DEMOCRATIC REPUBLIC

OF

SOMALIA

MOGANBO IRRIGATION PROJECT

FEASIBILITY STUDY

SUMMARY REPORT

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PREFACE

The following summary describes a viable irrigated agricultural project on the Lower Juba River in Somalia named the Moganbo Irrigation Project. The project embraces a net irrigable area of 6260 hectares. It has a livestock component which utilizes by-products from agricultural production.

The total project cost is estimated at SoSh 180,938,000 (US$ 28,720,000) of which the foreign currency exchange component is estimated to be 62% or SoSh 112,344,000 (US$ 16,832,000).

Annual production costs, including project operation and maintenance, are estimated at SoSh 48,423,300 and annual revenues should be SoSh 83,667,000 at full production.

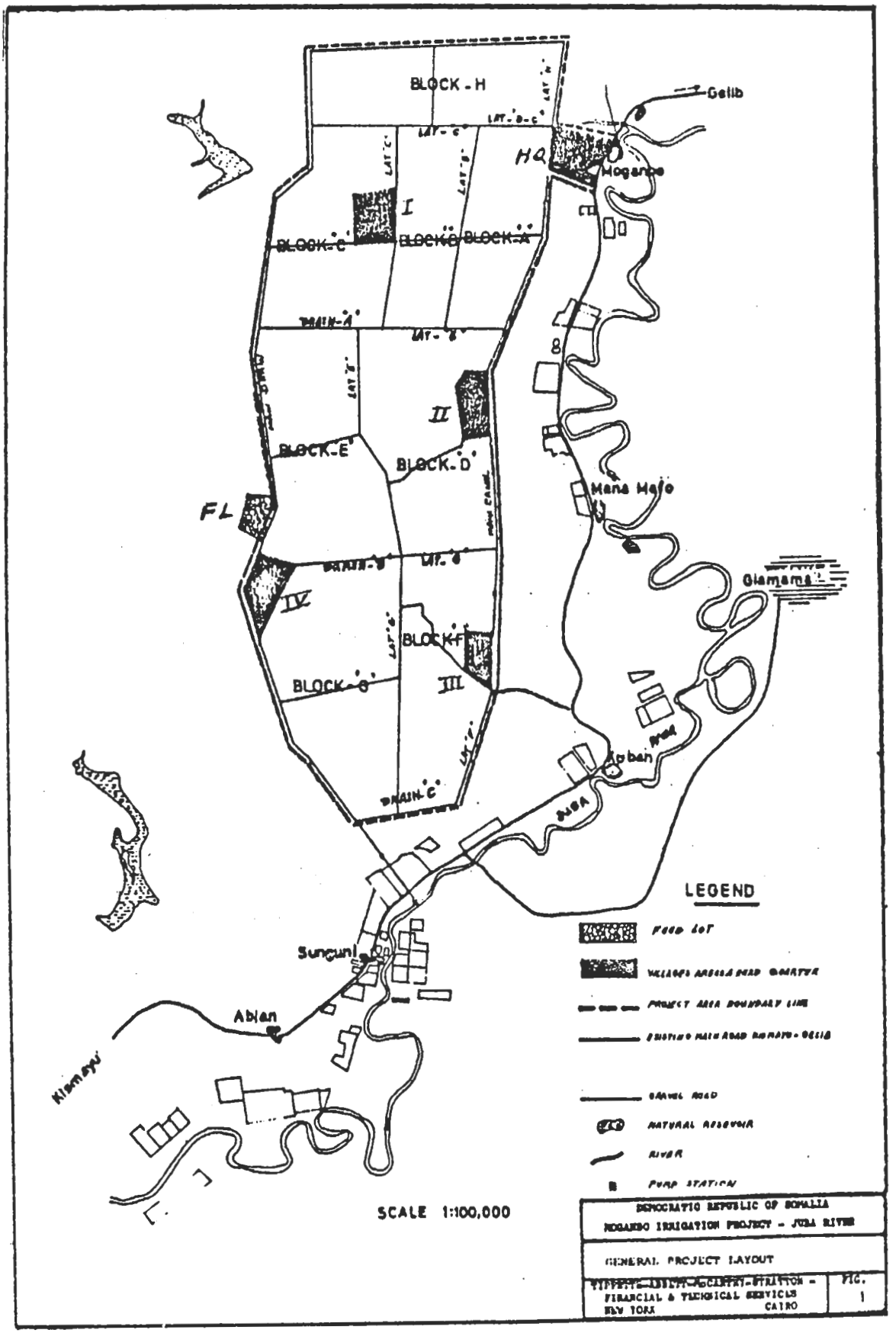
Economically the project has a financial rate of return of 15.1 per cent. The economic rate of return is calculated to be 16.2 per cent and benefits exceed costs.

Sensitivity analyses indicate that the project remains viable under the most pessimistic assumptions.

An estimated payout in 11 years from the commencement of construction further confirms the project's viability.

The Consultants received cooperation and assistance from the Chairman of the State Planning Commission and his staff for which they are grateful. Many others in the Government of Somalia, particularly in the Ministry of Agriculture, were helpful in gaining access to important sources of information.

General supervision of the work was by Mohamed El Moghazi, Executive Director of FINTECS and Dana E. Low, Partner-in-Charge for TAMS. Immediate supervision and direction of the feasibility study was by Paul H. Berg, Project Manager for TAMS/FINTECS. The professional staff included: Dr. A.R. Abou Akkada, Livestock Specialist; Dr. A.A. Abdel-Bary, Agronomist; Dr. H.A. El Attar, Soils Scientist; Dr. H.M. Bakr, Water Resources Engineer; Dr. I.A. El Dimeery, Road Engineer; R.F. Kreiss, Hydrologist; Dr. K.S. Reda, Agricultural Economist, and Dr. S.M. El Zoghby, Rural Sociologist. Topographic surveys were made by Bashir Gouled Mohamed, Survey Engineer, Saeed Mohamed Liben, Survey Engineer, and Saiid Hussein Ali, Draftsman, all of Somalia. Statistical analysis was carried out by Y.O. Alawany and M.M. Morsy. Assistance in report preparation was provided by B. Trottier and typing by M. Dungan-Megalli.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DEMOCRATIC REPUBLIC OF SOMALIA
BOGAMBO IRRIGATION PROJECT - JUBA RIVER
GENERAL PROJECT LAYOUT
FINANCIAL & TECHNICAL SERVICES
NEW YORK
CAIRO
FIG. 1

SOMALIA

MOGANBO IRRIGATION PROJECT

SUMMARY REPORT

I BACKGROUND

1.01 Somalia covers over 627,000 square kilometers and has an estimated population of 4.0 million (1976). GNP in 1974 was about US $240-250 million, with annual per capita incomes at an average of US $80. The economy is based on agriculture which accounts for 80 per cent of employment, over 85 per cent of exports and over 80 per cent of GNP.

1.02 Livestock and bananas are the sole exports of consequence. Agricultural cultivation, with the exception of bananas and sugar cane, is for subsistence. Only 700,000 out of an estimated 8 million hectares of arable land are actually cultivated; 37,000 hectares are under controlled irrigation. Cultural practices are not conducive to high production and marketable surpluses are small. The main crops are sorghum (800,000 hectares per year in two

seasons) and maize (170,000 hectares) which the country must import when the rains fail. The production of sesame (70,000 hectares), the third major crop, does not meet the domestic demand for edible oils. Some cotton and rice is grown but the country imports most of its requirements.

1.03 The livestock population of Somalia is estimated at 2.5 million camels, 14 million sheep and goats and 3 million cattle, the latter predominantly in the south. Traditional husbandry practices are based on wide-ranging pastoral systems which result in high mortalities, heavy weight losses and range deterioration. Somalia's major export is live animals but this activity has suffered prejudice from the haphazard manner in which is it conducted. The aim of the Government is to apply good management and conservation techniques, especially in the north and in the Juba region, and to initiate intensive production, including selection and feedlot fattening, in the southern regions.

1.04 Somalia has always had a deficit balance of payments in food products, especially cereals, sugar and vegetable oils. The current 1974-1978 Development

Plan emphasizes irrigation and the establishment of state farms as a means of raising production. The long term objectives are to raise the rural living standard, generate productive employment and increase exports. There is good potential for the irrigation of rice, cotton, maize, sesame and other oilseeds, pulses, sugar cane and many kinds of vegetables, especially in the virtually undeveloped Juba Valley where about two-thirds of the national potential for irrigation is found.

1.05 Perhaps the most critical constraint on development in Somalia is the shortage of skilled and experienced managerial and technical staff as well as labor. Greater emphasis on education and training since 1971 should bear fruit towards the end of the current plan period. The concentration of available competence on state farms would be a good focal point for an efficient production-oriented strategy.

II THE PROJECT AREA

2.01 The Project would be located in the alluvial flood plain of the Lower Juba River, which is flat with a parallel surface drainage network towards the Juba or the Indian Ocean. Stagnant pools called desceks form in the very flat meandering swamps on either side of the river. Terraces, channel remnants, levees and oxbows are other common features.

2.02 The Lower Juba area has a typically semi-arid tropical climate. Temperature variations are slight and the only limitation to growing season is availability of moisture. Rainfall averages 414 mm per year, but is too irregular for dependable rainfed cultivation. As in all of Somalia, there is a constant risk of drought.

Water Resources

2.03 The Juba River is Somalia's largest and most reliable river. Cultivated area in the valley has been estimated to be 93,500 hectares out of a total potential of over 400,000 hectares. The potential for irrigation

is 221,500 hectares, of which only 8,500 have been developed. Some 20,000 to 25,000 hectares are farmed under some form of flood irrigation. All groundwater investigations have found water with unsuitable chemical contents so the only possible source of a dependable supply of irrigation water is the Juba itself. A trial operation based on full regulation by the planned Bardera and Saco Dams has confirmed the reliability of water availabilities for year round irrigation of at least 150,000 hectares.

Agriculture

2.04 The Juba Valley is one of the major areas of settled agriculture in Somalia yet production is largely for subsistence. Maize is the main rainfed crop in the Lower Juba (20,000 hectares) followed by sesame (5,000 hectares) and cotton (3,800 hectares). Yields are low at 400 kg per hectare for maize and 220 kg per hectare for sesame and cotton. Flood irrigation more than doubles these yields, even if no additional inputs are used.

2.05 There are irrigated commercial banana plantations on over 5,000 hectares on both sides of the river, the majority being located immediately south

of the Moganbo site and extending south into the Kismayu district. An irrigated sugar cane plantation (6000 hectares) and associated sugar mill is being developed on Touta Island with a planned expansion area of 6000 hectares extending downstream almost to the northwest boundary of the designated project site. Other projects include the Fanole project where cotton, maize, legumes and fodder would be grown on about 8000 hectares; a 2400 hectare cotton project with associated industries at Giamama, and the Trans-Juba forage farm on the north boundary of the project site. Only the banana plantations are operational. Implementation on the Trans-Juba, Fanole and Juba Sugar Projects has begun.

Livestock

2.06 Cattle are the predominant livestock in south Somalia. Livestock husbandry is a minor activity in a strip of land about 10 km wide on either side of the river where tsetse flies are found in the vegetation, but the ranges beyond this strip have a total cattle population estimated at 1.5 million head.

2.07 The prevailing nomadic husbandry practices are not conducive to high production. Animal weights

are low and mortalities high, especially in dry periods. Range management on 170,000 square kilometers between the Juba River and the border with Kenya is under the control of the LDA-operated Trans-Juba Livestock Development Project which also has a feedlot component (30,000 head per year) associated with the previously mentioned irrigated forage farm. Other projects include the planned Gelib Multipurpose ranch (7,500 head) that will work on improving production through selection and better husbandry, and a small herd (350 head) in the Fanole irrigation project where performance in milk and meat production under improved feeding would be studied.

Infrastructures

2.08 The paved Kismayu-Gelib road passes near the northeastern border of the project site, providing an excellent link with the seaport and airport at Kismayu. The Gelib-Golwein road slated for improvement under the current Plan will improve connections with Mogadishu. The other roads of the area are not passable during the rainy season and all feeder roads are no more than tracks.

2.09 Processing facilities are scarce in the region. Grains are milled by the farmers themselves or by small local mills. A new gin, an oil extracting unit and cottonseed cake plant will be built in connection with the Giamama cotton project. Two small gins at Giamama are obsolete but could be renovated to supplement this capacity.

2.10 The Kismayu meat factory is operating at near capacity; both canning and chilled storage capacity will be increased under the current Plan. The Juba Valley Development Program contemplates investment in two meat packing factories in Gelib and Kismayu by the year 1980.

2.11 None of the hamlets or the isolated dwellings have electricity or any other utilities. There are schools in the towns of Sheik Cambul, Moganbo, Koban and Mona Muga, and clinics in Moganbo and Koban. There are no veterinary clinics or industries.

Conclusions

2.12 Agricultural production in the Juba Valley is overly dependent on the vagaries of weather. Prospects are excellent for improving the availability of many foods now in short supply. A major handicap in such

development would be the current shortage of people trained in efficient agricultural methods. This can be overcome by setting up state farms where available managerial and technical competence can be concentrated. The intent is to secure higher efficiency in production while training agricultural laborers in improved techniques. This should encourage emulation by both private and public projects.

The Project Site

2.13 The area surveyed covered 10,000 hectares on the west banks of the Juba River about 18 km south of Kamsuma. It is bounded to the west and north by the Trans-Juba Livestock Development Project and to the east and south by commercial banana plantations. About 500 households occupy six small hamlets and some isolated farms. The total population in the immediate vicinity has been estimated at 15,000 to 20,000 people in twenty villages with a working-age population of 3,750. The local availabilities of labor are scarce.

2.14 Apart from the banana plantations mentioned, agricultural production in the area is strictly for subsistence. The project site is unoccupied by any

economic activity other than small, scattered dryland or flood-irrigated farms on 20 to 30% of the total area, and occasional use by nomadic herdsmen. Land is allocated following traditional practices in the absence of any other form of regulation. Maize is virtually the only crop with some intercropped sesame. Some tobacco is also grown. Varieties are generally low-yielding ones and cultural practices seldom go beyond land clearing and burning. Production is low as no fertilizer or plant protection measures are applied. Pests, diseases and birds take a heavy toll of the harvests.

III THE PROJECT

A. Project Components

3.01 The project described here would provide a dependable water supply for year-round cultivation of national target food crops and cotton on a state farm with a net area of 6260 hectares. Its components include:

a) irrigation canals
b) pumping plant for diversion from the Juba
c) small diesel power plant for pumps
d) drainage system
e) road network
f) headquarters village and four laborers' villages
g) cattle feedlot
h) purchase of machinery and equipments for crops production, systems maintenance and feedlot

3.02 The intent is to secure maximum benefits from the combination of land, water and labor.

B. Description of Works

Soils

3.03 The soils survey showed that 6943 hectares are arable and susceptible to irrigation by the works described herein. A total of 683 hectares were subtracted to allow for roads, canals, drains and villages. Over 85% of the soils are loams, silt loams and clay with about one half being silt loams to clay. All are free from salt hazard, have low electrical conductivity and low sodium absorption ratio in the upper root zone. Should additional works be built, such as the canal from a diversion near Kaliakoko, most all of the 10,000 hectares surveyed could become irrigable.

Water Requirements

3.04 Crop water requirements were calculated using the Blaney-Criddle method. Monthly requirements range from 2011 m^3x10^3 in August to 14,379 m^3x10^3 in December. The annual mean requirement is 87,100 m^3x10^3 which is much less than available water supplies, if regulated by upstream storage. Water quality is good. The irrigation water would be diverted from the Juba River by pumping. There is indication that a headworks at

Kaliakoko may be built in order to provide irrigation water to all irrigable areas downstream. Should this structure be built it may prove more economic than pumped diversion. When regulated by Bardera Dam, adequate water should be available to meet all requirements. Until the dam is built, there may be some shortages in January and April.

Irrigation System

3.05 The irrigation canals would carry water to 6260 hectares of cropped land via 10 kilometers of main canal, 35.6 km of secondary canals and a suitable network of tertiary canals. All canals would be above natural ground level. Foreseeable water velocities are 0.46 m/s to 0.38 m/s. The low side of each canal would accomodate project roads. Construction of drains and canals should be concurrent so that excavation material from the former can be used to build up the latter.

3.06 Diversion would be by a battery of six plus one standby vertical propeller pumps of 1.0 cms capacity, housed in a suitable structure at the end of a 100-meter intake channel equipped with sediment skimming weir. Power for the pumps and the headquarters village would be

provided by an adjacent power station with one 500-kw and two 250-kw diesel generators. Plans include diesel fuel storage for 250,000 liters corresponding to estimated requirements for the three months of maximum water requirement. Also included are spare parts for 5 years and a spare motor for the pumps. The pumps would operate under variable heads until regulation by Bardera dam stabilizes the river levels.

2.07 Draingage would be a critical problem on the project soils. The main drain would be 23.1 km long from a place near Bulo Yag village and running southward along the project's west border to the discharge point near Sanguni. There would be 29.2 km of secondary drains and a suitable network of tertiary or field drains. Main drain bottom widths would range from 1 to 4 meters. Both main and secondary drains would be a minimum of 1.5 meters deep. Since the Government has adopted a policy of no drainage water being emptied into the river, it will be necessary to locate a suitable depression into which drainage water may be discharged. Relatively closely spaced open field drains may be required in the future but further study may

prove that savings in cropped land would offset the cost of mole or tile drains.

3.08 Although no water table was found during the investigations, experience with soils of the types in the project site shows that subsurface field drainage will ultimately be necessary. Provision has been made in the cost estimates for funds to build such drains as and when needed.

Infrastructures

3.09 The water delivery side of the canals and embankments along drains would be utilized for 98 km of coral surfaced access roads. Earth roads would provide access to each field.

Feedlot

3.10 The feedlot integrated with the irrigation project would be located on the western edge of the project site, near Village IV. A total allotment of 0.2 hectares per 100 animals was planned to allow for work corrals, feed storage, 15 animal pens and roads.

Villages

3.11 One headquarters village for 1500 inhabitants and four workers villages for 2000-2700 inhabitants each would be built. Housing would be provided through the project but mosques, schools, health infrastructures, etc. should be provided, staffed and operated by the appropriate national authorities (estimated construction cost, SoSh. 6,920,000).

3.12 The housing would comprise four types of dwellings, ranging from a first-class dwelling suitable for top staff and expatriates, all in the headquarters village, to housing for intermediate staff and housing for workers. Local building materials would be employed where feasible. Each village would have fresh clean running water, sanitary and drainage facilities, but only the headquarters village would have electricity and telephone communications.

3.13 The village volunteer government, advised by the village manager, would assume all responsibility for maintenance of housing and village infrastructures. The project would provide technicians and labor where needed.

Cost Estimate

3.14 Total project costs have been estimated at SoSh. 180,938,000, or US$ 28,720,000. The foreign exchange requirement is 62%, or SoSh. 112,344,000 (US$ 17,833,000). Project costs are based on prevailing unit costs in the country for construction and land reclamation works, with a contingency of 15 per cent. An allowance of 8 per cent was made for engineering and supervision and 10 per cent was added for overheads and administration. Machinery costs were also based on actual costs including transport to the project site and installation. A contingency of 10 per cent was added. The allowance for spare parts was 20 per cent, and 10 per cent was added for administration. Project costs are summarized in Table 1.

3.15 The Table shows that the irrigation and drainage system represents 58 per cent of total project costs,. followed by villages and crops which represent 19 and 13 per cent, respectively.

Phasing

3.16 Construction of the project would be phased over a period of seven years, as shown in Table 2.

Table 1

Summary of Project Investment Costs

	SoSh. Million			U.S.$ Million			For. Exch.
	Local	Foreign	Total	Local	Foreign	Total	%
Irrigation & Drainage	37.204	67.954	105.158	5.905	10.787	16.692	65
Roads	10.696	2.674	13.370	1.698	0.424	2.122	20
Villages	17.190	17.350	34.540	2.729	2.754	5.483	50
Feedlot	0.580	0.875	1.455	0.092	0.139	0.231	61
Machinery & Equipment							
Crops	2.583	20.390	22.973	0.410	3.237	3.647	89
Feedlot	0.234	2.102	2.336	0.036	0.334	0.370	90
System	0.110	0.996	1.106	0.018	0.158	0.176	90
Total:	68.597	112.344	180.938	10.888	17.833	28.721	62

Table 2

Construction Costs by Project Years

(000 SoSh.)

Project Year	Canal Drainage	Roads	Villages	Feedlot	Crops	Total
I	2,559.0	-	-	-	-	2,559.0
II	19,641.0	5,980.0	8,400.0	-	-	34,021.0
III	13,847.0	2,650.0	11,800.0	1,347.0	5,007.5	34,651.5
IV	15,266.8	4,740.0	5,750.0	607.0	4,112.0	30.475.8
V	11,773.4	-	5,630.0	659.0	4,892.0	22,954.4
VI	15,942.7	-	2,960.0	607.0	4,489.5	23,999.2
VII	13,555.5	-	-	571.0	4,472.0	18,598.5
Future[1]	13,678.2	-	-	-	-	13,678.2
Total:	106,263.6	13,370.0	34,540.0	3,791.0	22,973.0	180,937.6

[1] Estimated requirement for drains to be constructed when needed after project construction is completed.

IV PRODUCTION

Existing Production

4.01 The value of existing production in the project site has been estimated at SoSh. 360,000 on the basis of a total cropped area of 1200. hectares (double cropped) of maize, a yield of 400 kg per hectare and the ADC 1977 farmgate price of SoSh. 75 per quintal.

Cropping Pattern and Rotations

4.02 Upon completion of the project, a total of 6,260 hectares of irrigated land would be cultivated with a cropping intensity of 200 per cent. Production per hectare is expected to build up over a three-year period after land development as soil fertility improves under good management. Full operational development would thus be reached in Project Year X when the anticipated production would be 12,000 tons of maize, 3,800 tons of unmilled rice, 1,450 tons of sesame, 3,200 tons of seed cotton, 7,800 tons of pulses and 76,000 tons of clover. This can be compared to the existing production of less than 500 tons of maize. By-products from this production should be used for cattle feed.

4.03 The selection of crops was based on consideration of (i) soils and climatic suitability, (ii) national food needs and import subsitution, and (iii) maintenance of soil fertility. Maize, clover and rice would be rotated on the heavier soils, while cotton, pulses, maize, sesame and clover would be placed on a three-year rotation pattern on the lighter soils. Maize, rice, sesame and cotton are in short supply nationally, pulses are an important diet component and both pulses and clover are excellent nitrogen fixers. Project soils were found to be more suitable for sesame than for other oilseeds. Should bird tolerant varieties of rice reportedly developed by IRI prove adapted, rice could be double-cropped and the production of maize reduced accordingly.

4.04 Anticipated yields per hectare at full production are: maize, 5 tons; rice, 4 tons; cotton, 2.2 tons; sesame, 1 ton; pulses, 1.8 tons, and clover, 40 tons. These are conservative estimates based on the results of trials of irrigated crops elsewhere in the country.

Cultural Practices

4.05 Major field preparation would be done during the dry seasons. Manure from the feedlot would be added

during deep plowing to enrich soils in organic matter, nitrogen, potassium and phosphate. Chemical fertilizers would be added duirng harrowing and again during the growing cycle as appropriate. Pest control would focus on good cultural practices and full removal of crop residues. Rice would be grown in the Der season to reduce losses from birds. Maize and cotton would be sprayed at least twice against pests. Herbicides would be used on rice and maize to reduce manual weeding to one operation per season. One fungicide application would be necessary on cotton. A pre-planting application of water would be followed by waterings as needed, probably at intervals of 10 to 15 days.

4.07 Maize would be grown in Gu season and cotton in Der season in order to distribute labor requirements for harvesting fairly evenly throughout the year. Rice, sesame and pulses would be combine harvested to reduce shattering losses. Clover for the feedlot would be mowed and delivered daily.

4.08 The itemized costs of production are shown in Table 3.

Table 3

Summary of Production Costs at Full Development[1]

Crops Production Sector	000 SoSh.	000 US$[2]
A. Irrigation and Drainage		
Personnel (incl. 48,000, labor)	310.0	49.2
O&M systems	902.0	143.2
O&M roads	392.0	62.2
Machinery replacements	201.0	31.9
	1805.0	286.5
B. Crops Production		
Personnel (incl. 48,000, labor)	6782.0	1076.5
Operating costs	11141.0	1768.4
Machinery replacement	2950.0	468.3
	20873.0	3313.2
Total irrigation and drainage, crops	22678.0	3599.5
Livestock Feedlot Sector		
Personnel (incl. 615,000, labor)	769.0	122.0
Operating costs		
Cattle purchases	15000.0	2381.0
Other	9687.0	1537.6
Machinery replacements	289.0	45.9
	25745.0	4086.5
Total Production Costs	48423.0	7686.1

[1]Includes machinery and equipment replacement costs averaged over Project Years IX to XXX

[2]Discrepancies due to rounding

Feedlot

4.10 Annual capacity of the feedlot at full development would be 30,000 head or a net production of 28,500 fattened bulls. This was determined on the basis of the amount of feeds that would be available from the Moganbo project's cropping activity. Bulls would be purchased from the surrounding rangelands at the rate of 750 head per week for five-month fattening periods. The purchase price of SoSh. 2.5 per kg is the current LDA average buying price. The cattle would be fed a daily ration composed of 16 kg freshly cut clover, 5 kg roughage in the form of hammer-milled maize or sesame stover or rice straw, and 3 kg pelleted concentrate mixture. This corresponds to annual needs of 72,000 tons fodder, 18,000 tons roughage and 13,500 tons concentrate mixture. The purchase of cattle represents 58 per cent of the total production costs of the feedlot and the purchase of the concentrate mixture 36 per cent. The cost of the clover was not included as it is offset against the value of the manure which the feedlot will deliver to the fields for soils enrichment.

V. MARKET PROSPECTS, PRICES AND REVENUES

Market Prospects

5.01 Maize, rice and oilseeds are major food staples in Somalia, but existing production is almost exclusively for internal consumption. Maize output meets domestic needs when rainfall is good, but Somalia must import grains in dry years. Rice has always been a major import item and the country also imports vegetable oils and cotton for which it has a growing potential. The Governments wants to replace these imports with domestic produciton and to secure full self-sufficiency.

5.02 Pulses are an important part of the national diet and are grown throughout the country for local consumption. Forage is not grown commercially at the present time in spite of the fact that livestock plays an extremely important role in the national economy.

5.03 Projected demand for the selected crops in the year 1990 shows that production from the project would be equivalent to 2.5 per cent of the foreseeable national demand for maize, 5.7 per cent for rice, 18 per cent for cotton lint, 4 per cent for edible oils and 16 per cent for pulses. The project feedlot would absorb

part of the anticipated production of clover and surpluses could be sold to local livestock owners or to the nearby Trans-Juba Project. During more detailed studies, consideration should be given to the feasibility of growing long-staple cotton for export, especially if the national textile factory sets up its own cotton plantation. Similarly, export outlets could be sought for maize and pulses.

5.04 The project's production of rice, maize, cotton and sesame would be sold to the ADC, the sole authorized buyer, which has monopoly powers for the import, export, storage and national distribution of these and other national target crops. Buying prices are fixed by the SRSP Politburo and the Council of Ministers. Pulses would be sold through wholesalers and clover would be fed to the cattle in the project's feedlot in exchange for organic fertilizer.

5.05 The annual net output of the proposed feedlot would be 28,500 head of well finished cattle. Half would be exported live through Kismayu port which has the necessary free capacity. The remainder would be sold to the Kismayu meat factory for processing as chilled or frozen beef that could be exported via Kismayu's recently completed airport. Studies confirm

the existence of ready markets expecially in view of the improved quality that the project would provide.

5.06 The Government is contemplating the following capacity increases in the meat factory in direct connection with proposed livestock developments in the Lower Juba area:

	Present Capacity	Future Capacity
Canning	60,000 head	120,000 head (annually)
Chilled storage capacity	360 tons	1,000 tons
Freezing	27 tons/wk	

5.07 The factory is buying its own animals from the range. Since fattening enhances meat quality in addition to increasing weights per head, the factory may choose to draw all its future requirements from feedlots, especially for the planned chilled meat processing operations. The Trans-Juba feedlot would have a capacity of about 30,000 head per year. The Moganbo project's proposed delivery of 15,000 head is equivalent to a carcass weight of 2,700 tons, which may be easily accomodated by the chilled-storage space of the factory.

Prices

5.07 Recent information indicates that the ADC increased its prices for 1977 by an average of about 25 per cent over 1976. Project revenues have been calculated on the basis of 1977 prices:

	SoSh. per ton
Maize	750
Rice (milled)	3500
Sesame	2400
Cotton, 2/3 Grade I and 1/3 Grade II	2533

5.08 Pulses were retailing at SoSh. 4 per kg in 1977, so a farmgate price of SoSh. 2.5 per kg was assumed. As the costs of production for clover were found to be about equal to the cost of fertilizers replaced by the feedlot manure, these costs were off set.

5.09 The FAO/UNDP By-Products Utilization Project at Km 7 near Mogadishu is selling finished cattle at SoSh. 3.5 per kg liveweight and this figure was adopted for the feedlot revenue calculations.

Project Revenues

5.10 The anticipated annual revenue of the project at full operational development, i.e. as from Project Year X, is shown below.

Table 4

Anticipated Annual Project Revenue

at Full Operational Development

	Project Production (tons)	Price SoSh. per ton	Total Annual* Revenues 000 SoSh.
Crops Production			
Maize	12,025	750	9,019
Rice (milled)	2,559[1]	3500	8,957
Sesame	1,450	2400	3,480
Cotton	3,190	2533[2]	6,080
Pulses	7,830	2500	19,575
Subtotal:			49,111
Feedlot			
Live annimals for export (heads)	14,250	1,200	17,100
Kismayu Meat Factory (heads)	14,250	1,225	17,456
			34,556
Total Annual Revenue:			83,667

[1] One ton paddy rice = 670 kg milled rice

[2] Assuming 2/3 Grade I and 1/3 Grade II

[3] Assuming SoSh. 25 per ton for export duties

*rounded

VI ECONOMIC JUSTIFICATION AND BENEFITS

Benefits

6.01 Benefits derived from the project fall into three classes: economic, value added and intangible. The economic ratio of benefit to cost, using 6 per cent interest, would be 1.296, and using 8 per cent would be 1.223. The value added is computed to be SoSh.174,807,000.

6.02 Intangible benefits include the added stability of food supply, improvement in the foreign exchange position of the country, the providing of jobs for people and the added step toward national economic independence.

Economic Justification

6.03 The internal financial rate of return has been computed at 15.1 per cent. The economic rate of return is 16.2 per cent.

Sensitivity

6.04 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
1. Two year delay in implementation	14.1 %
2. 20% increase in construction costs	12.6 %
3. 20% increase in production costs	10.9 %
4. Two year delay in planned yield levels	14.0 %
5. Full production achieved one year early	15.8
6. 10% reduction in construction costs	16.4 %
7. 10% increase in crop prices	16.8 %
8. 20% increase in production costs, cattle purchases unchanged	12.4 %
9. Combination 20% increase in capital and and operating costs and 10% increase in farm prices with cattle unchanged	11.9 %
10. Combination of 20% increase in production costs including cattle purchase, 20% increase in capital costs, and 10% increase in prices received	10.6 %

TABLE 5

SOMALIA

MOGANBO IRRIGATION PROJECT

Payback Period (Assuming No Interest During Grace Period) 000 SoSh.

Year	Amount of loan to recover deficit	Total Deficit	Interest at end of year at 6%	Surplus	Net Deficit
1	3967				
2	35298				
3	34791				
4	28876				
5	16991				
6	10302				
Subtotal	129225				
7		129225	7753	5512	131466
8		131466	7888	31867	107487
9		107487	6449	33493	80443
10		80443	4826	37162	48107
11		48107	2886	22703	28290
12		28290	1697	36683	(6696)

VII ORGANIZATION AND MANAGEMENT

7.01 The project would be operated as a production-oriented government state farm. Although it would be placed under the Ministry of Agriculture it would function as a fully autonomous production unit under the direction of the Farm Manager. The organizational principle is based on optimal mechanization with the maximum use of labor wherever manual operations would be efficient. Permanent settlement of laborers would be encouraged through the provision of housing in the project.

7.02 The Farm Manager would have direct responsibility for the successful operation of the project including marketing of production. He should not only be trained and experienced in crop production but also have a sound managerial background. He would be assisted by four village managers, each assigned to a specific area of the project, a feedlot manager and an irrigation manager.

7.03 As from Project Year II and for five years thereafter, the Farm Manager would be assisted by an expatriate advisor expert in farm management. Expatriate

advisors would be assigned for three years to the village managers, the feedlot manager, and the irrigation systems manager to assist in starting operations on a sound basis. A master mechanic for three years and an expert in pumping and power plant operation for two months would complete the expatriate staff requirements.

7.04 Direct liaisons would be established between the village managers and the irrigation systems manager for water deliveries, systems maintenance timing, etc. Similarly, the village managers and the feedlot manager would work out the schedules for the delivery of clover and crop residues to the feedlot, and the provision of manure to the fields undergoing land preparation prior to planting. The Farm Manager would supervise all operations and his decisions would be final.

Incentives

7.05 The success of a production-oriented project depends on the type of incentives offered. Such incentives may take the form of profit-sharing bonuses in proportion to annual earnings, or they may involve fringe benefits such as housing or produce grants,

salary adjustments, etc. Laborers might be engaged for a basic wage well below the minimum wage level with additional payments based on performance, reliability, etc. A detailed incentive program should be drawn up during the design phase and empirically improved as the project develops.