	832.0	832.0	832.0	832.0
Three-furrow mounted moldboard plow	-	-	-	-	-	-	-	-	-	63.7	63.7
Mounted 20-disc harrow	-	-	-	-	-	-	-	-	-	54.8	41.1
Mounted ridger, 3-4 furrow	-	-	-	-	-	-	-	-	-	45.5	36.4
Land leveler,wheel tractor trailed	-	-	-	-	-	-	-	-	-	82.5	41.3
Tractor mounted fertilizer distrib.	-	-	-	-	-	-	-	-	-	18.1	12.1
Reo tractor, mounted steering hs.	-	-	-	-	-	-	-	-	-	45.4	37.8
Cotton sprayer, tractor trailed	-	-	-	-	-	266.3	282.8	-	-	-	-
Planter	-	-	-	-	-	-	-	-	-	105.9	84.6
Seed drill	-	-	-	-	-	-	-	-	-	36.6	24.5
Ditcher	-	-	-	-	-	-	-	-	-	12.0	6.0
Combine	-	-	-	-	471.2	235.6	471.2	235.6	235.6	-	-
Baler	-	-	-	-	42.3	21.2	42.3	21.2	21.2	-	-
Truck (8-10 ton)	1371.5	1097.2	1371.5	1097.2	1097.2	-	1371.5	1097.2	1371.5	1097.2	1097.2
Trailer	-	-	-	-	10.4	8.3	8.3	8.3	8.3	-	-
Seed Cotton delinting machine	-	-	-	-	-	-	-	-	-	-	-
Organic manure spreader	-	-	-	-	-	-	-	-	-	180.0	120.0
Mower	-	-	-	-	13.5	13.5	18.0	-	-	-	-
Subtotal	2203.5	1929.2	3019.5	2745.2	3282.5	1360.9	3842.1	2194.3	2468.6	2573.7	3212.7
Contingencies 10%	220.3	192.9	301.9	274.5	328.2	136.0	384.2	219.4	246.8	257.3	321.2
Subtotal	2423.8	2122.1	3321.4	3019.7	3610.7	1496.9	4226.3	2413.7	2715.4	2831.0	3533.9
Spare parts 20%	-	-	-	-	118.3	119.1	180.7	58.3	58.6	142.0	103.1
SUBTOTAL	2423.8	2122.1	3321.4	3019.7	3729.0	1616.0	4407.0	2472.0	2774.0	2973.0	3637.0

Table IX-13, page 2

SOMALIA

MOGANBO IRRIGATION PROJECT

Machinery and Equipment Replacement Costs by Year

Agricultural Machinery	Project Year 20	21	22	23	24	25	26	27	28	29	30
										000 So.Sh.	
Heavy-duty tractor (70-90hp)	816.0	816.0	816.0	816.0	-	-	-	816.0	816.0	816.0	816.0
Wheel tractor (45-60hp)	-	832.0	832.0	832.0	832.0	832.0	-	832.0	832.0	832.0	832.0
Three-furrow mounted moldboard plow	63.7	63.7	45.2	-	-	-	-	-	-	-	-
Mounted 20-disc harrow	41.1	41.1	54.8	-	-	-	-	-	-	-	-
Mounted ridger, 3-4 furrow	45.5	36.4	36.4	-	-	-	-	-	-	-	-
Land leveler, wheel tractor trailed	82.5	41.1	41.1	-	-	-	-	-	-	-	-
Tractor mounted fertilizer distrib.	12.1	12.1	12.1	-	-	-	-	-	-	-	-
Reo tractor mounted steering hs	45.4	45.4	37.8	-	-	-	-	-	-	-	-
Cotton sprayer, tractor trailed	-	-	266.3	282.8	-	-	-	-	-	-	266.3
Planter	105.9	84.6	84.6	-	-	-	-	-	-	-	-
Seed drill	24.5	24.5	24.5	-	-	-	-	-	-	-	-
Ditcher	12.0	6.0	6.0	-	-	-	-	-	-	-	-
Combine	-	-	-	471.2	235.6	471.2	235.6	235.6	-	-	-
Baler	-	-	-	42.3	21.2	42.3	21.3	21.2	-	-	-
Trucks (8-10 ton)	-	1371.5	1097.2	1371.5	1097.2	1097.2	-	1371.5	1097.2	1371.5	1097.2
Trailer	-	-	-	10.4	8.3	8.3	8.3	8.3	-	-	-
Cotton seed delinting machine	-	22.7	11.3	-	-	-	-	-	-	-	-
Organic manure spreader	120.0	120.0	120.0	-	-	-	-	-	-	-	-
Mower	-	-		13.5	13.5	18.0	-	-	-	-	-
Subtotal	1368.7	3517.1	3485.3	3039.7	2207.8	2469.0	265.2	3284.6	3011.5	3019.5	3011.5
Contingencies 10%	136.8	351.7	348.5	303.9	220.8	246.9	26.5	328.4	301.1	301.9	301.1
Subtotal	1505.5	3868.8	3833.8	3343.6	2428.6	2715.9	291.7	3613.0	3312.6	3321.4	3312.6
Spare Parts 20%	121.5	109.2	102.2	180.4	61.4	118.1	58.3	58.0	-	-	58.4
SUBTOTAL	1627.0	3978.0	3936.0	3524.0	2490.0	2834.0	350.0	3671.0	3312.6	3321.4	3371.0

III PRODUCTION AND REVENUES

The details of anticipated project production are given in Part V (Agricultural Crops) and Part VI (Livestock Sector) of the Appendices, Volume 2.

33 Crops production is expected to build up over three years as shown in Table IX-14. The anticipated production at full operation, i.e. in Project Year X, is shown in Table IX-15.

34 Livestock fattening operations would produce 28,500 head of well finished cattle per year at full production. The buildup of production is as follows.

Project Year	III	2,850 head
	IV	8,550
	V	14,250
	VI	19,950
	VII-XXX	28,500

Sales Prices

35 Part VIII of Appendices Volume 3, Markets and Prices, contains details of the prices adopted for the revenue calculation.

36 All the crops produced in the Project with the exception of legumes and clover would be marketed through the Agricultural Development Corporation (ADC), the government agency with monopoly buying powers. The prices adopted for calculations are shown in Table IX-15.

Prices are fixed annually by the Board of Directors in collaboration with the Ministry of Agriculture. The price of legumes is not controlled and they can be sold freely. Clover (berseem) production would not be sold but would be fed to the cattle in the Project's feedlot. The ADC's farmgate prices for 1977 were adopted for maize, cotton, sesame and rice. A conservative average farmgate price of SoSh. 2500/ton was assumed for legumes, as beans were retailing for an average price of SoSh. 4.0 per kg (1976). Clover would be taken to the feedlot in exchange for organic fertilizer. For information, the farmgate price of alfalfa and peanut hay was reported to be SoSh. 250/ton in 1976 (Appraisal of the Northwest Region Agricultural Development Project, Somalia, IBRD, 1976).

37 A selling price of SoSh. 3.5 per kg was adopted for livestock sales on the basis of prices currently obtained by the FAO-UNDP Km-7 By-Products Utilization Project near Mogadishu. This corresponds to SoSh. 1225 per head assuming an average finished weight of 350 kg per animal. The sales for live export were priced at SoSh. 1220 per head to allow for export tax.

38 Table IX-15 shows the gross values of product at full development. A little over 58.7 per cent of the Project's returns are obtained from the crops production sector and 41.3 per cent from the livestock sector. Legumes bring the highest total return among the various crops followed by maize, rice, cotton and sesame. As may be seen below, however, the highest gross return per hectare is obtained from rice, followed by cotton and legumes.

	Gross Return per Hectare (round off)
Rice	SoSh. 9380
Cotton	SoSh. 5570
Legumes	SoSh. 4500
Maize	SoSh. 3750
Sesame	SoSh. 2400

Table IX-14

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Build-up of Crop Yields

Project	Maize		Cotton		Sesame		Rice		Legumes		Clover	
Year	ha	Yield	ha	Yield	ha	Yield	ha	Yield	ha	Yield	ha	Yield
I	-	-	-	-	-	-	-	-	-	-	-	-
II	200	2.5	-	-	-	-	200	2.5	-	-	400	20
III	200	4.0	-	-	-	-	200	3.0	-	-	400	25
	285	2.5	-	-	-	-	285	2.5	-	-	570	20
IV	200	5.0	-	-	-	-	200	4.0	-	-	400	40
	285	4.0	-	-	-	-	285	3.0	-	-	570	25
	470	2.5	-	-	-	-	470	2.5	-	-	940	20
V	200	5.0	405	1.2	405	0.6	200	4.0	1215	1.2	400	40
	285	5.0	-	-	-	-	285	4.0	-	-	570	40
	470	4.0	-	-	-	-	470	3.0	-	-	940	25
	402	2.5	-	-	-	-	-	-	-	-	-	-
VI	485	5.0	405	1.6	405	0.8	200	4.0	1215	1.5	400	40
	470	5.0	555	1.2	555	0.6	285	4.0	1665	1.2	570	40
	405	4.0	-	-	-	-	470=	4.0	-	-	940	40
	555	2.5	-	-	-	-	-	-	-	-	-	-
VII	1360	5.0	405	2.2	405	1.0	955	4.0	1215	1.8	1910	40
	555	4.0	555	1.6	555	0.8	-	-	1665	1.5	-	-
	490	2.5	490	1.2	490	0.6	-	-	1470	1.2	-	-
VIII	1915	5.0	960	2.2	960	1.0	955	4.0	2880	1.8	1910	40
	490	4.0	490	1.6	490	0.8	-	-	1470	1.5	-	-
IX	2405	5.0	1450	2.2	1450	1.0	955	4.0	4350	1.8	1910	40

SOMALIA

MOGANBO IRRIGATION PROJECT

Table IX-15

Summary of Production, Prices and Revenues at Full Development

	Total Annual Production Tons	Unit Price per ton (per head) SoSh.	Total Annual Revenues 000 SoSh.
Crops			
Rice (955 ha; 67% paddy production = milled rice at SoSh 3500/T)	2,559	3,500	8,957
Seed Cotton (1450 ha; 2/3 Grade I at SoSh 2700/T and 1/3 Grade II at SoSh 2200)	3,190	2,533	8,080
Maize (2405 ha)	12,025	750	9,019
Sesame (1450 ha)	1,450	2,400	3,480
Legumes (4350 ha)	7,830	2,500	19,575
Clover (1910 ha)*	76,400	-	-
TOTAL, Crops			49,111
Feedlot			
Live Export	14,250	1,200	17,100
Kismayu Meat Factory	12,250	1,225	17,456
TOTAL, Feedlot			34,556
TOTAL PROJECT			83,667

*See para. 36

IV ECONOMIC ANALYSIS

A. Financial Rate of Return

39 The economic life of the Project was assumed to be 30 years. The stream of costs and benefits stemming from the Project are given in Table IX-16. The calculations carried out show that the Project has a financial rate of return of 15.1 per cent. Table IX-17 shows the Annual Operating Costs tabulated over the 30 year period and Table IX-18 shows revenue buildups.

TABLE IX-16

SOMALIA

MOGANBO IRRIGATION PROJECT

FINANCIAL RATE OF RETURN

000 So.Sh.

Project Year	Capital Cost	Operating Cost	Replacement Cost	Total Outflow	Revenue of Project	Revenue pre-Project	Incremental Revenue	Incremental Benefit	Discount Factor at 15%	Present Worth at 15%	Discount Factor at 16%	Present Worth at 16%
1	2559.0	408		2967.0	-	360	(360)	(3327.0)	.870	(2895)	0.862	(2870)
2	34021.0	1277		35298.0	-	360	(360)	(35658.0)	.756	(26957)	0.743	(26494)
3	33545.8	6249		39794.8	5004	360	4644	(35150.8)	.658	(23129)	0.641	(22532)
4	30475.8	12981		43456.8	14581	360	14221	(29235.8)	.571	(16691)	0.552	(16138)
5	22954.4	20451		43405.4	26414	"	26054	(17351.4)	.497	(8623)	0.476	(8259)
6	23999.2	27777		51776.2	41474	"	41114	(10662.2)	.432	(4606	0.410	(4371)
7	18598.2	39695		58293.2	63806	"	63446	5152.8	.376	1938	0.354	1824
8		44190		44190.0	76057	"	75697	31507.0	.327	10303	0.305	9610
9		43893	3831.3	47724.3	81217	"	80857	33132.7	.284	9409	0.263	8714
10		44081	2423.8	46504.8	83667	"	83307	36802.2	.247	9090	0.227	8354
11	13678.2	42663	3623.1	60664.3	"	"	"	22642.7	.215	4868	0.195	4415
12		43663	3321.4	46984.4	"	"	"	36322.6	.187	6792	0.168	6102
13		43663	4115.3	47778.3	"	"	"	35528.7	.163	5791	0.145	5151
14		44190	1647.8	45837.8	"	"	"	37469.2	.141	5283	0.125	4683
15		43893	5899.1	49792.1	"	"	"	33514.9	.123	4122	0.108	3620
16		44081	2805.5	46886.5	"	"	"	36420.5	.107	3896	0.093	3387
17		43663	3108.1	46771.1	"	"	"	36535.9	.093	3398	0.080	2923
18		43663	3294.5	46957.5	"	"	"	36349.5	.081	2944	0.069	2508
19		43663	3958.5	47621.5	"	"	"	35685.5	.070	2498	0.060	2141
20		44190	1646.8	45836.8	"	"	"	37470.2	.061	2286	0.051	1911
21		43893	5405.3	49298.3	"	"	"	34008.7	.053	1802	0.044	1496
22		44081	4257.5	48338.5	"	"	"	34968.5	.046	1609	0.038	1329
23		43663	3910.3	47573.3	"	"	"	35733.7	.040	1429	0.033	1178
24		43663	2823.5	46486.5	"	"	"	36820.5	.035	1275	0.028	1031
25		43663	3220.3	46883.3	"	"	"	36423.7	.030	1093	0.024	874
26		44190	381.8	44571.8	"	"	"	38735.2	.026	1007	0.021	814
27		43893	5110.3	49003.3	"	"	"	34303.7	.023	789	0.018	618
28		44081	3623.3	47704.3	"	"	"	35602.7	.020	712	0.016	570
29		43663	3623.1	47286.1	"	"	"	36020.9	.017	613	0.014	504
30		43663	3762.7	47335.7	83667	360	83307	35971.3	.015	540	0.012	431
										82901-		80664-
										83487+		74188+
										586+		6476-

Internal Rate of Return = $15+ (1 \times \frac{586}{7062}) = 15 + 0.083 = 15.1\%$

TABLE IX-17

SOMALIA

MOGANBO IRRIGATION PROJECT

Financial Rate of Return: Tablulated Operating Costs

000 SoSh.

Project Year	Irrigation System	Agricultural Crops	Livestock Feedlot	Roads Maintenance	Personnel and Labor	Total*
1	-	-	-	-	408	408
2	-	-	-	87.7	1189	1277
3	57.5	755.5	2492.0	126.1	2818	6249
4	139.6	1832.2	7425.7	195.7	3388	12981
5	284.8	3607.5	12363.4	195.7	4000	20451
6	450.9	5525.9	17299.1	195.7	4305	27777
7	669.2	7857.4	24686.5	195.7	6286	39695
8	902.0	10057.8	11140.8	722.9	7821	44190
9	"	"	"	426.1	"	43893
10	"	"	"	613.3	"	44081
11	"	"	"	195.7	"	43663
12	"	"	"	195.7	"	43663
13	"	"	"	195.7	"	43663
14	"	"	"	722.9	"	44190
15	"	"	"	426.1	"	43893
16	"	"	"	613.3	"	44081
17	"	"	"	195.7	"	43663
18	"	"	"	195.7	"	43663
19	"	"	"	195.7	"	43663
20	"	"	"	722.9	"	44190
21	"	"	"	426.1	"	43893
22	"	"	"	613.3	"	44081
23	"	"	"	195.7	"	43663
24	"	"	"	195.7	"	43663
25	"	"	"	195.7	"	43663
26	"	"	"	722.9	"	44190
27	"	"	"	426.1	"	43893
28	"	"	"	613.3	"	44081
29	"	"	"	195.7	"	43663
30	"	"	"	195.7	"	43663

*rounded

TABLE IX-18

SOMALIA

MOGANBO IRRIGATION PROJECT

CALCULATION OF FINANCIAL RATE OF RETURN

ANNUAL REVENUE BY PROJECT YEAR

000 SoSh.

Project Production	Price/ *Unit SoSh.	YEAR I-II Vol	Val	III Vol	Value	IV Vol	Value	V Vol	Value	VI Vol	Value	VII Vol	Value	VIII Vol	Value	IX Vol	Value	XX-XXX Vol	Value
Rice[1]	3500	-	-	335	1172.5	880.0	3080.0	1900	6650.0	2240	7840.0	2559.4	8957.0	2559.4	8947.0	2559.4	8957.0	2559.4	8957.0
Maize	750	-	-	500	375.0	1512.5	1134.4	3315	2486.2	5317	3987.8	7782.5	5836.9	10245.0	7683.8	11535.0	8651.2	12025.0	9018.8
Cotton[2]	2533	-	-		-		-		-	485	1228.5	1314.0	3328.4	2367.0	5995.6	2896.0	7335.6	3190.0	8080.3
Sesame	2400	-	-		-		-		-	243	583.2	657.0	1576.8	1143.0	2743.2	1352.0	3244.8	1450.0	3480.0
Legumes[3]	2500	-	-		-		-		-	1458	3645.0	3820.5	9551.2	6448.5	16121.2	7389.0	18472.5	7830.0	19575.0
Subtotal (rounded)		-	-		1548		4214		9136		17285		29250		41501		46661		49111
Livestock																			
Sale, live export	1200	-	-	1425	1710	4275	5130	7125	8550	9975	11970	14250	17100	14250	17100	14250	17100	14250	17100
Sale, chilling	1225	-	-	1425	1746	4275	5237	7125	8728	9975	12219	14250	17456	14250	17456	14250	17456	14250	17456
Subtotal					3456		10367		17278		24189		34556		34556		34556		34556
TOTAL PROJECT REVENUES					5004		14581		26414		41474		63806		76057		81217		83667

*Units: Crops: tons; Livestock: heads

[1] Annual production calculated as milled rice (one ton paddy = 670 kg milled)

[2] Assuming two-thirds Grade I (SoSh. 2700/ton) and one-third Grade II (SoSh. 2200/ton), ADC 1977

[3] estimated

B. Economic Rate of Return

40 Taking into consideration the two factors below, the economic rate of return was found to be 16.2% (Table IX-19). Table IX-20 shows the tabulated operating costs and Table IX-21 gives revenue figures.

1. Taxes and duties paid on fuel and for plant protection materials have been deducted from costs.
2. The Project's economic benefits from exported or import-substitute commodities were calculated on world import or export prices for 1976. The prices per ton for the various crops were adopted as follows overleaf.

		Per Ton
Rice	SoSh.	2150[1] (milled rice[2])
Maize	SoSh.	1070[3]
Cotton	SoSh.	10000[4] (lint cotton)
Cotton Seed	SoSh.	950[5]
Sesame	SoSh.	3780[5]
Legumes	SoSh.	1970[6]

(1) CIF Mogadishu, including handling charges, etc.

(2) Rate of extraction 67%

(3) $120 per ton, World Bank prospective prices, plus addition of $50 transport charges

(4) Somaltex prices

(5) FOB Sudan Port, plus transport, handling charges (World Bank)

(6) Adjusted for transport and other charges (World Bank)

TABLE IX-19

SOMALIA

MOGANBO IRRIGATION PROJECT

ECONOMIC RATE OF RETURN

000 So.Sh.

Project Year	Capital Cost	Operating Cost	Replacement Cost	Total Outflow	Revenue of Project	Revenue pre-Project	Incremental Revenue	Incremental Benefit	Discount Factor at 17%	Present Worth at 17%	Discount Factor at 18%	Present Worth at 18%
1	2559.0	408	-	2967.0	-	513.6	(513.6)	3480.6	.855	2976	.862	(3000)
2	34021.0	1277	-	35298.0	-	"	(513.6)	35811.6	.731	26178	.743	(26608)
3	33545.8	6155	-	39700.8	4708.7	"	4195.1	35505.7	.624	22156	.641	(22759)
4	30475.8	12752	-	43227.8	13858.0	"	13344.4	29883.4	.534	15958	.552	(16496)
5	22954.4	19998	-	42952.4	24922.0	"	24408.4	18544.0	.456	8456	.476	(8827)
6	23999.2	27084	-	51083.2	40536.7	"	40023.1	(11060.1)	.390	4313)	.410	(4535)
7	18592.2	38757	-	57349.2	63904.0	"	63390.4	6041.2	.330	1994	.354	2139
8		42994	-	42994.0	78051.8	"	77538.2	34544.2	.285	9845	.305	10536
9		42745	3831.3	46576.3	84335.0	"	83821.4	37245.1	.243	9051	.263	9795
10		42959	2423.8	45382.8	87344.3	"	86830.7	41447.9	.208	8621	.227	9409
11	13678.2	42541	3623.1	59842.3	"	"	"	26988.4	.178	4804	.195	5263
12		42541	3321.4	45862.4	"	"	"	40968.3	.152	6227	.168	6883
13		42541	4115.3	46656.3	"	"	"	40174.4	.130	5223	.145	5825
14		43068	1647.8	43715.8	"	"	"	43114.9	.111	4786	.125	5383
15		42772	5899.1	48671.1	"	"	"	38159.6	.095	3625	.108	4121
16		42959	2805.5	45764.5	"	"	"	41066.2	.081	3326	.093	3819
17		42541	3108.1	45649.1	"	"	"	41181.6	.069	2842	.080	3295
18		42541	3294.5	45835.5	"	"	"	40995.2	.059	2419	.069	2829
19		42541	3958.5	46499.5	"	"	"	40331.2	.050	2017	.060	2420
20		43068	1646.8	44714.8	"	"	"	42115.9	.043	1811	.051	2148
21		42772	5405.3	48177.3	"	"	"	38653.4	.037	1430	.044	1701
22		42959	4257.5	47216.3	"	"	"	39614.2	.032	1268	.038	1505
23		42541	3910.3	46451.3	"	"	"	40379.4	.027	1090	.033	1333
24		42541	2823.5	45364.3	"	"	"	41466.4	.023	954	.028	1161
25		42541	3220.3	45761.3	"	"	"	41069.4	.020	821	.024	986
26		43068	381.8	43449.8	"	"	"	43380.9	.017	737	.021	911
27		42772	5110.3	47882.3	"	"	"	38948.4	.014	545	.018	701
28		42959	3623.3	46582.3	"	"	"	40248.4	.012	483	.016	644
29		42541	3623.1	46164.1	"	"	"	40666.6	.011	447	.014	569
30		42541	3672.7	46213.7	87344.3	513.6	86830.7	40617.0	.009	366	.012	487
										80037-		82225-
										74732+		83869+
										5305-		1644+

Internal Rate of Return = $16+(1 \times \frac{1644}{6949}) = 16 + 0.24 = 16.2\%$

TABLE IX-20

SOMALIA

MOGANBO IRRIGATION PROJECT

Economic Rate of Return: Tabulated Operating Costs

000 SoSh.

Project Year	Irrigation Systems	Agricultural Crops	Livestock Feedlot	Roads Maintenance	Personnel and Labor	Ginning	Total*
1	-	-	-	-	408	-	408
2	-	-	-	87.7	1189	-	1277
3	32.4	694.9	2483.6	126.1	2818	-	6155
4	78.4	1683.6	7405.9	195.7	3388	-	12752
5	155.5	3314.8	12332.2	195.7	4000	-	19998
6	253.5	5028.1	17256.5	195.7	4305	43.7	27084
7	388.1	7139.4	24629.5	195.7	6286	118.3	38757
8	516.3	9091.6	"	722.9	7821	213.0	42994
9	"	"	"	426.1	"	260.6	42745
10	"	"	"	613.3	"	287.1	42959
11	"	"	"	195.7	"	287.1	42541
12	"	"	"	195.7	"	"	42541
13	"	"	"	195.7	"	"	42541
14	"	"	"	722.9	"	"	43068
15	"	"	"	426.1	"	"	42772
16	"	"	"	613.3	"	"	42959
17	"	"	"	195.7	"	"	42541
18	"	"	"	195.7	"	"	42541
19	"	"	"	195.7	"	"	42541
20	"	"	"	722.9	"	"	43068
21	"	"	"	426.1	"	"	42772
22	"	"	"	613.3	"	"	42959
23	"	"	"	195.7	"	"	42541
24	"	"	"	195.7	"	"	42541
25	"	"	"	195.7	"	"	42541
26	"	"	"	722.9	"	"	43068
27	"	"	"	426.1	"	"	42772
28	"	"	"	613.3	"	"	42959
29	"	"	"	195.7	"	"	42541
30	"	"	"	195.7	"	"	42541

*rounded

Table IX-21

SOMALIA

MOGAMBO IRRIGATION PROJECT

Calculation of Economic Rate of Return

Annual Revenue by Project Year

Units: Tons for crops; heads for livestock
Values: 000 SoSh

Project	Price / Unit		Project Year I & II		III		IV		V		VI		VII		VIII		IX		X - XXX	
Production	US$	SoSh	Vol	Value	Vol	Value	Vol	Value	Vol	Value	Vol	Value	Vol	Value	Vol	Value	Vol	Value	Vol	Value
Rice (1)	245	2250	-	-	335	753.7	880	1980	1900	4275	2240	5040	2560	5760	2560	5760	2560	5760	2560	5760
Maize (2)	170	1070	-	-	500	535	1512	1618	3315	3547	6317	6689	7782	8327	10,245	10,962	11,535	12,342	12,025	12,867
Cotton (3)																				
Lint	1587	10000	-	-	-	-	-	-	-	-	180	1800	486	4860	875.8	8758	1071.5	10,715	1180.3	11,803
Seed	150	950	-	-	-	-	-	-	-	-	292	277.4	788	748.6	3420.2	1349.2	1737.5	1650.7	1914.0	1818.3
Sesame (3)	600	3780	-	-	-	-	-	-	-	-	243	918	657	2483	1143	4320	1352	5111	1450	5481
Legume (2)	220	1870	-	-	-	-	-	-	-	-	1458	2872.3	3820	7525.4	6448	12,702.6	7289	14,556.8	7830	15,415
Subtotal (Rounded)						1289		3598		7822		16,697		28,704		43,852		50,135		53,144
Livestock (5)																				
Subtotal	180	1200	-	-	2850	3420	8550	10,260	14,250	17,100	19,950	23,940	28,500	34,200	28,500	34,200	28,500	34,200	28,500	34,200
Total Project Revenues						4709		13,858		24,922		40,537		63,904		78,052		89,335		87,344

Notes: (1) IBRD's Price Prospects for major primary commodities,
June 1976: $195/ton milled rice FOB Bangkok; $245/ton CIF Mogadishu
(2) Idem. U.S.$ 120/ton +$50
(3) Based on export price (Sudan) of U.S.$ 570/ton +$30
(4) Somaltex (lint prices); IBRD (cotton seed prices)
(5) Export as live animals

C. Benefit/Cost Ratio, Net Present Worth

41 In the calculations, the opportunity cost of capital in Somalia has been assumed to be between 6% and 8%. Long-term loans to agriculture are given by the Somalia Development Bank (SDB) at 6% per year, to industry at a rate of 6.5% per year and to other sectors at 7.5% per year. Table IX-22 shows the benefit/cost ratio and the net present worth discounted at 6% and 8%.

	Discounted at 6%	Discounted at 8%
Net Present Worth	SoSh. 178,218,000	SoSh. 110,462,000
Benefit/Cost Ratio	1.296	1.223

With a benefit/cost ratio of more than One, at a discount rate of 8%, the Project can be considered economically viable.

42 Another way of showing project benefits is to show value added. Table IX-23 shows the computation of value added, using operating costs exclusive of labor, and discounted to present worth at 8 per cent. This shows a net domestic value added of SoSh. 174,807,000.

TABLE IX-22

SOMALIA

MOGANBO IRRIGATION PROJECT

COMPUTATION OF BENEFIT/COST RATIO

000 SoSh.

Project Year	Total Costs (Capital, Operating, Replacement)	Incremental Revenues	Discount Factor at 6%	Present Worth of Total Cost at 6%	Present Worth of Incremental Revenue at 6%	Discount Factor at 8%	Present Worth of Total Cost at 8%	Present Worth of Incremental Revenue at 8%
1	2967.0	(360)	.943	2798	(339)	.925	2744	(333)
2	35298.0	(360)	.890	31415	(320)	.857	30250	(309)
3	39794.8	4644	.840	33428	3901	.794	31597	3687
4	43456.8	14221	.792	34418	11263	.735	31941	10452
5	43405.4	26054	.747	32424	19462	.681	29559	17743
6	51776.2	41114	.705	36502	28985	.630	32619	25902
7	58293.2	63446	.665	38765	42192	.583	33985	36989
8	44190.0	75697	.627	27707	47462	.540	23863	40876
9	47724.3	80857	.592	28253	47867	.500	23862	40429
10	46504.8	83307	.558	25950	From 10 to 30	.463	21532	From 1 to 10
11	60664.3	83307	.527	31970	Present Worth	.428	25964	Present Worth
12	46984.4	"	.497	23351	of Incremental	.397	18653	of Incremental
13	47778.3	"	.469	22408	Revenue at 6%	.368	17582	Revenue at 6%
14	45837.8	"	.442	20260	= 580067	.340	15585	= 417451
15	49792.1	"	.417	20763		.315	15369	
16	46886.5	"	.394	18473		.292	13691	
17	46771.1	"	.371	17352		.270	12628	
18	46957.5	"	.350	16435		.250	11740	
19	47621.5	"	.331	15763		.232	11048	
20	45836.8	"	.312	14801		.215	9855	
21	49298.3	"	.294	14494		.199	9810	
22	48338.5	"	.278	13438		.184	8894	
23	47573.3	"	.262	12464		.170	8087	
24	46486.5	"	.247	11482		.158	7345	
25	46883.3	"	.233	10924		.146	6800	
26	44571.8	"	.220	9806		.135	6017	
27	49003.3	"	.207	10144		.125	6125	
28	47704.3	"	.196	9350		.116	5534	
29	47286.1	"	.185	8748		.107	5060	
30	47335.7	83307	.174	8236		.099	4686	
				602322	780540		592887	

Benefit/Cost Ratio at 6% = $\frac{780540}{602322}$ = 1.296 Net Present Worth at 6% = 780540-602322 = SoSh. 178,218,000

Benefit/Cost Ratio at 8% = $\frac{592887}{482425}$ = 1.223 Net Present Worth at 8% = 592887-482425 = SoSh. 110,462,000

TABLE IX-23

SOMALIA

MOGANBO IRRIGATION PROJECT

COMPUTATION OF VALUE ADDED

000 SoSh.

Project Year	*Capital Cost	Operation cost, excluding Labor	Replacement Cost	Total	Incremental Revenue	Value Added	Discount Factor at 8%	Present Worth of Value Added at 8%
1	2559	-		2559	(360)	(2919)	.926	(2703)
2	34021	88		34109	(360)	(34469)	.857	(29540)
3	33546	3431		36977	4644	(32333)	.794	(25672)
4	30476	9593		40069	14221	(25848)	.735	(18998)
5	22055	16451		39406	26054	(13352)	.681	(9093)
6	23999	23472		46471	41114	(5357)	.630	(3375)
7	18598	33409		52007	63446	11439	.583	6669
8		36369		36369	75697	39328	.540	21237
9		36072	3831	36903	80857	43954	.500	21977
10		36260	2424	38684	83307	44623	.463	20660
11	13678	35842	3623	53143		30164	.429	12940
12		35842	3321	39163		44144	.397	17525
13		35842	4115	39957		43350	.368	15953
14		36369	1648	38017		45290	.340	15399
15		36072	5899	41971		41336	.315	13021
16		36260	2806	39066		44241	.292	13228
17		35842	3108	38950		44357	.270	11976
18		35842	3295	39137		44170	.250	11043
19		35842	3959	39801		43506	.232	10093
20		36369	1647	38016		45291	.215	9738
21		36072	5405	41477		41830	.199	8324
22		36260	4258	40518		42789	.184	7873
23		35842	3910	39752		43555	.170	7404
24		35842	2820	38662		44645	.158	7054
25		35842	3220	39062		44245	.146	6460
26		36369	382	36751		46556	.135	6285
27		36072	5110	41182		42125	.125	5266
28		36260	3623	39883		43424	.116	5037
29		35842	3623	39465		43842	.107	4691
30		35842	3673	39515		43792	.099	4335
								89381-
								264188+
*Rounded		Net Domestic Value Added = 174,807,000 SoSh. (assuming SDR = 8%)						174807+

D. Sensitivity Analyses (Financial rate of return)

43 In order to appraise the value of the project, the sensitivity of the financial rate of return to varying conditions was analyzed. The following is a summary of these findings.

Analysis	Rate of Return	Table
1. Two year delay in implementation	14.1%	IX-24
2. 20% increase in construction costs	12.6%	IX-25
3. 20% increase in production costs	10.9%	IX-26
4. Two year delay in planned yield levels	14.0	IX-27
5. Full production achieved one year earlier	15,8%	IX-28
6. 10% reduction in construction costs	16.4%	IX-29
7. 10% increase in crop prices	16.8%	IX-30
8. 20% increase in production costs, cattle purchase unchanged	12.4%	IX-31
9. Combination 20% increase in capital and operating costs and 10% increase in farm prices with cattle unchanged	11.9%	IX-32
10. Combination of 20% increase in production costs including cattle purchases, 20% increase in capital costs, and 10% increase in prices received	10.6%	IX-33

44 Some thought was given to an analysis with 20% decrease in farm prices but likelihood of this occurrence during the period of analysis, without commensurate reductions in production cost, seemed somewhat remote. Similarly, to speculate on a 3 or 4 per cent annual increase in crop prices seemed unwarranted.

Project Revenue and Payback Period

45 Table IX-38 shows that during the first six years of the project life, total annual costs will exceed total annual revenues. It is expected that the deficit will be financed through loans. Payback periods for the loans have been calculated using three assumptions. The resulting payback periods are as follows:

a) Assuming a loan payback grace period of six years on interest free loans, loans will be paid back by the eleventh year of project life (Table IX-38).
b) Assuming a payback period of six years, during which no interest is paid and the loans bear six per cent interest starting from year six, the loans will be paid back by the twelfth year (Table IX-39). This table is also shown in the Main Report and Summary.
c) Assuming a loan payback period of six years, and that the loans bear six per cent interest capitalized as of project year I, the loans will be paid back by year 13 of the project life (Table IX-40).

TABLE IX-24

SOMALIA

MOGANBO IRRIGATION PROJECT

Financial: Sensitivity Analysis (Two Year Delay in Implementation)

000 SoSh.

Year	Capital Cost	Operating Cost	Replacement Cost	Total Outflow	Incremental Revenue	Incremental Benefit	Discount Factor at 14%	Present Worth at 14%	Discount Factor at 15%	Present Worth at 15%
1	2559	408		2967	(360)	(3327)	.877	(2918)	.870	(2894)
2	8060	408		8468	(360)	(8828)	.759	(6789)	.756	(6674)
3	9165	1189		10354	(360)	(10714)	.675	(7232)	.658	(7050)
4	27546	1277		28823	(360)	(29183)	.592	(17276)	.571	(16663)
5	36083	6249		42333	4644	(37689)	.519	(19561)	.497	(18731)
6	28351	12981		41332	14221	(27111)	.455	(12363)	.432	(11712)
7	22344	20451		42795	26054	(16741)	.400	(6696)	.376	(6295)
8	19198	27777		46975	41114	(5861)	.351	(2057)	.327	(1917)
9	12848	39695		52543	63446	10903	.308	3358	.284	3096
10		44190		44190	75697	31507	.270	8507	.247	7782
11		43893	3831	47724	80857	33133	.237	7852	.215	7124
12		44081	2424	46505	83307	36802	.208	7655	.187	6882
13	13678	43663	3623	60964	"	22343	.182	4066	.163	3642
14		43663	3321	46984	"	36323	.160	5812	.141	5122
15		43663	4115	47778	"	35529	.140	4974	.123	4370
16		44190	1648	45838	"	37469	.123	4609	.107	4009
17		43893	5899	49792	"	33515	.108	3620	.093	3117
18		44081	2806	46887	"	36420	.095	3460	.081	2950
19		43663	3108	46771	"	36536	.083	3032	.070	2558
20		43663	3295	46958	"	36349	.073	2653	.061	2217
21		43663	3959	46622	"	36685	.064	2348	.053	1944
22		44190	1647	45837	"	37470	.056	2098	.046	1724
23		43893	5405	49298	"	34009	.049	1666	.040	1360
24		44081	4258	48339	"	34968	.043	1504	.035	1224
25		43663	3019	46682	"	36625	.038	1392	.030	1099
26		43663	2820	46483	"	36824	.033	1215	.026	957
27		43663	3220	46883	"	36424	.029	1056	.023	838
28		44190	382	44572	"	38735	.026	1007	.020	775
29		43893	5110	49003	"	34304	.022	755	.017	583
30		44081	3623	47704	83307	35603	.020	712	.015	534
								74892-		71936-
								75408+		63907+
								516+		8029-

Internal Rate of Return = $14 + (1 \times \frac{516}{8545}) = 14.0 + 0.06 = \underline{14.1\%}$

TABLE IX-25

SOMALIA

MOGANBO IRRIGATION PROJECT

Financial: Sensitivity Analysis (Assuming 20% Increase in Construction Costs

000 SoSh.

Year	Capital Cost	Operating Cost	Replacement Cost	Total Outflow	Incremental Revenue	Revenue Pre-Project	Incremental Revenue	Incremental Benefit	Discount Factor at 12%	Present Worth at 12%	Discount Factor at 13%	Present Worth at 13%
1	3070	408		3478	-	360	(360)	(3838)	.893	(3427)	.885	3397
2	40825	1277		42102	-	360	(360)	(42462)	.797	(33842)	.783	33248
3	40255	6249		46504	5004	360	4644	(41860)	.712	(29804)	.693	29009
4	36571	12981		49552	14581	360	14221	(35331)	.636	(22471)	.613	21658
5	27545	20451		47996	26414	360	26054	(21942)	.567	(12441)	.543	11915
6	28799	27777		56576	41474	360	41114	(15462)	.506	(7824)	.480	(7422)
7	22318	39695		62013	63806	360	63446	1433	.452	648	.425	609
8		44190		44190	76057	360	75697	31507	.404	12729	.376	11847
9		43893	4597	48490	81217	360	80857	32367	.361	11684	.333	10778
10		44081	2910	46991	83667	360	83307	36316	.322	11694	.295	10713
11	16414	43663	4348	64425	"	"	"	18882	.287	5419	.261	4928
12		43663	3985	47648	"	"	"	35659	.257	9164	.231	8237
13		43663	4938	48501	"	"	"	34806	.229	7971	.204	7100
14		44190	1977	46167	"	"	"	37140	.205	7614	.181	6722
15		43893	7089	51082	"	"	"	32225	.183	5897	.160	5156
16		44081	3366	47447	"	"	"	35860	.163	5845	.141	5056
17		43663	3730	47393	"	"	"	35914	.145	5243	.125	4489
18		43663	3953	47616	"	"	"	35691	.130	4640	.111	3962
19		43663	4749	48412	"	"	"	34895	.115	4048	.098	3420
20		44190	1977	46167	"	"	"	37140	.104	3863	.087	3231
21		43893	6486	50379	"	"	"	32928	.093	3062	.077	2535
22		44081	5106	49187	"	"	"	34120	.083	2832	.068	2320
23		43663	4692	48355	"	"	"	34952	.074	2586	.060	2097
24		43663	3389	47052	"	"	"	36255	.066	2393	.053	1922
25		43663	3364	47027	"	"	"	36280	.059	2141	.047	1705
26		44190	458	44648	"	"	"	38659	.053	2049	.042	1624
27		43893	6132	50025	"	"	"	33282	.047	1564	.037	1231
28		44081	4348	48429	"	"	"	34878	.042	1465	.032	1116
29		43663	4348	48011	"	"	"	35296	.037	1306	.029	1024
30		43663	4406	48069	83667	360	83307	35238	.033	1163	.026	916
										109889-		106649-
										117020+		102738+
										7211+		3911-

Internal Rate of Return = $12 + (1 \times \frac{7211}{11122}) = 12 + 0.64 = 12.6\%$

TABLE IX-26

SOMALIA

MOGANBO IRRIGATION PROJECT

Financial: Sensitivity Analysis (Assuming 20% Increase in all Production Costs)

000 SoSh.

Year	Capital Cost	Operating Cost	Replacement Cost	Total Outflow	Incremental Revenue	Incremental Benefit	Discount Factor at 10%	Present Worth at 10%	Discount Factor at 11%	Present Worth at 11%
1	2559	490		3049	(360)	(3409)	.909	(3099)	.901	(3072)
2	34021	1532		35553	(360)	(35913)	.826	(29664)	.812	(29161)
3	33546	7499		41045	4640	(36405	.751	(27340)	.731	(26612)
4	30476	15577		46053	14221	(31832)	.683	(21741)	.659	(20977)
5	22955	24541		47496	26054	(21442)	.621	(13315)	.593	(12715)
6	23999	33332		57331	41114	(16217)	.564	(9146)	.535	(8676)
7	18598	47634		66232	63446	(2786)	.513	(1429)	.482	(1343)
8		53028		53028	75697	22669	.467	10586	.434	9838
9		52672	3831	56503	80857	24354	.424	10326	.391	9522
10		52897	2424	55321	83307	27986	.386	10803	.352	9851
11	13678	52396	3623	69697	"	13610	.350	4673	.317	4314
12		52396	3321	55717	"	27590	.319	8801	.286	7891
13		52396	4115	5650	"	36806	.290	7774	.258	6916
14		53028	1648	54666	"	28641	.263	7533	.232	6645
15		52672	5899	58571	"	24736	.239	5912	.209	5170
16		52897	2806	55703	"	27604	.218	6018	.188	5190
17		52396	3108	55504	"	27803	.198	5505	.170	4727
18		52396	3295	55691	"	27616	.180	4971	.153	4225
19		52396	3959	56395	"	26912	.164	4414	.138	3714
20		53028	1647	54675	"	28632	.149	4266	.124	3550
21		52672	5405	58077	"	25230	.135	3406	.112	2826
22		52897	4258	57195	"	26112	.123	3212	.101	2637
23		52396	3019	55405	"	27902	.112	3125	3125	2539
24		52396	2820	55216	"	28091	.102	2865	.082	2303
25		52396	3220	55616	"	27691	.092	2548	.074	2049
26		53028	382	53410	"	29897	.084	2511	.066	1973
27		52672	5110	57782	"	25525	.076	1940	.060	1532
28		52897	3623	56520	"	26787	.069	1848	.054	1446
29		52396	3623	56019	"	27288	.063	1719	.048	1310
30		52396	3673	56069	83307	27238	.057	1553	.044	1198
								105734-		102556-
								116399+		101366+
								10665+		1190-

Internal Rate of Return = $10 + (1 \times \frac{10665}{11855}) = 10 + .9 = 10.9\%$

TABLE IX-27

SOMALIA

MOGANBO IRRIGATION PROJECT

Financial: Sensitivity Analysis (Assuming Two Year Delay in Planned Yield Levels)

000 SoSh.

Year	Capital Cost	Operating Cost	Replacement Cost	Total Outflow	Incremental Revenue	Incremental Benefit	Discount Factor at 14%	Present Worth at 14%	Discount Factor at 13%	Present Worth at 13%
1	2559.0	408		2967	(360)	(3327)	.877	2918	.885	2944
2	34021.0	1277		35298	(360)	(35658)	.770	27421	.783	27920
3	33545.8	6249		39794.8	4644	(33150.8)	.676	22377	.693	22973
4	30475.8	12981		43456.8	13760	(29696.8)	.592	17581	.613	18204
5	22954.4	20451		43405.4	24867	(18538.4)	.519	9621	.543	10067
6	23999.2	27777		51776.2	38548	(13228.2)	.456	6032	.480	6349
7	18598.2	39695		58293.2	58885	(591.8)	.400	236	.425	251
8		44190		44190	69366	25176	.351	8837	.376	9466
9		43893	3831	47724	73672	25948	.308	7992	.333	8641
10		44081	2424	46505	78083	31578	.270	8526	.295	9316
11	13678.2	43663	3623	60964.2	81157	20192.8	.237	4786	.261	5270
12		43663	3321	46984	83307	36323	.208	7555	.231	8391
13		43663	4115	47778	"	35529	.182	6466	.204	7248
14		44190	1647	45837	"	37470	.160	5995	.181	6782
15		43893	5899	49792	"	33515	.140	4692	.160	5362
16		44081	2806	46887	"	36420	.122	4443	.141	5135
17		43663	3108	46771	"	36536	.108	3946	.125	4567
18		43663	3295	48958	"	34349	.095	3263	.111	3813
19		43663	3959	47622	"	35685	.083	2962	.098	3497
20		44190	1647	45837	"	37470	.073	2735	.087	3260
21		43893	5405	49298	"	34009	.064	2177	.077	2619
22		44081	4257	48338	"	34969	.056	1958	.068	2378
23		43663	3910	47573	"	35734	.049	1751	.060	2144
24		43663	2824	46487	"	36820	.043	1583	.053	1951
25		43663	3220	46883	"	36424	.038	1384	.047	1712
26		44190	381	44571	"	38736	.033	1278	.042	1627
27		43893	5110	49003	"	34304	.029	995	.037	1269
28		44081	3623	47704	"	35603	.026	926	.033	1175
29		43663	3623	47286	"	36021	.022	792	.029	1045
30		43663	3673	47336	"	35971	.020	719	.020	935
								86019-		88457-
								85997+		99481+
								22-		11024+

Internal Rate of Return = $13 + (1 \times \frac{11024}{11046}) = 13 + .998 \approx 14\%$

TABLE IX-28

SOMALIA

MOGANBO IRRIGATION PROJECT

Financial: Sensitivity Analysis (Full Production Achieved One Year Earlier, 2-Year Buildup of Yields) 000 SoSh.

Year	Capital Cost	Operating Cost	Replacement Cost	Total Outflow	Incremental Revenue	Incremental Benefit	Discount Factor at 15%	Present Worth at 15%	Discount Factor at 16%	Present Worth at 16%
1	2559.0	408		2967	(360)	(3327)	.870	2894	.862	2868
2	34021.0	1277		35298	(360)	(35658)	.756	26957	.743	26494
3	33545.8	6249		39794.8	4644	(33150.8)	.658	21813	.641	21250
4	30475.8	12981		43456.8	14837	(28619.8)	.572	16371	.552	15798
5	22954.4	20451		43405.4	26922.5	(16482.9)	.497	8192	.476	7846
6	23999.2	27777		51776.2	42586.8	(9189.4)	.432	3970	.410	3768
7	18598.2	39695		58293.2	65472	7178.8	.376	2699	.354	2541
8		44190		44190	78473	34283	.327	11211	.305	10456
9		43893	3831	47724	83307	35583	.289	10106	.263	9358
10		44081	2424	46505	"	36802	.247	9090	.227	8354
11	13678.2	43663	3623	60964.2	"	24162.2	.215	5195	.195	4712
12		43663	3321	46984	"	36323	.187	6792	.168	6102
13		43663	4115	47778	"	35529	.163	5791	.145	5152
14		44190	1647	45837	"	37470	.141	5283	.125	4684
15		43893	2899	49792	"	33515	.123	4122	.108	3620
16		44081	2806	46887	"	36420	.107	3897	.093	3387
17		43663	3108	46771	"	36536	.093	3398	.080	2923
18		43663	3295	48958	"	34349	.081	2782	.069	2370
19		43663	3959	47622	"	35685	.070	2498	.060	2141
20		44190	1647	45837	"	37470	.061	2286	.051	1911
21		43893	5405	49298	"	34009	.053	1802	.044	1496
22		44081	4257	48338	"	34969	.046	1609	.038	1329
23		43663	3910	47573	"	35734	.040	1429	.033	1179
24		43663	2824	46487	"	36820	.035	1289	.028	1031
25		43663	3220	46883	"	36424	.030	1093	.024	874
26		44190	381	44571	"	38736	.026	1007	.021	813
27		43893	5110	49003	"	34304	.023	789	.018	617
28		44081	3623	47704	"	35603	.020	712	.016	570
29		43663	3623	47286	"	36021	.017	612	.014	504
30		43663	3673	47336	83307	35971	.015	540	.012	432
								80197-		78024-
								86032+		76456+
								5835+		1568-

Internal Rate of Return = $15 + (1 \times \frac{5835}{7403}) = 15 + .79 = 15.8\%$

TABLE IX-29

SOMALIA

MOGANBO IRRIGATION PROJECT

Financial: Sensitivity Analysis (Assuming 10% Reduction in Construction Costs) 000 SoSh.

Year	Capital Cost	Operating Cost	Replacement Cost	Total Outflow	Incremental Revenue	Incremental Benefit	Discount Factor at 17%	Present Worth at 17%	Discount Factor at 16%	Present Worth at 16%
1	2303	408		3711	(360)	4071	.855	3481	.862	3509
2	30619	1277		31896	(360)	32256	.731	23579	.743	23966
3	30191	6249		36440	4644	31796	.624	19841	.641	20381
4	27428	12981		40409	14221	26188	.534	13984	.552	14456
5	20660	20451		41111	26054	15057	.456	6866	.476	7168
6	21599	27777		49376	41114	(8262)	.390	3222	.410	3387
7	16738	39695		56433	63446	7013	.333	2335	.354	2483
8		44190		44190	75697	31507	.285	8979	.305	9610
9		43893	3448	47341	80857	33516	.243	8144	.263	8815
10		44081	2182	46263	83307	37044	.208	7711	.227	8409
11	12310	43663	3261	59234	"	24073	.178	4285	.195	4694
12		43663	2989	46652	"	36655	.152	5572	.168	5158
13		43663	3704	47367	"	35940	.130	4672	.145	5211
14		44190	1483	45673	"	37634	.111	4177	.125	4704
15		43893	5309	49202	"	34105	.095	3240	.108	3683
16		44081	2525	46606	"	36701	.081	2985	.093	3413
17		43663	2797	46460	"	36847	.069	2542	.080	2948
18		43663	2966	46629	"	36678	.059	2164	.069	2531
19		43663	3563	47226	"	36081	.050	1804	.060	2165
20		44190	1482	45672	"	37635	.043	1618	.051	1919
21		43893	4865	48758	"	34549	.037	1278	.044	1520
22		44081	3832	47913	"	35394	.032	1133	.038	1345
23		43663	3519	47182	"	36125	.027	975	.033	1192
24		43663	2538	46201	"	37106	.023	853	.028	1039
25		43663	2898	46561	"	36746	.020	735	.024	882
26		44190	344	44534	"	38773	.017	659	.021	814
27		43893	4599	48492	"	34815	.014	487	.018	627
28		44081	3261	47342	"	35965	.012	432	.016	575
29		43663	3261	46924	"	36383	.011	400	.014	509
30		43663	3306	46969	83307	36338	.009	327	.012	436
								70973-		72876-
								67507+		75582+
								3466-		2715+

Internal Rate of Return = $15 + (1 \times \frac{2715}{6181}) = 16 + .44 = 16.4\%$

TABLE IX-30

SOMALIA

MOGANBO IRRIGATION PROJECT

Financial: Sensitivity Analysis (Assuming 10% Increase in Farmgate Prices for Crops)[1] 000 SoSh.

Year	Capital Cost	Operating Cost	Replacement Cost	Total Outflow	Incremental Revenue	Incremental Benefit	Discount Factor at 16%	Present Worth at 16%	Discount Factor at 17%	Present Worth at 17%
1	2559.0	408		2967	(396)	(3363)	.862	2899	.855	2875
2	34021.0	1277		35298	(396)	(35694)	.743	26521	.731	26092
3	33545.8	6249		29794.8	4608	(35187)	.641	22555	.624	21957
4	30475.8	12981		43456.8	14606	(28851)	.552	15926	.534	15406
5	22954.4	20451		43405.4	26932	(16473)	.476	7841	.456	7512
6	23999.2	27777		51776.2	42807	(8969)	.410	3677	.390	3498
7	18598.2	39695		58283.2	66335	8042	.354	2847	.333	2678
8		44190		44190	79811	35621	.305	10864	.285	10152
9		43893	3831	47724	85487	37763	.263	9932	.243	9176
10		44081	2424	46505	88182	41677	.227	9461	.208	8669
11	13678.2	43663	3623	60964.2	"	27218	.195	5308	.178	4845
12		43663	3321	46984	"	41198	.168	6921	.152	6262
13		43663	4115	48778	"	39404	.145	5714	.130	5123
14		44190	1647	45837	"	42345	.125	5293	.111	4700
15		43893	5899	49792	"	39390	.108	4254	.095	3742
16		44081	2806	26887	"	41295	.093	3840	.081	3345
17		43663	3108	46771	"	41411	.080	3313	.069	2857
18		43663	3295	48958	"	39224	.069	2706	.059	2314
19		43663	3959	47662	"	40560	.060	2434	.050	2028
20		44190	1647	45837	"	42345	.051	2160	.043	1821
21		43893	5405	49298	"	38884	.044	1711	.037	1439
22		44081	4257	48338	"	39844	.038	1514	.032	1275
23		43663	3910	47573	"	40609	.033	1340	.027	1096
24		43663	2824	46487	"	41795	.028	1167	.023	959
25		43663	3220	46883	"	41299	.024	991	.020	826
26		44190	381	44571	"	43611	.021	895	.017	741
27		43893	5110	49003	"	39179	.018	705	.014	549
28		44081	3623	47704	"	40478	.016	648	.012	486
29		43663	3623	47286	"	40895	.014	573	.011	450
30		43663	3673	47336	88182	40846	.012	340	.009	367
								79419-		77340-
								84931+		75930+
								5512+		1410-

Internal Rate of Return = $16 + (1 \times \frac{5512}{6922}) = 16 + .796 \approx 16.8\%$

[1] Cattle prices unchanged

TABLE IX-31

SOMALIA

MOGANBO IRRIGATION PROJECT

Financial: Sensitivity Analysis (Assuming 20% Increase in Production Costs)[1] 000 SoSh.

Year	Capital Cost	Operating Cost	Replacement Cost	Total Outflow	Incremental Revenue	Incremental Benefit	Discount Factor at 12%	Present Worth at 12%	Discount Factor at 13%	Present Worth at 13%
1	2559	490		3049	(360)	(3409)	.893	(3044)	.885	(3017)
2	34021	1532		35553	(360)	(35913)	.797	(28623)	.783	(28120)
3	33546	7199		40795	4644	(36151)	.712	(25740)	.693	(25053)
4	30476	14677		45153	14221	(30932)	.636	(19673)	.613	(18961)
5	22955	23041		45996	26054	(19942)	.567	(11307)	.543	(10829)
6	23999	31232		55231	41114	(14117)	.506	(7143)	.480	(6776)
7	18598	44634		63232	63446	214	.452	97	.425	91
8		50028		50028	75697	25663	.404	10370	.376	9652
9		49672	3831	53503	80857	27354	.361	9875	.333	9109
10		49897	2424	52321	83307	30986	.322	9977	.295	9141
11	13678	49396	3623	66697	"	16610	.287	4767	.261	4335
12		49396	3321	52717	"	30590	.257	7862	.231	7066
13		49396	4115	53511	"	29796	.229	6823	.204	6078
14		50028	1648	51676	"	31631	.205	6484	.181	5725
15		49672	5899	55571	"	27736	.183	5076	.160	4438
16		49897	2806	52703	"	30604	.163	4988	.141	4315
17		49396	3108	52504	"	30803	.146	4497	.125	3850
18		49396	3295	52691	"	30616	.130	3980	.111	3398
19		49396	3959	53355	"	29952	.116	3474	.098	2935
20		50028	1647	51675	"	31632	.104	3290	.087	2752
21		49672	5405	55077	"	28230	.093	2625	.077	2174
22		49897	4258	54155	"	29152	.083	2420	.068	1982
23		49396	3910	53306	"	30001	.074	2220	.060	1800
24		49396	2824	52220	"	31087	.066	2052	.053	1648
25		49396	3220	52616	"	30691	.059	1811	.047	1442
26		50028	382	50410	"	32897	.053	1744	.042	1382
27		49672	5110	54782	"	28505	.047	1340	.037	1055
28		49897	3623	53520	"	29787	.042	1251	.032	953
29		49396	3623	53019	"	30288	.037	1121	.029	878
30		49396	3672	53068	83307	30239	.033	998	.026	786
								95530-		92756-
								99142+		86985+
								3612+		5771-

Internal Rate of Return = $12 + (1x \frac{3612}{9383}) = 12 + .38 = \underline{12.4\%}$

[1]Cattle purchases unchanged

TABLE IX-32

SOMALIA

MOGANBO IRRIGATION PROJECT

Financial: Sensitivity Analysis

Combination 20% Increase in Capital and Operating Costs[1] and 10% Increase in Farmgate Prices[2]

000 SoSh.

Year	Captial Cost	Operating Cost	Replacement Cost	Total Outflow	Incremental Revenue	Incremental Benefit	Discount Factor at 12%	Present Worth at 12%	Discount Factor at 11%	Present Worth at 11%
1	3070	490		3560	(396)	(3956)	.893	(3533)	.901	(3564)
2	40825	1532		42357	(396)	(42753)	.797	(34074)	.812	(34715)
3	40255	7199		47454	4763	(42681)	.712	(30389)	.731	(31200)
4	36571	14677		51248	14606	(36642)	.636	(23304)	.659	(24147)
5	27545	23041		50596	26932	(23664)	.567	(13417)	.593	(14033)
6	28799	31232		60031	42807	(17124)	.506	(8665)	.535	(9161)
7	22318	44634		66952	66335	(617)	.452	(279)	.482	(297)
8		50028		50028	79811	29783	.404	12032	.434	12926
9		49672	4597	54269	85487	31218	.361	11270	.391	12206
10		49897	2910	52807	88182	35375	.322	11391	.352	12452
11	16414	49396	4348	70158	"	18024	.287	5173	.317	5714
12		49396	3985	53381	"	34801	.257	9844	.286	9953
13		49396	4938	54334	"	33848	.229	7751	.258	8733
14		50028	1977	52005	"	36177	.205	7416	.232	8393
15		49672	7089	56761	"	31421	.183	5750	.209	6567
16		49897	3366	53263	"	34919	.163	5692	.188	6565
17		49396	3730	53126	"	35056	.146	5118	.170	5960
18		49396	3953	53349	"	34833	.130	4528	.153	5329
19		49396	4749	54145	"	34037	.116	3948	.138	4697
20		50028	1977	52005	"	36177	.104	3762	.124	4486
21		49672	6486	56158	"	32024	.093	2978	.112	3587
22		49897	5106	55003	"	33179	.083	2754	.101	3351
23		49396	4692	54088	"	34094	.074	2523	.091	3103
24		49396	3389	52785	"	35397	.066	2336	.082	2903
25		49396	3364	53760	"	34422	.059	2031	.074	2547
26		50028	458	50486	"	37696	.053	1998	.066	2488
27		49672	6132	55804	"	32378	.047	1522	.060	1943
28		49897	4348	54245	"	33937	.042	1425	.054	1833
29		49396	4348	53744	"	34438	.037	1274	.048	1653
30		49396	4406	53804	88182	34378	.033	1134	.044	1513
								113661-		117117-
								112750+		128902+
								911-		11785+

Internal Rate of Return = $11 + (1 \times \frac{11785}{12692}) = 11 + .93 = 11.9\%$

[1] Cattle purchases unchanged

[2] Livestock prices unchanged

TABLE IX-33

SOMALIA

MOGANBO IRRIGATION PROJECT

Financial: Sensitivity Analysis

Combination: 20% Increase in Production Costs[1], 20% Increase in Capital Costs and 10% Increase in Prices Received

000 SoSh.

Year	Capital Cost	Production Cost	Replacement Cost	Total Outflow	Incremental Revenue	Incremental Benefit	Discount Factor at 10%	Present Worth at 10%	Discount Factor at 11%	Present Worth at 11%
1	3070	490		3560	(396)	3956	.909	3596	.901	3564
2	40825	1532		42356	(396)	42753	.826	36597	.812	34715
3	40255	7499		47754	4608	43146	.751	32403	.731	31540
4	36571	15577		52148	14606	37542	.683	25641	.659	24740
5	27545	24541		52086	26932	25154	.621	15621	.593	14916
6	28799	33332		62131	42807	19324	.564	10899	.535	10338
7	22318	47634		69952	66335	(3617)	.513	1856	.482	1743
8		53028		53028	79811	26783	.467	12508	.434	11624
9		52672	4597	57269	85487	28218	.424	11964	.391	11033
10		52897	2910	55807	88182	32375	.386	12497	.352	11396
11	16414	52396	4348	73158	"	15024	.350	5258	.317	4763
12		52396	3985	56381	"	31801	.319	10145	.286	9095
13		52396	4938	57334	"	30848	.290	8946	.258	7959
14		53028	1977	55005	"	33177	.263	8726	.232	7697
15		52672	7089	59761	"	28421	.239	6793	.209	5940
16		52897	3366	56263	"	31919	.218	6958	.188	6001
17		52396	3730	56126	"	32056	.198	6347	.170	5450
18		52396	3953	56349	"	31833	.180	5736	.153	4870
19		52396	4749	57145	"	31037	.164	5090	.138	4203
20		53028	1977	55005	"	33177	.149	4943	.124	4114
21		52672	6486	59158	"	29024	.135	3918	.112	3251
22		52897	5106	58003	"	30179	.123	3712	.101	3048
23		52396	4692	57088	"	31094	.112	3483	.091	2830
24		52396	3389	55785	"	32397	.102	3305	.082	2657
25		52396	3364	55760	"	32422	.092	2983	.074	2399
26		53028	458	53476	"	34706	.084	2915	.066	2291
27		52672	6132	58804	"	29378	.076	2233	.060	1763
28		52897	4348	57135	"	31047	.069	2142	.054	1677
29		52396	4348	56744	"	31438	.063	1981	.048	1509
30		52396	4406	56802	"	31380	.057	1789	.044	1381
								126613-		121556-
								134366+		117031+
								7753+		4525-

Internal Rate of Return = $10 + (1 \times \frac{7753}{12278}) = 10 + .63 = 10.6\%$

46 The value of the project was also analyzed in terms of the sensitivity of the economic rate of return to varying conditions.

Analysis	Rate of Return	Table
1. Assuming 20% increase in costs of production	12.4%	IX-34
2. Assuming two-year delay in implementation	14.8%	IX-35
3. Assuming 20% increase in construction costs	14.3%	IX-36
4. Assuming 20% increase in construction costs and two year delay in implementation	12.7%	IX-37

TABLE IX-34

SOMALIA

MOGANBO IRRIGATION PROJECT

Economic: Sensitivity Analysis (Assuming 20% Increase in Cost of Production)

000 SoSh.

Year	Capital Cost	Operating Cost	Replacement Cost	Total Outflow	Incremental Revenue	Incremental Benefit	Discount Factor at 13%	Present Worth at 13%	Discount Factor at 12%	Present Worth at 12%
1	2559	490		3049	(514)	(3563)	.885	(3153)	.893	(3182)
2	34021	1532		35553	(514)	(36067)	.783	(28240)	.797	(28745)
3	33546	7386		40932	4195	(36737)	.693	(25459)	.712	(26157)
4	30476	15302		45778	13344	(32434)	.613	(19882)	.636	(20628)
5	22955	23998		46953	24408	(22545)	.543	(12242)	.567	(12783)
6	23999	32501		56500	40023	(16477)	.480	(7909)	.506	(8337)
7	18598	46508		65106	63390	(1716)	.425	(720)	.452	(776)
8		51593		51593	77538	25945	.376	9755	.404	10482
9		51294	3831	55125	83821	28696	.333	9556	.361	10359
10		51551	2424	53975	86831	32856	.295	9692	.322	10580
11	13678	51049	3623	68350	"	18481	.261	4824	.287	5304
12		51049	3321	54370	"	32461	.231	7498	.257	8342
13		51049	4115	55164	"	31667	.204	6460	.229	7252
14		51682	1648	53330	"	33501	.181	6064	.205	6868
15		51326	5899	57225	"	29606	.160	4737	.183	5418
16		51551	2806	54357	"	32474	.141	4579	.163	5293
17		51049	3108	54157	"	32674	.125	4084	.145	4738
18		51049	3295	54344	"	32487	.111	3606	.130	4223
19		51049	3959	55008	"	31823	.098	3119	.116	3691
20		51682	1647	53329	"	33502	.087	2915	.104	3484
21		51326	5405	56731	"	30100	.077	2318	.093	2799
22		51551	4258	55809	"	31022	.068	2109	.083	2575
23		51049	3910	54959	"	31872	.060	1912	.074	2359
24		51049	2824	53873	"	32957	.053	1747	.066	2175
25		51049	3220	54269	"	32562	.047	1530	.059	1921
26		51682	382	52064	"	34767	.042	1460	.053	1843
27		51326	5110	56436	"	30395	.037	1125	.042	1429
28		51551	3623	55174	"	31657	.032	1013	.042	1330
29		51049	3623	54672	"	32159	.029	933	.037	1190
20		51049	3672	54721	86831	32110	.026	835	.033	1060
								97614-		100608-
								91871+		104715+
								5743-		4107+

Internal Rate of Return = $12 + (1 \times \frac{4107}{9850}) = 12 + .42 = 12.4\%$

TABLE IX-35

SOMALIA

MOGANBO IRRIGATION PROJECT

Economic: Sensitivity Analysis (Assuming Two Year Delay in Implementation) 000 SoSh.

Year	Capital Cost	Operating Cost	Replacement Cost	Total Outflow	Incremental Revenue	Incremental Benefit	Discount Factor at 15%	Present Worth at 15%	Discount Factor at 14%	Present Worth at 14%
1	2559	408		2967	(514)	(3481)	.870	(3028)	.877	(3053)
2	8060	408		8468	(514)	(8982)	.756	(6790)	.759	(6817)
3	9165	1189		10354	(514)	(10868)	.658	(7151)	.675	(7336)
4	27546	1277		28823	(514)	(29337)	.571	(16751)	.592	(17368)
5	36083	6155		42238	4195	(38043)	.497	(18907)	.519	(19744)
6	28341	12752		41103	13344	(27759)	.432	(11992)	.455	(12630)
7	22344	19998		42342	24408	(17934)	.376	(6743)	.400	(7174)
8	19198	27084		46282	40023	(6259)	.327	(2047)	.351	(2197)
9	12148	38757		50905	63390	12485	.284	3546	.308	3845
10		42994		42994	77538	34544	.247	8532	.270	9327
11		42745	3831	46576	83821	37245	.215	8008	.237	8827
12		42959	2424	45383	86831	41448	.187	7751	.208	8621
13	13678	42541	3623	59842	"	26999	.163	4401	.182	4914
14		42541	3321	45862	"	40969	.141	5777	.160	6555
15		42541	4115	46656	"	40175	.123	4942	.140	5625
16		43068	1648	44816	"	42015	.107	4496	.123	5168
17		42772	5890	48671	"	38160	.093	3549	.108	4121
18		42959	2805	45764	"	41067	.081	3326	.095	3901
19		42541	3108	45649	"	41182	.070	2883	.083	3418
20		42541	3295	45836	"	40995	.061	2501	.073	2993
21		42541	3959	46500	"	40331	.053	2138	.064	2581
22		43068	1647	44715	"	42116	.046	1937	.056	2358
23		42772	5405	48177	"	38654	.040	1546	.049	1894
24		42959	4258	47217	"	39614	.035	1386	.043	1703
25		42541	3019	45560	"	41271	.030	1238	.038	1568
26		42541	2820	45361	"	41470	.026	1078	.033	1369
27		42541	3220	45761	"	41070	.023	945	.029	1191
28		43068	382	43450	"	43381	.020	868	.026	1128
29		42772	5110	47882	"	38949	.017	662	.022	857
30		42959	3623	46582	86831	40249	.015	604	.020	805
								73409-		76319-
								72114+		82769+
								1295-		6450+

Internal Rate of Return = $14 + (1 \times \frac{6450}{7745}) = 14 + .83 = 14.8\%$

TABLE IX-36

SOMALIA

MOGANBO IRRIGATION PROJECT

Economic: Sensitivity Analysis (Assuming 20% Increase in Construction Costs

000 SoSh.

Year	Capital Cost	Operating Cost	Replacement Cost	Total Outflow	Incremental Revenue	Incremental Benefit	Discount Factor at 15%	Present Worth at 15%	Discount Factor at 14%	Present Worth at 1
1	3070	408		3478	(514)	(3992)	.870	(3473)	.877	(3501)
2	40825	1277		42102	(514)	(42616)	.756	32218	.759	(32345)
3	40255	6155		46410	4195	(42215)	.658	27777	.675	(28495)
4	36571	12752		49293	13344	(35048)	.571	(20527)	.592	(21282)
5	27545	19998		47543	24408	(23135)	.497	(11498)	.519	(12007)
6	28799	27084		55883	40023	(15860)	.432	(6851)	.455	(7216)
7	22318	38757		61075	63390	2315	.376	870	.400	926
8		42994		42994	77538	34544	.327	11296	.351	12125
9		42745	4597	47342	83821	36479	.284	10360	.308	11235
10		42959	2910	45869	86831	40962	.247	10118	.270	11060
11	16414	42541	4348	63303	"	43528	.215	9359	.237	10316
12		42541	3985	46526	"	40305	.187	7537	.208	8383
13		42541	4938	47479	"	39352	.163	6414	.182	7162
14		43068	1977	45045	"	41786	.141	5892	.160	6686
15		42772	7089	49861	"	36970	.123	4547	.140	5176
16		42959	3366	46325	"	40506	.107	4334	.123	4982
17		42541	3730	46271	"	40506	.093	3772	.108	4380
18		42541	3953	46494	"	40337	.081	3267	.095	3832
19		42541	4749	47290	"	39541	.070	2768	.083	3282
20		43068	1977	45045	"	41786	.061	2549	.073	3050
21		42772	6486	49258	"	37573	.053	1991	.064	2405
22		42959	5106	48065	"	38766	.046	1783	.056	2171
23		42541	4692	47233	"	39598	.040	1584	.049	1940
24		42541	3389	45930	"	40901	.035	1432	.043	1759
25		42541	3364	45905	"	40926	.030	1228	.038	1555
26		43068	458	43426	"	43405	.026	1129	.033	1432
27		42772	6132	48904	"	37927	.023	872	.029	1100
28		42959	4348	47307	"	39524	.020	790	.026	1028
29		42541	4348	46889	"	39942	.017	679	.022	879
30		42541	4406	46947	86831	39884	.015	598	.020	798
								120344-		104847-
								95169+		107662+
								7175-		2815+

Internal Rate of Return = $14 + (1 \times \frac{2815}{9990}) = 14 + .28 = 14.3\%$