

This report was prepared for use within the Bank and its affiliated organizations. They do not accept responsibility for its accuracy or completeness. The report may not be published nor may it be quoted as representing their views.

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT  
INTERNATIONAL DEVELOPMENT ASSOCIATION

---

HUMERA  
AGRICULTURE DEVELOPMENT PROJECT  
ETHIOPIA

April 7, 1970

Agriculture Projects Department

### CURRENCY EQUIVALENTS

US\$1.00	=	Ethiopian dollars (E\$) 2.50
E\$1.00	=	US\$0.40
E\$1 million	=	US\$4,00,000

### WEIGHTS AND MEASURES

(Metric System)

1 meter (m)	=	3.28 feet
1 kilometer (km)	=	0.62 miles
1 hectare (ha)	=	2.47 acres (ac)
1 kilogram (kg)	=	2.20 pounds (lb)
1 quintal (100 kg)	=	220.46 pounds
1 metric ton (m ton)	=	0.98 long ton (lg ton)

### ABBREVIATIONS

IEG = Imperial Ethiopian Government  
IHA = Imperial Highways Authority

# HUMERA AGRICULTURE DEVELOPMENT PROJECT

## ETHIOPIA

### TABLE OF CONTENTS

	<u>Page No.</u>
SUMMARY AND CONCLUSIONS .....	1
I. INTRODUCTION .....	1
II. BACKGROUND .....	1
III. DEVELOPMENT OF MECHANIZED FARMING IN THE NORTHWEST LOWLANDS .....	2
IV. THE PROJECT AREA .....	5
Population .....	5
Settlement .....	5
Soils .....	5
Climate .....	6
Water Supply .....	6
Communications .....	6
V. THE PROJECT .....	7
A. Description .....	7
B. Detailed Features .....	8
Improvement of Communications .....	8
Humera Water Supply .....	8
Demonstration Farm .....	9
Preparation of Second Phase Investment Project .....	9
C. Cost Estimates and Financial Arrangements ...	10
Cost Estimates .....	10
Financing .....	12
Procurement .....	13
Disbursement .....	13

---

This report is based on the findings of a Bank Appraisal Mission to Ethiopia in April/May 1969, composed of Messrs. M. van Gent, A. Denness and M. Palein, and assisted by Mr. F. Reid of PMEA.

TABLE OF CONTENTS (Continued)

	<u>Page No.</u>
VI. ORGANIZATION AND MANAGEMENT .....	14
VII. ECONOMIC EVALUATION .....	16
A. Roads and Bridges .....	16
B. Project Farm and Extension Services .....	17
C. Humera Water Supply .....	17
D. Preparation of Second Phase Investment Project .....	18
VIII. RECOMMENDATIONS .....	18

ANNEXES

1. COST ESTIMATES

- Table 1: Road and Bridges
- 2: Project Farm
- 3: Water Supply
- 4: Studies

2. IMPROVEMENT OF COMMUNICATIONS

- Table 1: Equipment Required for Construction
- 2: Estimates of Total Production and Produce Transported  
    Through Tessenei
- 3: Tekkezie Bridge - Economic Savings
- 4: Rate of Return Calculation

3. HUMERA WATER SUPPLY

- Table 1: Operation and Maintenance
- 2: Application and Source of Funds

4. ORGANIZATION OF THE MINISTRY OF AGRICULTURE

- Table 1: Machinery Required for Project Farm

5. PRE-INVESTMENT STUDIES

MAP

# HUMERA AGRICULTURAL DEVELOPMENT PROJECT

## ETHIOPIA

### APPRAISAL REPORT

#### SUMMARY AND CONCLUSIONS

i. This report contains the appraisal of a project which would be the first phase of a program of regional agricultural development in the northwest lowlands of Ethiopia. A Development Credit of US\$3.1 million equivalent is proposed.

ii. Agriculture produced some 95% of Ethiopia's exports in 1968, of which arabica coffee accounted for nearly 60%. A large proportion of Ethiopia's population lives in highland areas where pressure on the land precludes any large and rapid increase in agricultural production, and indications are that the country may face serious problems through inadequate supplies of food products due to rapid population growth. There is thus a vital need to develop suitable low populated areas for the production of food, as well as export and import-substitute crops.

iii. Regional agricultural development has priority in Ethiopia's development plans. A credit of US\$3.5 million equivalent was approved by IDA in October 1969 for Ethiopia's second regional development project (The Wolamo Agricultural Development Project), in the south of the country. The initial project of this type is being financed by the Swedish International Development Authority in another region of the country.

iv. The northwest lowlands, extends over some 1.6 million ha, of which about 320,000 ha of Government owned land is believed to be suitable for the mechanized production of rainfed sorghum, cotton, and sesame. Spontaneous development has already brought about 100,000 ha under cultivation, but the stage has been reached when large scale infrastructural improvements are required if the pace of development is to be sustained. The proposed project includes:

- construction of a main access road to the region;
- completion of a demonstration farm;
- construction of a water supply system for the region's administrative center;
- preparation in detail of an investment project for a second phase of the development program which, in particular, would be aimed at extending the area under cultivation and at improving productivity; and the studies precedent to this.

The total cost of the project would be US\$4.4 million. Foreign exchange costs are estimated at US\$3.1 million or 70%. United Kingdom Technical Assistance would provide the aerial photography needed for preparation of the investment project.

v. The project would be carried out by the Imperial Ethiopian Government (IEG) through the Ministries of Agriculture and Interior, and the Imperial Highways Authority (IHA). Project actions would be coordinated by the planning unit of the Ministry of Agriculture.

vi. The project, through its road and water supply elements alone, would have the immediate impact of significantly increasing agricultural production in the northwest lowlands, and thus of improving Ethiopia's agricultural economy. The demonstration farm would bring technical advances to a farming community presently using outdated methods in its crop production, and thus would lead to improvements in productivity. The investment and development project that would be prepared would have the capacity, when implemented, to bring about major increases in agricultural production and productivity in the northwest lowlands within the next decade. The estimated economic rate of return from investment in the road is 16%. While an economic rate of return has not been calculated for the water supply system it would provide consumers with water at a cost of about 8% of the charges they now pay, and yield a financial rate of return of about 11%. While prerequisites for subsequent development, no quantification has been attempted of the economic benefits of the demonstration farm and project preparation.

vii. The project would be suitable for a credit of US\$3.1 million which would cover 70% of project costs. This would finance an amount equivalent to the estimated foreign exchange costs of the project, but excluding about US\$16,000 financed by bilateral aid. International competitive bidding would be employed to procure goods estimated at \$1.6 million (excluding contingencies). In addition, goods with an estimated foreign exchange cost of \$0.5 million would be procured under acceptable local tender procedures. The remainder of the credit amount is allocated for supervisory staff, consultants services, and contingencies.

# HUMERA AGRICULTURAL DEVELOPMENT PROJECT

## ETHIOPIA

### I. INTRODUCTION

1.01 The Imperial Ethiopian Government (IEG) has applied for a credit to assist in financing the first phase of Humera Agricultural Development Project - a project aimed at developing mechanized agriculture in the northwest lowland region of the country.

1.02 The project which is the subject of this report, would provide support for existing development started by private commercial farmers. It would do so by improving communications, water supplies, and provision of a demonstration farm. The project would include also, the preparation of a second phase project, and the studies needed for such preparation, which would be concerned directly with the further development of mechanized farming in the northwest lowland region.

1.03 The project was prepared by Government with assistance from the FAO/IBRD Cooperative Program. FAO/IBRD project identification and preparation missions visited the project area in April 1968 and December 1968. This report is based on the findings of a Bank appraisal mission, composed of Messrs. M. van Gent, A. Denness and M. Palein which visited Ethiopia in April 1969. On the road element of the project the appraisal mission was assisted in Ethiopia by Mr. F. Reid of the Bank's Permanent Mission to Eastern Africa. Mr. Seidel, consultant to the Bank, visited Ethiopia to examine the water supply proposals in September 1969.

1.04 In October 1969, IDA approved a credit of US\$3.5 million to Ethiopia for an agricultural development project in the Wolamo area. Previous Bank group finance for agriculture in Ethiopia has been restricted to provisions of small amounts for agricultural credit under two loans, totalling US\$4,000,000 made in 1950 and 1961 to the Development Bank of Ethiopia.

### II. BACKGROUND

2.01 Ethiopia covers about 122 million km<sup>2</sup>, and lies between 34° and 48° longitude and 3° and 18° latitude. Climate is determined by the altitude of the hills and high plateaux of the Ethiopian massif, which rises to 4,620 m and is dissected by the Rift Valley. To the west, the massif falls away to the foothills and clay plains of the northwest lowlands where the project area is located. Rainfall increases from north to south, from a minimum of 250-300 mm in the northeast region near the Red Sea, to the very high rainfalls (above 1,000 m) of the mountainous plateaux of the southwest.

2.02 Ethiopia is an agricultural country, and about 90% of about 24 million population are engaged in agriculture. At present population is increasing at a rate of over 2% per annum. Recent studies show that about 45% of the population is 14 years of age or less; this, coupled with an anticipated reduction in infant mortality, will lead to even more rapid population growth in the near future and soon the country may face serious problems of food supply.

2.03 Population density is irregular. In the highlands it is over 210 people per km<sup>2</sup>, and less than 0.2 ha of cultivable land per capita is available. This situation emphasizes the vital need to develop new and less densely populated areas for the production of food, export, and import substitution crops.

2.04 In 1967/68 GDP totaled US\$1.4 billion equivalent, and of this agriculture accounted for about 60%. In 1968 agriculture generated about 95% of total exports which were valued at US\$106 million. Coffee accounts for about 58% of exports; and oilseeds, particularly sesame, and hides and skins share second place, each with 9%. Although Ethiopia could easily produce more coffee, its quota, set by the International Coffee Organization, prevents significant increases of exports. There is thus an urgent need to diversify agricultural production. The evolution by Ethiopian private enterprise of large scale mechanized rainfed farming in the lowlands of the northwest is an encouraging development for the Ethiopian economy. The further development of this mechanized farming presents opportunities for increasing foreign exchange earnings, improving food supplies, and providing raw materials, such as cotton, for Ethiopia's developing industries.

### III. DEVELOPMENT OF MECHANIZED FARMING IN THE NORTHWEST LOWLANDS

3.01 Mechanized farming began in the northwest lowlands in 1954. It started through the initiative of private entrepreneurs and subsequently has been developed by them. Government's role has been confined to the allocation of land to farmers, and to the general administration of the area. Early development was slow, but between 1963 and 1968 there was rapid expansion. By 1968, over 400 tractors were in use and about 100,000 ha of land were under cultivation. Despite poor communications and a general lack of facilities, tractor dealers have either set up workshops, or appointed dealers to hold stocks of fast moving spares at Humera, and the service and spares situation for farm tractors is satisfactory.

3.02 The farming system is extensive, and based on low input and low outputs per unit of land. Many of the farmers and their laborers come from cities and neighboring highland areas and live on the farms only during the crop season. Farmers cultivate and plant maximum acreages at minimum cost by using modern tractor drawn equipment, but weeding and harvesting are not mechanized. Fertilizers and pesticides are not used,



although cotton pests are becoming a greater problem as the area under cotton cultivation increases. As yields increase through the use of improved machinery, better weeding, and new varieties, economic responses to fertilizer would be achievable.

3.03 Sorghum, sesame and cotton are the principal crops. Cultivation begins after the early rains have produced a reasonable growth of weeds. The land is then rapidly cultivated with a wide level disc harrow usually pulled by a 70 drawbar hp tractor. A second harrowing is carried out after fourteen days and seed sown by hand. Because speed is essential, standards of seedbed cultivation are poor and with poor seed and uneven sowing, yields are of necessity low.

3.04 All crops are harvested by hand, and until suitable machines and new varieties become available there will continue to be a peak demand for labor during the sesame and cotton harvests in November and December. Sorghum presents few problems as the harvest can be prolonged into the dry season.

3.05 No accurate data are available for crop yields, and the following estimates were made after considering ecological conditions, crop stands, farmers' opinions, and the experience of farming under similar conditions in Sudan:

ESTIMATED YIELDS OF MAJOR CROPS

Sesame	300 kg/ha
Sorghum	800 kg/ha
Cotton	300 kg/ha

Yield increases beyond the above levels are considered possible and could be obtained by the use of improved seed sown mechanically in rows so that weeding could be partially mechanized. Additional yield increases could be achieved through pest control and by the use of fertilizers and improved crop rotations.

3.06 Crops are not processed in the northwest lowlands. Seed cotton is ginned at Asmara (480 km from Humera). Sorghum, surplus to the requirements of the project areas - about 18,000 ton per annum - is marketed in Asmara.

3.07 Land in the mechanized farming areas is owned by the Government, and present occupiers have been allocated land by the Governor of the Woreda (District) under a system of annual permits. However, no titles or leases have been issued, and the only condition of occupation is that the occupier agrees to pay education and health taxes. As a result, farmers' rights to the land are not defined, there is no incentive for them

to invest in permanent improvements, and land cannot be used as a collateral for the credit most farmers need, to carry out improvements. Government is aware of the problem, and was informed during negotiations that satisfactory arrangements for the granting of long-term leases to farmers would be a requirement for any lending for a second stage project.

3.08 Farmers have the following three sources of credit:

- the Development Bank of Ethiopia, which by requiring 200% collateral in the form of real estate is seriously restricted in its lending activities;
- farm machinery dealers, whose volume of lending is limited; and
- local traders, who make cash advances against standing crops at times when labor must be hired for weeding and harvesting. Farmers frequently have no option but to borrow from such traders whose rates of interest are usurious.

3.09 A multi-purpose agricultural cooperative has been registered at Humera. At the time of appraisal, the society comprised about 100 farmers - about 33% of all farmers in the area - who have subscribed E \$36,000 (US\$14,400). The society is closely supervised by the Ministry of National Community Development and Social Affairs, which has stationed staff in Humera for the purpose. The cooperative offers its members short-term credit facilities, and purchases and markets members' crops. The establishment of a cotton ginnery by the society is being considered. This, if feasible, would provide an improved channel for providing credit, and for distributing the seed of improved cotton varieties.

3.10 The region's mechanized farms make a significant contribution to the economy of Ethiopia. Accurate data are not available but Customs receipts <sup>1/</sup> indicate that in 1968 mechanized farms in the region produced the following:

PRODUCTION FROM MECHANIZED FARMS, 1968

	Area Cultivated '000 ha	Average Yield q/ha	Total Production tons	Total Farm Gate Value E\$'000	Value/ha E\$
Sesame	45) Based on ) yield esti-	3	13,500	5,573	124
Sorghum	30) mates ex- ) plained in	8	24,000	1,382	46
Cotton	25) para. 3.05	3	7,500	3,960	158

<sup>1/</sup> Before leaving the region all trucks are required to visit a Customs post, and obtain a receipt detailing freight being carried.

3.11 Regional sesame exports in 1968 earned about US\$2.8 million in foreign exchange, equivalent to 2.4% of Ethiopia's total agricultural exports in terms of value. Cotton production, mostly ginned at Asmara, was equivalent in 1967 to 3.5 thousand tons of fiber, or 50% of all cotton ginned in Ethiopia in that year. The region could supply an increasingly significant amount of the cotton fiber requirements of Ethiopia's textile mills which are now dependent on imports for supplies. This would release irrigated land for the production of long staple cotton, for which a ready export market exists. Sorghum produced in the northwest lowlands already has lowered food prices both in Asmara, and in the depressed northern areas of Tigre, Eritrea and northern Wallo, where historically, shortage of food has been a constant source of poverty and civil strife.

#### IV. THE PROJECT AREA

4.01 The project is located in the middle reaches of the northwest lowlands, lying at elevations of between 450 and 700 m. Humera, the government's administrative center is situated roughly in the center of the project area (see Map).

##### Population

4.02 A population census of the project area has not been carried out. Population density is believed to be below the national average of 19 per km<sup>2</sup> but increasing steadily as development proceeds. Nonetheless the resident population is inadequate to provide sufficient labor for the mechanized farms which have developed in the area. Consequently, during sowing, weeding and harvesting periods, large numbers of migrant laborers - an estimated 60,000 in 1968 - enter the region from Ethiopia's depressed northern provinces.

##### Settlement

4.03 The region is in a pioneer stage of development, and significant settlement has so far been restricted to the townships of Om Hagar and Humera, and a few villages sited near permanent sources of water. The majority of the area's farmers are absentee landlords who live in the area only during the cropping seasons. Investment in the form of permanent houses, and farm equipment and road vehicle workshops, is increasing in Humera, however, and living conditions in the town are slowly improving. Medical facilities remain very scarce, and enteric diseases flourish due to contaminated drinking water supplies.

##### Soils

4.04 Soils of the project area are largely homogenous, and consist of alluvial grey-black to brown-colored heavy clays. Containing more than 50% clay, the soils are low in organic matter, are impervious when

wet, and crack deeply when dry. Soil total nitrogen contents are generally satisfactory for the yield levels obtained in the area and reserves of potash adequate; phosphorous contents are low, however, and experience elsewhere with similar soils indicates that economic responses probably would be obtained from the use of phosphatic fertilizers.

#### Climate

4.05 Temperatures are high throughout the year, reaching a maximum of over 50°C in April. Annual rainfall, which increases southwards, varies between 500 and 800 mm and occurs mainly in the months of June through October, with the highest precipitation levels in July and August. Rain falling prior to June, and after October is insignificant for agricultural purposes. The average rainfall is sufficient to sustain yields considerably above present levels.

#### Water Supply

4.06 The only sources of surface water are the region's widely spaced rivers and streams, most of which dry up during the dry season. Ground water resources have not been thoroughly prospected but are believed to be very limited. Consequently, for much of the year, water is hauled over long distances to the area's farms - up to 70 km in many cases - usually in tanks mounted on tractor pulled trailers. Water for Humera township, and many farms, is drawn from the Tekkezie River and distributed in bags on donkeys. Water from these surface sources is heavily contaminated, and the general level of health and ability to work is seriously reduced by water borne enteric diseases. A supply of clean drinking water for Humera and its nearby farms would do much to improve general health, and would provide added incentive for people to settle permanently in the town.

4.07 Recently an alternative water supply for Humera has been identified and investigated. This is the aquifer which underlies the town. Test pumpings of two recently constructed tubewells showed a production of 800 m<sup>3</sup> in 20 hours pumping. These two wells, together with two new tubewells, would provide sufficient water to meet the present requirements of Humera - about 1,500 m<sup>3</sup> per day. The development of this supply would form part of the project.

#### Communications

4.08 The area is served by 360 km of all weather road from Asmara to Tessenei, and by 120 km of rudimentary dry weather road from Tessenei to Humera (see Map). This latter section of the road is impassable to wheeled traffic between June and October, but is the only outlet from the project area to the cotton ginneries and grain markets of Asmara, and to the port of Masawa. The recent construction of an all-weather airfield at Humera, which was financed by private subscription, has improved wet season access to the project area, and has improved significantly the supply of farm tractor spares.

4.09 The bulk of future agricultural development will occur south of the Tekkezie River, but communications to this area are difficult because a narrow bridge across the river which was built in 1936 was partly destroyed in 1941, and has never been rebuilt. The area is almost completely cut off between June and September when the river is in full flood, and from October to January (the period of sesame and cotton harvests) transport of crops and goods across the river is possible only by camel or boat. The government has awarded a contract for the construction of a single lane bridge (see paragraph 5.17), which would be built on the existing pillars of the old bridge. These pillars are sound and adequate for the purpose.

4.11 South of the Tekkezie River roads are very poor, and freight transport impossible during the June through September wet season. Moreover the east-west courses of the Royan and Angareb rivers (see Map) create additional obstacles to north-south freight movement since these rivers cannot be forded for the greater part of the year. Extension of farming activity south of the Tekkezie River will require the bridging of these rivers and construction of a new system of feeder roads.

## V. THE PROJECT

### A. Description

5.01 The project would be the first phase of a program to establish the infrastructure and institutions required to enable the development of about 320,000 ha of land for mechanized agriculture in the northwest lowlands of Ethiopia. The project comprises actions to remove the constraints on further spontaneous development by commercial farmers, and the studies needed to provide data for the preparation of a second phase project. The Project would include:

- improvement of communications between Tessenei and the Royan river by the construction of about 120 km of all weather roads, and by bridging the Tekkezie River;
- construction of a water supply for the township of Humera. This would supply about 30,000 people with clean drinking water dispensed from public hydrants;
- completion of a demonstration farm including the improvement of agricultural extension services; and
- preparation in detail of an investment project for the project area which would be aimed at extending the area under cultivation and at improving productivity; and the studies precedent to this, including:

- (a) aerial photography and photomosaics;
- (b) soil survey and land use classification;
- (c) agro-economic survey;
- (d) credit, marketing and processing study;
- (e) road engineering of 200 km of new feeder roads; and
- (f) preparation of a master plan for the agricultural development of the northwest lowlands.

## B. Detailed Features

### Improvement of Communications

5.02 The existing dry season track from Tessenei to Humera, see Map, would be upgraded to gravel standards and be continued a further 17 km south of Humera to the Royan river. An additional 10 km of road would provide access to, and a main internal road for the project farm. The road has been designed to carry truck and trailer units with a gross loaded weight of about 32 tons and a maximum axle load of 11 tons. In the relatively flat terrain traversed, design speeds of 100 km.p.h. can be adopted without increasing cost. The overall width of the road, including shoulders, would be 6.0 m; the pavement structure would be graded sub-soil capped with gravel 6.0 m wide and 20 cm thick, and appropriate to carry expected traffic loads and volume. In areas of black cotton soil the top 15 cm would be stabilized with river sand, and fords or culverts would be built at minor stream and river crossings. These standards are considered adequate for the traffic envisaged on the proposed road. Assurances were obtained during negotiations that the road would be constructed to these standards and would be maintained thereafter by IHA and that appropriate measures for weight control of the vehicles would be taken.

5.03 The proposed road would cross four main rivers which would be bridged. Bailey bridges suitably reinforced to provide a load capacity of 37 tons, would be built over the Saubumaye, Geludji and Royan rivers. At the Tekkezie River, a single lane, reinforced concrete deck bridge would be built on existing pillars; designed by IHA it would consist of a single carriageway 206 m long and 3.5 m wide. Further details of road and bridge construction are given in Annex 2.

### Humera Water Supply

5.04 Two tubewells would be installed and energized. With the two existing wells they would supply the maximum daily requirement of clean drinking water. The four tubewells would be linked to reservoirs capable

of storing 8 hours pumping. Water would be distributed through a pipeline to ten water fountains placed at strategic points throughout the town. The system is essentially a rural water supply, with everyone served by public hydrants and with facilities designed to permit bulk suppliers to take water for transport to surrounding farms.

#### Demonstration Farm

5.05 Land suitable for a project demonstration farm has been acquired by the Government five miles south of Humera. About 300 ha have been cleared and some machinery has been purchased. However, more staffing, housing, machinery, and improved infrastructure are required.

5.06 The project would provide housing for a farm manager, extension officer and two experimental recorders. Farm buildings including an office, store and workshops would be constructed, and farm implements purchased for farm operations and demonstrations and investigational purposes. The farm would also serve as a base for the preparation of the second phase investment project. Details are given in Annex 4. Finance would be required to meet the farm's administrative expenditures for the first 30 months of operation, by the end of which development would be complete. Assurances were obtained from the Government that thereafter adequate funds would be provided under the budget to enable the efficient operation of the farm.

#### Preparation of Second Phase Investment Project

5.07 Aerial Photography and Photomosaics. As part of the United Kingdom's technical assistance to Ethiopia, an area of 800,000 ha in the northwestern lowlands region of Ethiopia would be photographed in color on a scale of 1:20,000 in order to facilitate preparation of a second stage project. Ground control data for site location and the preparation of 1:20,000 photomosaics with a maximum error of 2% in horizontal measurement, would be provided under the project by consultants.

5.08 Because aerial photography is an essential prerequisite to further planning, it would be a condition of effectiveness of this loan that photographs of a quality satisfactory to the Association had been obtained, to permit preparation of accurate photomosaics.

5.09 Soil Survey and Land Use Classification. Details of all land suitable for cultivation within the project area would be surveyed. Soil profiles would be described; samples subjected to laboratory analysis; vegetation, topographical and land use features recorded; and land classification maps prepared.

5.10 Agro-Economic Survey. Basic technical, economic, and social data of the people and farming systems in the project area would be surveyed. Data obtained would enable rational recommendations to be made for the future development of agriculture in the project area. Studies of this type have not been made previously in the project area.

5.11 Credit, Marketing and Processing Study. The needs for both short and medium-term agricultural credit would be studied and recommendations made on possible sources of credit. Alternatives for oil seed processing and cotton ginning in the project area would be evaluated, and domestic and export markets reviewed for all crops.

5.12 Road Engineering. The bulk of future farm development will occur south of the Royan river, and about 200 km of new feeder roads would be required to serve this area. The alignment and design of such new roads, construction of which would form part of a subsequent Phase II of the project, would be determined.

5.13 Master Plan and Investment Project. The studies outlined above would provide the data required for preparing a comprehensive plan for the development of the area, and for a second phase investment project within its framework. The second phase project would include improvements in crop marketing and processing, agricultural credit, technical services, land registration, and a new feeder road system.

5.14 Detailed descriptions of the studies, and project preparation work are given in Annex 5.

### C. Cost Estimates and Financial Arrangements

#### Cost Estimates

5.15 Estimated project costs total E\$ 10.9 million (US\$4.4 million) of which the foreign exchange component is about E\$ 7.7 million (US\$3.1 million) or 70%. The breakdown of costs is given in detail in Annex 1 and is summarized in the following Table.



SUMMARY TABLE OF PROJECT COSTS

	E\$ '000			US\$ '000			%
	Local	Foreign	Total	Local	Foreign	Total	
<u>Road and Bridges</u>							
Mechanical Equipment	-	3,482	3,482	-	1,393	1,393	100
Labor	924	-	924	370	-	370	0
Materials-Fuel-Oil	375	500	875	150	200	350	57
Minor Bridges and Drainage	265	321	586	106	129	235	55
Tekkezle Bridge	200	200	400	80	80	160	50
Supervision	262	363	625	105	145	250	58
Subtotal	<u>2,026</u>	<u>4,866</u>	<u>6,892</u>	<u>811</u>	<u>1,947</u>	<u>2,758</u>	<u>71</u>
<u>Project Farm</u>							
Roads and Buildings	135	61	196	54	24	78	30
Machinery and Vehicles	-	174	174	-	70	70	100
Salaries and Wages	200	124	324	80	50	130	38
Farm Inputs	30	51	81	12	20	32	62
Subtotal	<u>365</u>	<u>410</u>	<u>775</u>	<u>146</u>	<u>164</u>	<u>310</u>	<u>53</u>
<u>Water Supply</u>							
Wells and Pumping Sets	15	80	95	6	32	38	84
Distribution System	52	255	307	21	102	123	82
Subtotal	<u>67</u>	<u>335</u>	<u>402</u>	<u>27</u>	<u>134</u>	<u>161</u>	<u>83</u>
<u>Studies</u>							
Ground Control and							
Photo Mosaics	10	112	122	4	45	49	91
Soil Survey	31	95	126	13	38	51	74
Agro-Economic Survey	67	150	217	27	60	87	68
Marketing, Credit Study	15	63	78	6	25	31	80
Road Engineering Study	15	55	70	6	22	28	78
Preparation Master Plan	10	64	74	4	25	29	86
Subtotal	<u>148</u>	<u>539</u>	<u>687</u>	<u>60</u>	<u>215</u>	<u>275</u>	<u>78</u>
TOTAL	<u>2,606</u>	<u>6,150</u>	<u>8,756</u>	<u>1044</u>	<u>2,460</u>	<u>3,504</u>	<u>70</u>
<u>Contingencies and Price Escalation</u>							
Escalation	614	1,480	2,094	246	592	838	71
TOTAL	<u>3,200</u>	<u>7,630</u>	<u>10,850</u>	<u>1,290</u>	<u>3,052</u>	<u>4,342</u>	<u>70</u>
Aerial Photography (UK)	-	40	40	-	16	16	100
GRAND TOTAL	<u>3,220</u>	<u>7,670</u>	<u>10,890</u>	<u>1,290</u>	<u>3,068</u>	<u>4,358</u>	<u>70</u>

5.16 Cost estimates for the proposed road works are based on experience gained in carrying out other Bank financed road construction projects in Ethiopia. Taking into account contingency allowances of 15% on physical quantities, and 10% for price escalation during the construction period of about 30 months, costs are equivalent to about E\$ 46,250/km of road (US\$18,500). The foreign exchange component of road construction costs is about 73%, and includes the full capital cost of road construction equipment (US\$1.39 million). Only the cost of equipment depreciation during construction (US\$0.58 million) has been used in the economic evaluation. The residual value of the equipment (US\$0.81 million) would be available for road maintenance in the region and for additional road construction under the second phase of project development.

5.17 The cost of the Tekkezie bridge, about E\$ 400,000 (US\$160,000), is based on actual bids received by IHA from reputable local contractors under local competitive bidding. The cost of purchasing, erecting, and strengthening Bailey bridges over the Royan, Saubumaye, and Geludji rivers is estimated by IHA at about E\$ 272,000 (US\$109,000); this is a reasonable cost estimate.

5.18 Costs of the Humera water supply, project farm and consultant services for the regional development studies, are based on data provided by Government, FAO, WHO and other appropriate agencies, and are comparable with the costs of similar projects in other countries. A contingency allowance of 20% has been included for the Humera water supply, 10% for the project farm, and 15% for the development studies.

#### Financing

5.19 The credit would finance an amount equivalent to the estimated foreign exchange costs of the project - US\$3.1 million and would be repayable on standard terms.

5.20 The British Government's contribution would be a grant of US\$16,000 and would comprise aerial photography of the project area. Agreement has been reached on this matter between IEG and the British Government.

5.21 The borrower would be the Imperial Ethiopian Government (IEG). Proceeds of the credit together with government's contribution from the national budget, would be made available to:

- the IHA for Road and Bridge Construction;
- the Ministry of the Interior for the Humera Water supply system; and
- the Ministry of Agriculture for project farm, second phase project preparation and studies.

5.22 A contract has been awarded for construction of the Tekkezie bridge and construction is expected to start before the proposed credit would be considered by the Board. It was important to start construction without any further delay so as to provide access to the area, and it is therefore recommended that the foreign exchange cost of the bridge (\$80,000) be retroactively financed. IHA has produced a design acceptable to the Association and has followed satisfactory tendering and bidding procedures.

#### Procurement

5.23 The procurement of all road construction equipment and Bailey bridges (US\$1.45 million), and the construction of the water supply (US\$161,000), would be on the basis of international competitive bidding. All goods required for the project farm, including machinery, vehicles, fertilizers and insecticides (totalling US\$75,000), would be procured by established Government procurement procedures since individual contracts would be too small to attract international bids, and sufficient imported farm machinery dealers exist to ensure adequate competitive bidding. Government procurement procedures are satisfactory. Construction of project farm buildings (US\$78,000) would be tendered locally as the amounts involved would preclude international bidding and several building contractors are available in the area. All other goods, for the project including fuel, and road construction materials, totalling US\$382,000 would be tendered locally. The award of local contracts would be administered by the IEG purchasing committee in accordance with procedures agreed during negotiations and designed to ensure a satisfactory degree of local competition.

#### Disbursement

5.24 Disbursement of the proposed credit would be made against 100% of the cif cost of the imported road construction equipment and Bailey bridges, and 100% of the foreign exchange costs of consultant services. For civil works contracts (water supply system, Tekkezie bridge, and project farm buildings), supervisory staff, as well as for other project items to be financed under the credit (which are likely to be procured locally - e.g. fuel, spares, road construction material and project farm inputs) reimbursement would be made on a percentage basis of 57% representing the estimated average foreign exchange component. Estimated disbursements of the credit over the three-year construction period are:

	<u>1969/70</u>	<u>1970/71</u>	<u>1971/72</u>	<u>Total</u>
	----- millions -----			
U.S. \$	1.6	.8	.7	3.1
E\$ equivalent	4.1	2.0	1.6	7.7

5.25 The IHA, the Ministry of the Interior and the Ministry of Agriculture would each keep separate accounts for the project. These would

be collated by the Ministry of Agriculture, as coordinator of the project (see para. 6.01). Project accounts would be audited annually by an independent auditor, acceptable to the Association, and would be submitted to the Association not later than six months after the closing of each financial year.

## VI. ORGANIZATION AND MANAGEMENT

6.01 This project would be completed within 2-1/2 years and would be carried out by the Imperial Highway Authority (IHA), the Ministry of the Interior (water supply section), and the Ministry of Agriculture. All project activity would be coordinated by a senior member of a planning unit recently established in the Ministry of Agriculture. Assurances were obtained during negotiations that the project coordinator appointed would be mutually acceptable to the Government and the Association. His appointment would be a condition of effectiveness. The scope and duration of the project does not warrant the formation of a separate organization for its management. In the event of a second phase project being implemented, however, such an organization would be required; and proposals for this would be developed in the course of its preparation.

6.02 IHA is an autonomous entity and is responsible for all road construction in Ethiopia, IHA would direct construction of the proposed road and the Bailey bridges. Both road and the Bailey bridges would be constructed by force account, using equipment imported for the project, which, after construction, would be used to maintain roads in the area and could also be used for further road construction if the second phase of development is undertaken. Details of this equipment are given in Annex 2. Construction work would be supervised by five experienced supervisors (probably including expatriates as IHA may not have sufficient experienced staff). The supervisors required would be (i) a senior road constructor, assisted by (ii) two field mechanics, (iii) one concrete worker, and (iv) an assistant road constructor. They would be in executive control of all local personnel necessary for the work, and would have charge of all equipment financed by the Association for the construction of the road. Assurances were obtained during negotiations that the IHA would appoint five qualified supervisors for road construction who would be satisfactory to the Association.

6.03 The Tekkezie bridge would be built by a local contractor and IHA would ensure that construction complied with design requirements.

6.04 The water supply section of the Ministry of the Interior would be responsible for completing the preliminary design and preparing the final design of the water supply system, and would arrange for contractors to install the wells and distribution system. During loan negotiations, assurances were obtained that the Ministry of the Interior would prepare the final design and submit it to the Association for approval prior to construction.

6.05 The completed water supply system would, at least initially, be operated by the Ministry of Interior, which would employ trained staff to operate and maintain the system. If Humera should later become a municipality, the Ministry of Interior would still exercise sufficient supervision of municipal operations to ensure adequate operation and maintenance of the water supply system. Water connections to individual dwellings cannot be considered until new town plans for Humera have been completed. An attendant would be appointed at each fountain to sell water to townspeople and farmers. This method of distributing drinking water is common in Ethiopia. Assurances were obtained during negotiations that the ex-fountain price of water would not be less than E\$ 0.50/m<sup>3</sup> (US\$0.20/m<sup>3</sup>). This price compares with an existing price for the delivery of contaminated river water of E\$ 6.0/m<sup>3</sup> (US\$2.40/m<sup>3</sup>). A charge of E\$ 0.50/m<sup>3</sup> would provide a substantial surplus of revenue over costs. This surplus would be paid to the central Government, as is the usual procedure for rural water supply systems financed by IEG.

6.06 In addition to coordinating all project activities the Ministry of Agriculture would be responsible for establishing and operating the project farm and for the proper implementation of the regional development surveys and studies. An organization chart of the Ministry appears at Annex 4. The project farm would be directly under the Department of Plant Production and Protection, as are other regional demonstration farms.

6.07 The Ministry of Agriculture would appoint a farm manager who would be responsible for all activities associated with the project farm. During negotiations assurance was obtained that the Farm Manager, his terms of reference and condition of employment would be mutually acceptable to the Government and the Association. His appointment would be a condition of effectiveness. The Ministry of Agriculture would transfer a senior extension officer to the project farm, who would be responsible for extension work in the project area.

6.08 About one-half of the project farm would be for demonstration purposes and would be run as a normal farm, except that methods proven in similar conditions elsewhere, such as row planting and improved varieties, would be adopted. The other half would be used, under the general guidance of the Institute of Agricultural Research, to test more advanced techniques, including the use of fertilizers and pesticides, alternative crop rotations, and the use of more sophisticated farm machinery. During negotiations assurances were obtained from the Government that a detailed development and testing program for the farm would be submitted to the Association for approval within three months of effectiveness.

6.09 Consultant services acceptable to the Association would be retained by the Ministry of Agriculture on terms and conditions satisfactory to the Association, to carry out the studies of the project area and to prepare the master plan and second phase investment project. Assurances to this effect were obtained from the Government during negotiations. Details of the required studies, and form of project preparation are given in Annex 5.

## VII. ECONOMIC EVALUATION

### A. Road and Bridges

7.01 The economic benefits of the proposed road would accrue both from reduced transport costs (road user savings), and from an increase in mechanized farming within the northwest lowlands, which would not occur in the absence of improved communications.

7.02 Presently some 140,000 ha of cultivated land (100,000 ha of mechanized farms and 40,000 ha of subsistence smallholders) produce about 57,000 tons of agricultural produce. Of this, about 15,000 tons - mainly sorghum - are consumed within the region; 40,000 tons are transported from the project area over the unimproved Humera-Tessenei road; and the remaining 2,000 tons passes out by a mountainous track to the South of the region.

7.03 Production from mechanized agriculture in the northwest lowlands increased from almost zero in 1962 to about 45,000 tons in 1968, an average annual increment of about 6,500 tons (equivalent to the production of about 14,000 ha). The pace of agricultural development in the region is now tending to slow down due to continuing poor communications, lack of suitable agricultural credit facilities, inefficient marketing arrangements, and the absence of security of tenure to holdings. It is not anticipated that spontaneous development of the area will cease if the above constraints remain in force, but that the rate of growth will slow down significantly. Consequently, in evaluating the economic benefits of the proposed road it is assumed that without it, only 8,500 ha additional would be developed each year, although during the recent period of rapid development an average of 15,000 ha were developed annually. On this basis it is estimated that traffic would increase by about 5% annually during the period 1970 through 1984 (the lifetime of the proposed road).

7.04 A properly built road surface with a compacted base would reduce vehicle time and operating costs, both for trucks and for the buses which bring in large numbers of laborers during the farming season. It is estimated that vehicle operating savings would be equivalent to E\$ 105 for each truck and trailer round trip, Asmara-Humera, and E\$ 80 for each bus trip. By 1984 vehicle operating savings would amount to about a total of E\$ 730,000 annually (see Annex 2).

7.05 Since the proposed road would provide year round access to the region, merchants in the project area would no longer need to carry stocks for the four months wet period when the existing track is closed to all traffic. Thus, there would be substantial savings from reduced inventories as shown in Annex 2, and it is estimated that by 1984 annual savings in inventories would amount to about E\$ 120,000 annually.

7.06 The establishment of year round access to the project area would stimulate increases in agricultural development beyond those that would occur without improvement of the road. It is estimated conservatively that the road would cause 1,500 ha to come into production annually over and above the 8,500 ha which would be developed whether or not the road were built. The annual net value of this production has been included in project benefits. Beginning at a rate of about E\$ 75,000 annually, it is estimated that in 1984 the annual value of production generated directly by the road would be some E\$ 1.8 million (see Annex 2).

7.07 The bridge over the Tekkezie River would generate savings by obviating the need for transshipping goods (destined for or originating in Humera), across the Tekkezie River by boat or camel, and by providing direct road access to areas South of the river, see Map. It is estimated that these savings would average about E\$ 50,000 annually, increasing to a total of E\$ 165,000 in 1982 (details are given in Annex 2). On the basis of the above quantifiable benefits the economic rate of return from constructing the Tessenei-Humera road and the Tekkezie bridge would be 16%, assuming a 12-year life for the road and giving credit for the residual value of the equipment. In addition there would be benefits which cannot be quantified; these would include the increased use of light vehicles and improved administration of the area. Should the studies and project preparation which form part of the project result, as anticipated, in the implementation of a development plan for the region, the economic rate of return from investment in the road would be greatly increased.

#### B. Project Farm and Extension Services

7.08 Benefits from completion of the demonstration farm and improvement of the agricultural extension service cannot be quantified. The scope for improving productivity in terms of land, labor and machinery units is enormous, however, and the introduction of general use of improved seed alone (varieties are available) would result in large increases in production. The development potential of the area and its farmers is substantial. Without the farm and its services this potential would not be realized expeditiously throughout the project area and the experience for the second phase project would not be available for planning purposes. While not quantifiable the project farm would be justified.

#### C. Humera Water Supply

7.09 Public health conditions in Humera are very poor and medical facilities scarce. Enteric diseases flourish, and a supply of clean drinking water would do much to alleviate this problem both in Humera and its surrounding farms. It would also give further encouragement

to permanent settlement in Humera. While no attempt has been made to quantify economic benefits the water supply would provide sufficient revenue to cover management and amortization costs; and the financial rate of return from the investment would be about 11% (see Annex 3).

D. Preparation of Second Phase Investment Project

7.10 Insufficient data is available to plan a detailed investment program for future development of the northwest lowlands. The impressive spontaneous development that has occurred already is indicative of the development opportunities existing in the region. The proposed studies would systematically prepare for the full exploitation of these opportunities, and in view of the existing experience they seem fully justified.

VIII. RECOMMENDATIONS

8.01 During credit negotiations agreement was reached on the following points:

- (a) IHA would build the project road to the agreed standards, would maintain it thereafter, and take appropriate measures for weight control of vehicles (para. 5.02).
- (b) Procedures adequate to ensure a satisfactory degree of competition for award of local contracts would be employed (para. 5.23).
- (c) The Ministry of the Interior would prepare the final design of the water distribution system and submit it to the Association for approval prior to construction (para. 6.04).
- (d) The IEG would prepare a development and testing program for the project farm and submit it to the Association for approval within three months of credit effectiveness (para. 6.08).
- (e) The Ministry of Agriculture would retain consultants acceptable to the Association on terms and conditions satisfactory to the Association to carry out the studies of the project area and to prepare the master plan and second phase investment project (para. 6.09).

8.02 Conditions of effectiveness of the credit should be that:



- (a) Aerial photographs of a quality satisfactory to the Association had been obtained for an area of approximately 800,000 ha in the northwestern lowlands region of Ethiopia (paras. 5.07, 5.08).
- (b) The manager of the Project Farm, and the Project Coordinator had been appointed (paras. 6.01, 6.07).

8.03 With the indicated assurances, the project would be suitable for a Development Credit of US\$3.1 million, on standard terms.



ETHIOPIA  
HUMERA AGRICULTURAL DEVELOPMENT PROJECT  
ROAD AND BRIDGES  
COST ESTIMATES

	TOTAL COST		DEVELOPMENT PHASING			FOREIGN EXCHANGE US\$
	E\$	US\$	YEARS			
			1	2	3	
			E\$			
1. MECHANICAL EQUIPMENT	3,481,780	1,392,712	3,481,780			1,392,712
2. ROAD WORKS						
(a) Labor	924,260	369,704	124,260	400,000	400,000	
(b) Materials - Fuel oil	875,000	350,000	75,000	400,000	400,000	200,000
3. BRIDGES AND DRAINAGE						
(a) Tekkezie bridge	400,000	160,000	400,000			80,000
(b) Saubumaye, Geludji & Royan bridges						
(i) Bridging Materials	143,066	57,226		87,018	56,048	57,226
(ii) Reinforcement	25,871	10,348		15,117	10,754	9,000
(iii) Transport and Erection	102,500	41,000		64,500	38,000	2,400
(c) Minor Drainage	315,000	126,000		165,000	150,000	60,000
4. SUPERVISION	625,000	250,000	125,000	250,000	250,000	145,000
Contingencies 15%	1,033,872	413,549	630,906	207,245	195,720	291,951
Sub-Total	7,926,349	3,170,539	4,836,946	1,588,880	1,500,522	2,238,289
Price Escalation 10%	792,635	317,054	483,695	158,888	150,052	223,829
TOTAL	8,718,984	3,487,593	5,320,641	1,747,768	1,650,574	2,462,118

October 21, 1969

ETHIOPIA

HUMERA AGRICULTURAL DEVELOPMENT PROJECT

PROJECT FARM

COST ESTIMATES

	UNITS	UNIT COST E\$	TOTAL COST		DEVELOPMENT PHASING YEARS			FOREIGN EXCHANGE US\$
			E\$	US\$	1	2	3	
			-----E\$-----					
<b>A. INVESTMENTS</b>								
1. Fences (m)	3,500	3.5	12,250	4,900	-	6,250	6,000	2,450
2. Roads			10,000	4,000	-	6,000	4,000	2,400
3. Water Supplies								
(a) Borehole and Pumps	1		15,000	6,000	10,000	5,000	-	5,400
(b) Pipes and Fittings			4,000	1,600	4,000	-	-	1,440
4. Land Clearing			6,000	2,400	-	3,000	3,000	-
5. Constructions								
(a) Manager's House			30,800	12,320	-	30,800	-	2,464
(b) Extension Officer's House			22,400	8,960	-	22,400	-	1,792
(c) Staff Houses	3	9,000	27,000	10,800	-	18,000	9,000	2,160
(d) Guest Houses			12,500	5,000	12,500	-	-	1,000
(e) Office Block			12,000	4,800	-	12,000	-	960
(f) Store			3,000	1,200	-	3,000	-	240
(g) Workshop			6,000	2,400	-	6,000	-	480
(h) Electric Wiring			12,000	4,800	4,000	4,000	4,000	2,880
(i) Furniture			22,000	8,800	6,000	10,000	6,000	1,760
6. Machinery and Vehicles								
(a) Four wheel drive vehicles	4	11,000	44,000	17,600	22,000	22,000	-	17,600
(b) Motorcycles	4	1,000	4,000	1,600	4,000	-	-	1,600
(c) Farm Machinery			69,470	27,788	10,000	59,470	-	27,788
(d) Workshop Machinery			16,800	6,720	6,000	10,800	-	6,720
(e) Electric Generators	2	20,000	40,000	16,000	40,000	-	-	16,000
Contingencies 10%			<u>46,222</u>	<u>18,504</u>	<u>11,850</u>	<u>21,872</u>	<u>3,200</u>	<u>7,000</u>
Total Investments			<u>406,142</u>	<u>162,457</u>	<u>130,350</u>	<u>240,592</u>	<u>35,200</u>	<u>102,154</u>
<b>B. OPERATING EXPENSES</b>								
7. Salaries and Wages								
(a) Manager	1	60,000	150,000	60,000	30,000	60,000	60,000	50,000
(b) Extension Agent	1	10,000	25,000	10,000	5,000	10,000	10,000	
(c) Mechanic	1	6,000	15,000	6,000	3,000	6,000	6,000	
(d) Experimental Recorder	2	6,000	30,000	12,000	6,000	12,000	12,000	
(e) Junior Extension Staff	4	3,000	30,000	12,000	6,000	12,000	12,000	
(f) Store Keeper	1	3,000	7,500	3,000	1,500	3,000	3,000	
(g) Secretary	1	4,500	11,250	4,500	2,250	4,500	4,500	
(h) Guards	2	560	2,800	1,120	-	1,400	1,400	
(i) Drivers	8	1,600	32,000	12,800	6,400	12,800	12,800	
(j) Temporary Labour			20,000	8,000	4,000	8,000	8,000	
8. Fuel, Oil and Spares			52,000	20,800	10,000	21,000	21,000	17,000
9. Repairs and Maintenance of Buildings			2,400	960		1,200	1,200	
10. Seeds-Fertilizers-Insecticides			12,000	4,800	2,000	5,000	5,000	3,200
11. Food for Temporary Labour			10,000	4,000	2,000	4,000	4,000	
12. General Expenses			4,600	1,840	1,000	1,800	1,800	
Contingencies 10%			<u>40,455</u>	<u>16,182</u>	<u>7,925</u>	<u>16,270</u>	<u>16,270</u>	<u>7,200</u>
Total Operating Expenses			<u>445,005</u>	<u>178,000</u>	<u>87,065</u>	<u>178,970</u>	<u>178,970</u>	<u>77,400</u>
TOTAL			<u>851,147</u>	<u>340,457</u>	<u>217,415</u>	<u>419,562</u>	<u>214,170</u>	<u>179,554</u>

ANNEX 1  
TABLE 2

October 21, 1969

E T H I O P I A

HUMERA AGRICULTURAL DEVELOPMENT PROJECT

WATER SUPPLY

COST ESTIMATES

	<u>UNITS</u>	<u>UNIT COST</u> E\$	<u>TOTAL COST</u>		<u>DEVELOPMENT PHASING</u>			<u>FOREIGN EXCHANGE</u> US\$
			<u>E\$</u>	<u>US\$</u>	<u>1</u>	<u>2</u>	<u>3</u>	
1. <u>SURVEY AND PREPARATION</u>			8,000	3,200	8,000			800
2. <u>WATER CATCHMENT</u>								
(a) Drilling 10" (meters)	100	150	15,000	6,000		15,000		5,400
(b) Steel casing 8" ("	100	80	8,000	3,200		8,000		2,800
(c) Parameters 3" with 2"	100	60	6,000	2,400		6,000		2,100
Steel casing 2"	100	60	6,000	2,400		6,000		2,100
(d) Development (days)	4	1,450	5,800	2,320		5,800		1,800
(e) Pumping test (days)	2	2,400	4,800	1,920		4,800		1,400
(f) Pumping sets	3	12,500	37,500	15,000		37,500		14,000
(g) Transport			2,500	1,000		2,500		750
(h) Valves and fittings			1,000	400		1,000		350
3. <u>DISTRIBUTION NETWORK</u>								
(a) Pipe 8" (meters)	3,500	25	87,500	35,000		87,500		32,000
(b) Pipe 3" (meters)	5,500	8	44,000	17,600		44,000		16,000
(c) Reservoirs (700 cu.m.)	3	50,000	150,000	60,000		150,000		48,000
(d) Trenching and laying pipes			10,000	4,000		10,000		1,000
(e) Valves and fittings			6,000	2,400		6,000		2,000
(f) Public Fountains	10	1,000	10,000	4,000		10,000		3,000
Contingencies 20%			<u>80,420</u>	<u>32,168</u>		<u>80,420</u>		<u>27,000</u>
TOTAL			<u>482,520</u>	<u>193,008</u>	<u>8,000</u>	<u>474,520</u>		<u>160,500</u>

ANNEX 1  
TABLE 3

November 20, 1969

HUNGRIA AGRICULTURAL DEVELOPMENT PROJECT

STUDIES  
COST ESTIMATES

	UNITS	UNIT COST £\$	£\$	TOTAL COST US\$	DEVELOPMENT PHASING			FOREIGN EXCHANGE US\$
					YEARS			
					1	2	3	
					-----ES-----			
1. AERIAL PHOTOGRAPHY 1/								
(a) Aerial Photography ha	800,000	.05	40,000	16,000	40,000			16,000
(b) Ground Control			50,000	20,000	50,000			15,000
(c) Photographs			25,200	10,080	25,200			9,880
(d) Mosaic Prints			47,500	19,000	47,500			19,000
TOTAL			162,700	65,080	162,700			61,080
2. SOIL SURVEY, LAND CLASSIFICATION								
(a) Survey Team Field Man months	6	7,500	45,000	18,000	35,000	10,000		15,000
" Office Man months	4	6,250	25,000	10,000	18,000	7,000		10,000
(b) Counterpart Staff Man months	3	2,000	6,000	2,400	4,500	1,500		
Assistants Man months	12	1,000	12,000	4,800	9,000	3,000		
(c) Equipment			8,000	3,200	8,000			2,000
(d) External Air Fares			6,000	2,400	3,000	3,000		2,400
(e) Local Transportation			12,500	5,000	10,000	2,500		4,000
(f) Laboratory Analysis			6,000	2,400	2,000	4,000		2,400
(g) Report Costs (including maps)			6,000	2,400		6,000		2,400
TOTAL			126,500	50,600	89,500	37,000		38,200
3. AGRO-ECONOMIC SURVEY								
(a) Survey Team Field Man months	12	7,500	90,000	36,000	66,000	24,000		30,000
" Office Man months	5	6,250	31,250	12,500	24,000	7,250		12,500
(b) Counterpart Staff Man months	6	2,000	12,000	4,800	9,000	3,000		
Assistants Man months	30	1,000	30,000	12,000	24,000	6,000		
(c) Equipment			15,000	6,000	15,000			4,000
(d) External Air Fares			8,000	3,200	4,000	4,000		3,200
(e) Local Transportation			25,000	10,000	20,000	5,000		8,000
(f) Report Costs			6,250	2,500		6,250		2,500
TOTAL			217,500	87,000	162,000	55,500		60,200
4. MARKETING PROCESSING CREDIT								
(a) Study Team Field Man months	4	7,500	30,000	12,000	30,000			10,000
" Office Man months	3	6,250	18,750	7,500	18,750			7,500
(b) Counterpart Staff Man months	2	2,000	4,000	1,600	4,000			
Assistants Man months	4	1,000	4,000	1,600	4,000			
(c) Equipment			5,000	2,000	5,000			1,200
(d) External Air Fares			6,000	2,400	6,000			2,400
(e) Local Transportation			8,000	3,200	8,000			2,500
(f) Report Costs			2,500	1,000	2,500			1,000
TOTAL			78,250	31,300	78,250			24,600
5. MASTER PLAN								
(a) Study Team Field Man months	3	7,500	22,500	9,000		22,500		7,500
" Office Man months	4	6,250	25,000	10,000		25,000		10,000
(b) Counterpart Staff Man months	2	2,000	4,000	1,600		4,000		
Assistants Man months	2	1,000	2,000	800		2,000		
(c) Equipment			4,000	1,600		1,600		1,000
(d) External Air Fares			4,000	1,600		1,600		1,600
(e) Local Transportation			6,000	2,400		2,400		2,000
(f) Report Costs			6,000	2,400		2,400		2,400
TOTAL			73,500	29,400		73,500		24,500
6. ROAD ENGINEERING								
(a) Survey Team Field Man months	3	7,500	22,500	9,000		22,500		7,500
" Office Man months	3	6,250	18,750	7,500		18,750		7,500
(b) Assistants Man months	9	1,000	9,000	3,600		9,000		
(c) Equipment			4,000	1,600		4,000		1,200
(d) External Air Fares			4,000	1,600		4,000		1,600
(e) Local Transportation			6,000	2,400		6,000		2,000
(f) Report Costs			6,000	2,400		6,000		2,400
TOTAL			70,250	28,100		70,250		22,200
Contingencies 15%			107,300	43,770	24,400	49,460	35,440	34,520
TOTAL			638,900	335,200	197,100	379,210	271,500	255,400

1/ Financed by British Government.

October 21, 1969

ANNEX  
TABLE 1

HUMERA AGRICULTURAL DEVELOPMENT PROJECT

ETHIOPIA

IMPROVEMENT OF COMMUNICATIONS

1. Access to the project area would be by road (120 km) from Tessenei to a point about 17 km south of Humera, the administrative headquarters of the project area.

A. Access Road

2. The proposed access road would follow an existing track which is in poor condition in the dry season and impassable in the wet season, June to October. The road would cross four rivers, the Saubumaye, Geludji, Tekkezie and Royan, all of which would require bridging.

3. The road would pass mainly through flat black cotton soil land which is partly developed for the production of cotton, sorghum and sesame. Gravel and sand deposits suitable for road construction are present in all river beds, and at several other points along the road.

B. Service Roads

4. A demonstration farm is at present being developed about 5 km southeast of Humera. About 10 km of service roads would be built to provide a link with the main road and some internal service roads.

C. Design Standards

Roads

5. Average traffic volumes are expected to be about 10-15 vehicles per day rising to a peak of about 60 vehicles per day after harvesting which will be in the dry season. A low standard gravelled road is sufficient for these traffic volumes. However, since little or no investment has yet been made along the line of the proposed access road, advantage would be taken to place its horizontal alignment on as high a standard and permanent a basis as possible. The horizontal alignment of the road would be properly designed for a speed of 100 km/h, and the formation raised, for drainage purposes, above the surrounding land by grading the natural material inwards from the sides. Formation levels would not be

accurately surveyed or aligned but would be judged as construction proceeds by an experienced road constructor. The IHA is competent to provide the nominal amount of engineering design prior to construction required for the low standard road proposed. The formation width would be 6.0 m. In areas of black cotton soil the top 15 cm would be stabilized with river sand, and a gravel running surface 20 cm thick, consisting of suitable select local materials, would be added throughout the road. The IHA has proposed that the finished road level should be raised about 1.3 m above the surrounding terrain. However, this is considered too high and would raise the cost of the embankment construction unnecessarily. It would be sufficient in most areas to raise the road level by about 0.8 m.

#### River Crossings

6. As stated in para 2 the main rivers which would be crossed by the road are the Saubumaye, Geludji, the Tekkezie and the Royan rivers, all of which would need to be bridged.

##### Saubumaye River

7. The IHA proposes to build a single/single type Bailey bridge across the Saubumaye River consisting of two spans, each of 60 ft. Since the heavy lorries and trailers which use this road have a gross loaded weight of 31 tons, this type of bridge which has load capacity of 15 ton is inadequate. The bridge loading should be increased by the addition of chord reinforcing pieces, which would give a load capacity of 37 tons, which would be adequate.

##### Geludji River

8. The IHA proposes to build a single/single type Bailey bridge across the Geludji River consisting of a single span of 60 ft. The load capacity for this type of bridge is 15 ton, which again is inadequate. As above (para 7) the bridge should be strengthened by the addition of chord reinforcing pieces giving a load capacity of 37 ton.

##### Tekkezie River

9. The abutments, piers and part of the steel deck exist of an old single lane bridge across the Tekkezie River. The IHA has examined these and found that, although the substructure is sound, the steel deck needs to be replaced. It has designed a single lane reinforced concrete deck to fit on the existing substructure. The design is for H20-S16 loading and the bridge will be 205.80 m long and 3.50 m wide. These standards are adequate. Contracts were advertised locally on the basis of this design and the IHA has awarded a contract in the sum of about US\$0.16 million to a local contractor. Completion is scheduled for the end of September 1970.



Royan River

10. The IHA proposes to build a single/single Bailey bridge across the Royan River consisting of two spans each of 60 ft with a load capacity of 15 tons. As in paras 7 and 8, a single/single Bailey bridge is inadequate and the IHA should strengthen the single/single bridge with chord reinforcing, giving it a load capacity of 37 tons.

Minor Drainage

11. Minor drainage would be provided by pipe or box culverts or, where the banks are not too high, by paved fords.

D. Construction

12. Because the country through which the road would pass is flat and construction simple, only a traverse survey and staking of the proposed road is necessary to ensure its correct alignment. No levels would be taken except at stream crossings to ensure a satisfactory arrangement at approaches to fords and culverts across minor streams. All the necessary survey work would be carried out by the IHA. The proposed road lies in a very isolated part of Ethiopia and the amount of construction work involved is relatively small, so it is unlikely to attract any bids from foreign or local contractors, or if so, only an uneconomic bid. It is proposed, therefore, that road construction would be undertaken by IHA under the supervision of experienced supervisors, financed under the project, with equipment also financed under the project. The list of equipment required is given in Table 1.

13. IHA has agreed that provision of equipment would be subject to international competitive bidding. Erection of the Bailey bridges would be carried out by the IHA who would also construct any necessary sub-structures.

14. As stated above, it is proposed that road construction would be carried out by the IHA under the supervision of experienced construction experts, (most probably including expatriates as IHA may not have sufficient experienced staff). The experts required would be: (i) a senior road construction supervisor assisted by; (ii) an assistant road construction supervisor; (iii) a concrete supervisor to supervise culvert and paved ford and other concrete construction; and (iv) two field mechanics. All these experts would be appointed to work in the IHA under whom the responsibility for construction of the road would lie. These supervisors would be in executive control of all personnel necessary for the work and have charge of all equipment financed by the Bank for the construction of roads included in the project. In case expatriate experts are employed, the IHA would provide counterpart personnel to work alongside these experts for training purposes.

### E. Cost Estimates

15. The total estimated costs of the project are shown in Annex 1.

#### Road Construction

16. The estimated cost of road construction (120 km) excluding bridges is about US\$1.4 million equivalent, including only the depreciation of equipment used on construction and excluding supervision and contingencies. This estimate is based upon a detailed examination of the road by a road construction expert financed under a previous highway loan to Ethiopia, Loan 523/Credit 111-ET. It represents a cost, excluding bridges, of about US\$12,000 equivalent per km. The foreign currency component for road construction has been estimated by the same expert at about 70%. The cost of culverts and fords is included in the above road construction estimates and is about US\$0.13 million equivalent with a foreign currency component of about 50%.

#### Bridges

##### Saubumaye River

17. The cost estimate, prepared by the IHA, for erecting a single/single reinforced Bailey bridge across the Saubumaye River is about US\$ 20,000 equivalent. It is reasonable and includes (i) chord reinforcing; (ii) the cost of transporting the bridge components to the site; (iii) the cost of substructure; and (iv) the cost of erecting the bridge. The cost of the Bailey bridge is estimated at about US\$22,000 equivalent.

##### Geludji River

18. The cost estimate, prepared by the IHA, for erecting a single/single reinforced Bailey bridge across the Geludji River is about US\$ 12,000 equivalent. It is reasonable and includes (i) chord reinforcing; (ii) the cost of transporting the bridge components to the site; (iii) the cost of substructure; and (iv) the cost of erecting the bridge. The cost of the Bailey bridge is estimated at about US\$12,000 equivalent.

##### Tekkezie River

19. The cost estimate for constructing the Tekkezie Bridge is about US\$0.16 million equivalent, excluding contingencies, and is based on actual bids received. The foreign currency component is (about 50% or) US\$0.08 million. As stated above, para 10, a contract has been awarded for the construction of this bridge. It is recommended that financing of the project be included in the credit, because the bridge is part of the improved communications system, and the relatively small size of the contract and isolated nature of the project area would exclude interest by international contractors.

Royan River

20. The cost estimate, prepared by the IHA, for erecting a single/single reinforced Bailey bridge across the Royan River is about US\$20,000 equivalent. It is reasonable and includes (i) chord reinforcement; (ii) the cost of transporting the bridge components to the site; (iii) the cost of substructures; and (iv) the cost of erecting the bridge. The cost of the Bailey bridge is estimated at about US\$22,000 equivalent.

F. Construction Experts

21. The estimated foreign exchange cost of expatriate construction experts is assumed to be US\$21,000 per year equivalent for the senior road construction supervisor and US\$18,500 per year each for the remainder. In addition, there would be a local element of about US\$2,000 each, for subsistence. For any of the positions for which sufficiently qualified and experienced Ethiopian engineers are available, and for counterpart personnel for expatriate construction experts, an average annual salary of US\$7,200 is assumed. The estimate of US\$145,000 equivalent in foreign exchange and US\$105,000 equivalent in local costs for supervision is based on an assumption of 3 expatriate experts, 2 fully qualified Ethiopians, and 3 counterparts. Actual cost will be more or less dependent upon the success of the IHA in finding sufficiently qualified Ethiopians. In some cases it may be desirable to pay higher than standard civil service salaries to attract qualified Ethiopian engineers currently employed by private contractors; this is allowed for in the estimates.

G. Road Maintenance

22. Because the road to be constructed under the project will be additional to those for which the IHA is already responsible, additional maintenance facilities and equipment will be required. Since IHA does not possess this equipment nor these facilities, the equipment and field workshops provided under the project for road construction will be retained after construction for maintenance of roads in the area and for possible construction of further roads under the second phase of development.



ETHIOPIA

HUMERA AGRICULTURAL DEVELOPMENT PROJECT

EQUIPMENT REQUIRED FOR CONSTRUCTION

OF PROJECT ROAD

	<u>CAPACITY</u>	<u>NO. REQUIRED</u>
Power grader	150 hp	2
Power grader	115 hp	2
Dozer-cable operated	180 hp	2
Dozer-hydraulic operated	180 hp	2
Dozer-hydraulic operated	250 hp	1
Roller-vibratory	5-7 ton	2
Roller-grid	double drum	2
Tractor-farm		2
Loader	2½ cu yd	2
Back hoe	½ cu yd	1
Concrete mixer		2
Dump truck	7 cu yd	12
Truck-stake body		2
Truck-water	2,000 gal	2
Welding machine-mobile	400 amp	2
Air compressor	600 cfm	1
Air compressor	250 cfm	2
Concrete vibrator		3
Electric generator	15 kw	2
Electric generator	1½ kw	4
Water pump	3 in	3
Lubrication assembly		2
Water tank	5,000 gal	3
Jack hammer	55 lb	6
Drill steel & bits		
Preparator	5 ft width	1
Landrovers		3
Pick-up trucks	¾ ton	7
Caravan trailers	41 ft x 10 ft	2
Caravan trailers	38 ft x 10 ft	3
Workshop equipment (lathes, grinders, presses, tools, etc.)		
Miscellaneous spare parts, load- ometers and other items as agreed		

Total Value = US\$1,393,000

October 21, 1969

ETHIOPIA  
HIMERA AGRICULTURAL DEVELOPMENT PROJECT  
ESTIMATES OF TOTAL PRODUCTION AND PRODUCE TRANSPORTED THROUGH TESSENEI<sup>3/</sup>

Project Year	Year	Area Under Cultivation			Yields q/ha			Sesame	Cotton	Sorghum	Total Production '000 q	Consumed In Region	Total Moved Mech. Farms	Total Area <sup>2/</sup> Mech. Farms	Total Moved From Region	Moved Gondar '000 q	Moved Via Tessenet	Number of <sup>3/</sup> Truck Loads	
		Sesame Area '000 ha	Cotton	Sorghum	Sesame	Cotton	Sorghum												
0	1969	100	45	25	30	3	3	8	135	75	240	450	150	300	140/100	420	.95	399	1,900
1	1970	110	50	30	30	3	3	8	150	90	240	480	160	320	150/110	436	.95	414	1,971
2	1971	120	55	35	30	3	3	8	165	105	240	510	170	340	160/120	453	.95	430	2,047
3	1972	130	61	38	31	3	3	8	183	114	248	545	180	365	170/130	477	.95	453	2,157
4	1973	140	66	42	32	3	3	9	198	126	288	612	190	422	180/140	512	.90	488	2,323
5	1974	150	70	50	30	3.5	3.5	10	245	175	300	720	200	520	190/150	658	.90	592	2,819
6	1975	160	76	56	28	3.5	4.0	11	266	224	308	798	210	588	200/160	735	.90	662	3,152
7	1976	170	82	62	26	4.0	4.5	12	328	279	312	919	220	699	210/170	863	.85	734	3,495
8	1977	180	88	68	24	4.5	4.5	13	396	306	312	1,014	230	784	220/180	958	.85	814	3,876
9	1978	190	93	73	24	4.5	4.5	13	419	329	312	1,060	240	820	230/190	992	.85	843	4,014
10	1979	200	98	78	24	4.5	4.5	13	441	351	312	1,104	250	854	240/200	1,024	.80	819	3,900
11	1980	210	103	83	24	4.5	4.5	13	464	374	312	1,150	260	890	250/210	1,059	.80	849	4,042
12	1981	220	108	88	24	4.5	4.5	13	486	396	312	1,194	270	924	260/220	1,092	.75	819	3,900
13	1982	230	112	93	25	4.5	4.5	13	504	419	325	1,248	280	968	280/230	1,178	.75	884	4,200
14	1983	240	117	98	25	4.5	4.5	13	527	441	325	1,293	290	1,003	290/240	1,211	.75	908	4,320
15	1984	250	122	103	25	4.5	4.5	13	549	464	325	1,338	300	1,038	300/250	1,245	.75	934	4,447

1/ Excluding production generated as a result of construction of the improved road.

2/ In order to calculate the total production moved from the region the mech. farms production is multiplied by the ratio:  $\frac{\text{total area (mech. farms + smallholders)}}{\text{mechanized farms area}}$

3/ Average load per truck: 21 ton.

October 29, 1969

10/10

E T H I O P I A  
HUMERA AGRICULTURAL DEVELOPMENT PROJECT  
TEKKEZIE BRIDGE  
ECONOMIC SAVINGS

<u>YEAR</u>	<u>PRODUCTION SOUTH OF BRIDGE</u>			<u>% CROSSING BRIDGE<sup>1/</sup></u>	<u>TOTAL CROSSING BRIDGE</u> Tons	<u>SAVINGS ON BRIDGE CROSSING</u> <sup>2/</sup> '000 E\$
	<u>SESAME</u> '000 qu	<u>COTTON</u> '000 qu	<u>TOTAL</u> '000 qu			
1970	150	90	240	84	20,160	50
1971	165	105	270	83	22,410	55
1972	183	114	297	82	24,354	60
1973	198	126	324	81	26,244	65
1974	245	175	420	80	33,600	85
1975	266	224	490	79	38,710	98
1976	328	279	607	78	47,346	117
1977	396	306	702	77	54,054	135
1978	419	329	748	76	56,848	143
1979	441	351	792	75	59,400	147
1980	464	374	838	74	62,012	155
1981	486	396	882	73	64,386	160
1982	504	419	923	72	66,456	165
1983	527	441	968	71	68,728	173
1984	549	464	1,013	70	70,910	177

<sup>1/</sup> Represents percentage of production transported over the bridges northward.

<sup>2/</sup> Transshipping savings and vehicle operating savings for 15 km of road south of bridge conservatively estimated at E\$2.50/ton.

October 29, 1969





ETHIOPIA  
HUMERA AGRICULTURAL DEVELOPMENT PROJECT

IMPROVED COMMUNICATIONS

RATE OF RETURN CALCULATION

'000 E\$

<u>YEAR</u>	<u>CONSTRUCTION COST</u>	<u>MAINTENANCE COST</u>	<u>TOTAL COSTS</u>	<u>VEHICLE FREIGHT<sup>1/</sup></u>	<u>OPERATING SAVINGS PASSENGERS<sup>2/</sup></u>	<u>SAVINGS ON INVENTORIES<sup>3/</sup></u>	<u>NET VALUE ADDED OF GENERATED PRODUCTIONS<sup>4/</sup></u>	<u>SAVINGS DUE TO BRIDGE<sup>5/</sup></u>	<u>RESIDUAL VALUE OF EQUIPMENT</u>	<u>TOTAL BENEFITS</u>	<u>NET</u>
1970	4,837	-	4,837	-	-	-	-	-	-	-	(4,837)
1971	1,589	-	1,589	104	63	-	-	50	-	217	(1,372)
1972	1,501	60	1,561	215	138	60	75	55	2,031	2,574	1,013
1973	-	120	120	226	149	65	147	60	-	647	527
1974	-	120	120	244	161	70	231	65	-	771	651
1975	-	120	120	296	172	75	456	85	-	1,084	964
1976	-	120	120	331	184	80	618	98	-	1,311	1,191
1977	-	120	120	367	195	85	915	117	-	1,679	1,559
1978	-	120	120	407	207	90	1,173	135	-	2,012	1,892
1979	-	120	120	421	218	95	1,288	143	-	2,165	2,045
1980	-	120	120	410	230	100	1,399	147	-	2,286	2,166
1981	-	120	120	424	241	105	1,514	155	-	2,439	2,319
1982	-	120	120	410	253	110	1,625	160	-	2,558	2,438
1983	-	120	120	441	264	115	1,715	165	-	2,700	2,580
1984	-	120	120	454	276	120	1,829	173	-	2,852	2,732

ECONOMIC RATE OF RETURN: 16%

<sup>1/</sup> Operating cost of 21 ton truck is estimated at E\$1.47 per km on the existing road and at E\$0.97 on the improved road, resulting in savings of E\$105 per round trip. Numbers of truck loads are calculated in Table 2.

<sup>2/</sup> Savings per round trip for a 62 seats bus are estimated at E\$80 per round trip. In 1968 bus companies reported a total of about 100,000 passengers; passenger traffic is assumed to grow in proportion with the area cultivated.

<sup>3/</sup> Based on the assumption of 10% interest per month for additional inventories carried in anticipation of the 4 month wet season; value of local sales estimated at E\$0.5 million per month, increasing to E\$1.2 million during harvest season.

<sup>4/</sup> From 1,500 ha brought into production annually.

<sup>5/</sup> See Table 3.

October 29, 1969



E T H I O P I A

HUMERA AGRICULTURE DEVELOPMENT PROJECT

HUMERA WATER SUPPLY

OPERATION AND MAINTENANCE COSTS

	<u>Unit</u>	<u>Unit Cost Per Month</u>	<u>Cost/Annum E\$</u>	<u>Cost/Annum US\$</u>
1. Maintenance of wells and pumps 5% of initial cost (E\$80,000) <u>1/</u>			4,000	1,600
2. Maintenance of Distribution System 5% of initial cost (E\$338,000) <u>1/</u>			16,900	6,760
3. Personnel				
a) Supervisor	1	1,000	12,000	4,800
b) Mechanic	1	1,000	12,000	4,800
c) Fountain attendants	10	500	60,000	24,000
d) Labor			10,000	4,000
4. Fuel (litres)	127,750		19,160	7,664
5. Overhaul of Pumps and Generators 50% of initial cost after 5 years			5,500 <sup>2/</sup>	2,200
6. Administration and Overhead			<u>25,000</u>	<u>10,000</u>
Total/annum			164,560	65,824

1/ Including 10% contingencies

2/ Average E\$5,500/annum, but financed in lump sum after 5 years operation.

November 20, 1969



E T H I O P I A  
HUMERA AGRICULTURAL DEVELOPMENT PROJECT  
HUMERA WATER SUPPLY  
APPLICATION AND SOURCES OF FUNDS

Year	1	2	3	4	5	6	7	8	9	10	11	12	13
<b>1. APPLICATIONS</b>													
(a) Investment	8,000	474,520											
(b) Operating Costs			143,660	143,660	143,660	143,660	143,660	143,660	143,660	143,660	143,660	143,660	143,660
(c) Maintenance				20,900	20,900	20,900	20,900	20,900	20,900	20,900	20,900	20,900	20,900
(d) Replacement							27,500					46,000	
	8,000	474,520	143,660	164,560	164,560	164,560	192,090	164,560	164,560	164,560	164,560	210,560	164,560
<b>2. SOURCES</b>													
(a) Sales at E\$0.50/m <sup>3</sup>			150,562	180,675	210,788	240,900	271,012	301,125	301,125	301,125	301,125	301,125	301,125
<u>Annual surplus/deficit</u> <sup>1/</sup>	(8,000)	(474,520)	6,902	16,115	46,228	76,340	78,952	136,565	136,565	136,565	136,565	90,565	136,565
<u>Cumulative surplus/deficit</u>	(8,000)	(482,520)	(475,609)	(459,494)	(413,266)	(336,926)	(257,974)	(121,409)	15,156	151,721	288,286	378,851	515,416

FINANCIAL RATE OF RETURN: 11 %

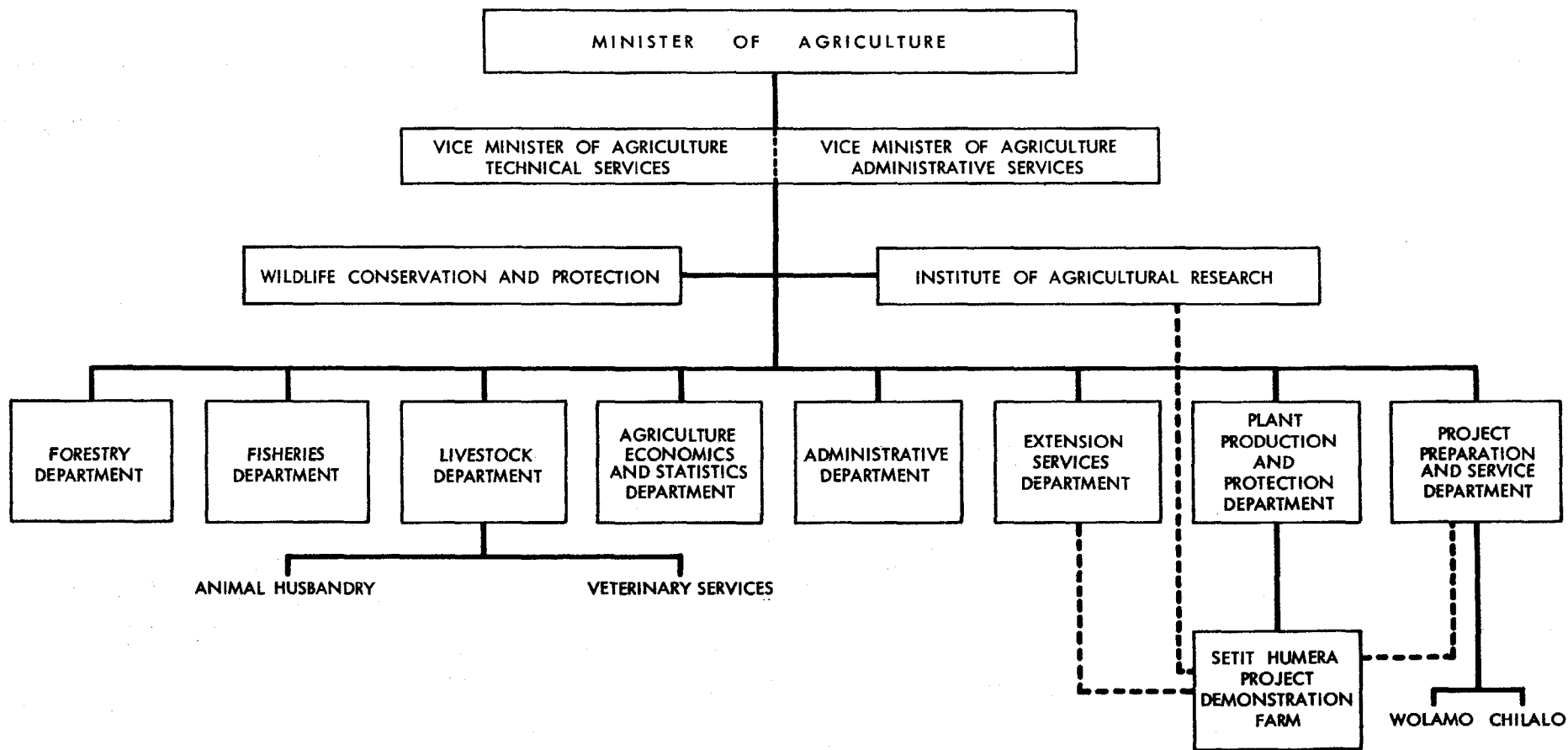
<sup>1/</sup> Bank loan interest payable by Government during the 3 year grace period would total approximately E\$1,019,000 (US\$407,000) and amortization of the loan from year 4 onwards would cost some E\$1 million (US\$400,000) annually. Cash surpluses arising from the operation of the Humera water supply from year 3 onwards would be paid to Government and could make a substantial contribution towards debt service.

November 20, 1969



# ETHIOPIA: SETIT HUMERA AGRICULTURAL DEVELOPMENT PROJECT

## ORGANIZATION OF THE MINISTRY OF AGRICULTURE







E T H I O P I A

HUMERA AGRICULTURAL DEVELOPMENT PROJECT

MACHINERY REQUIRED FOR PROJECT FARM

<u>Item</u>	<u>Capacity</u>	<u>No. Required</u>
High clearance tractor	65-70 hp	1
Disc plough	4 disc	1
Seed Drill	13 disc	2
Interrow Cultivators		2
Cotton Planter	6 unit	1
Fertilizer Spreader		1
Sprayer (Tank mounted)		1
Crop Dusters (Hand)		4
Crop Dusters (Tractor mounted)		1
Trailers (Tractor)	3 tons	2
Cotton ginner (Experimental)		1
Sorghum thresher		1
Groundnut lifters (Tractor mounted)		1

October 21, 1969



ETHIOPIA

HUMERA AGRICULTURAL DEVELOPMENT PROJECT

PRE-INVESTMENT STUDIES

Besides aerial photographs and photo mosaics of the project area a series of pre-investment studies are required to enable preparation of a feasibility study for further development of mechanized rainfed agriculture in the northwest lowlands of Ethiopia.

The Government would retain a consulting firm to review all studies made of the project area (and where appropriate areas with similar soil and climatic conditions), its agriculture, and the processing and marketing of agricultural products; and taking the findings of these into account to:

- A. Carry out a reconnaissance soil survey of about 400,000 ha of agricultural land in the northwestern lowlands in the borrowers Awrajas (sub provinces) of Gash-Setit, Wegera, Gondar and Chilga.
- B. Examine agricultural, economic and social conditions of mechanized farmers in the Humera area.
- C. Review present marketing, crop processing and credit facilities in the Humera area; giving priority to the possible need for the early establishment of a cotton ginnery.
- D. Review improvements needed in communications for future development of the area south of Humera.
- E. Prepare, in the light of conclusions drawn in carrying out A, B, C and D above, a feasibility study and investment proposal for a project for the further development of the north-western lowlands in Ethiopia.

A. SOIL SURVEY AND LAND USE CLASSIFICATION

To identify areas in the north-western lowlands, suitable for the development of mechanized rainfed agriculture, a soil survey and land capability classification are required. Soil survey requirements are as follows:

- (a) Broad outlines of the areas suitable for agricultural development - about 400,000 ha - should be obtained

from recent 1:20,000 colored aerial photographs of the region. The photographs should also be used to identify drainage lines, differences in topography, and vegetation.

- (b) A reconnaissance soil survey of the areas suitable for agricultural development is required. Because soils are generally uniform a sampling density of 1 soil profile description per 400 ha will probably be sufficient. However, the final density of soil sampling should be determined by the survey team after an inspection of the aerial photographs, and a consideration of soil surveys carried out in similar areas elsewhere.
- (c) Profile descriptions will normally be by auger borings to a depth of 2 m. However, about 250 soil profile pits 2 m deep, should be dug throughout the project area, and fifty of these should supply samples from at least 3 horizons for laboratory analysis.
- (d) The physical and chemical analysis of the soil samples collected from the representative soil pits, will cover:

Mechanical analysis:

% stones and gravel

coarse sand

fine sand

silt

clay

Chemical analysis:

p.H.

soluble salts (anions and cations)

organic N

% organic matter

C/N ratio

CaCO<sub>3</sub>%

total exchangeable bases

cation exchange capacity

base saturation

HCl extractable P and K  
(surface samples only)

In addition, samples from each of the profile sites should be hand textured in the field and at least 250 of them should have field determinations of their p.H. made, as well as full morphological descriptions on an horizon basis.

From the results of the soil survey and terrain evaluation a land capability map (on mosaic basis) will be produced. Classification would be in accordance with the system used by the USDA Conservation Service modified where necessary to take account of local conditions and land use requirements.

The soil survey report should include all data on soils, and the ecology and land use capabilities of the area. The following mosaic maps of the area suitable for agricultural development should be included:

- soil map, scale 1:20,000
- land use and classification map, scale 1:20,000
- summary of land classification map, scale 1:100,000

#### B. AGRICULTURE, ECONOMIC AND SOCIAL STUDY

##### Method

1. Establish the distribution of existing farms within the project area.
2. Determine the use of land on established farms by means of a sample survey. If possible, the list of holdings granted by the Government should be used as a survey frame; and the sample stratified according to size of holdings. An overall sampling percentage of at least 20% should be used, with strata percentages being decided after the details in 1 above have been established.

In carrying out 2 above, the following specific aspects of the sample holdings should be studied:

##### Physical Aspects

- (a) Area of the holding, and distances from water supplies and roads.
- (b) Soils, and percentage of each project soil type within the holding.
- (c) Area cropped and area under each crop.
- (d) Permanent improvements; housing, buildings, wells, etc.
- (e) Crop rotations, if any.
- (f) Agricultural land tenure assignments.

Machinery

- (a) Numbers and description of tractors and farm implements. Date of purchase; cost; condition; and estimate of remaining working life.
- (b) Cause of tractor breakdowns; spares held by farmers; availability of spares held by commercial agents.
- (c) Output capabilities of tractors and implements, factors limiting productive output of machinery.
- (d) Standard of operators and operator training.

Farming System

- (a) The existing farming system; timing and dates of field operations; number and type of cultivations; source and selection of seed; seed rates; number of weedings; yields of sesame, cotton and sorghum; labor employed for all different farm operations.
- (b) Costs of inputs and outputs including land clearing. Farm budgets and cash flows.

Social Conditions of Farmers

- (a) Religion, tribal group, size of family, usual place of residence, other occupations and sources of income.
- (b) Indebtedness; amounts borrowed; source of credit; when obtained; when to be repaid; amounts repaid; interest rates; purpose of loan; amounts borrowed in kind, e.g. use of tractors, implements, food.
- (c) Work done for others, and payments received.
- (d) Purchase of household goods. Distance of markets from the farms, how often markets are visited; what is sold and what is purchased.

C. CREDIT, MARKETING AND CROP PROCESSING STUDY

Credit

- (a) Analyze farm budgets in relation to existing conditions, and establish future requirements for short, medium and long term credit.

- (b) Review existing sources and methods of supplying credit, and recommend the nature and scale of operations of the type of lending agency or agencies needed, giving details of their organization and management, including basic criteria for selecting borrowers.

Marketing and Processing

- (a) Examine the internal and world market prospects for sesame, short and long staple cotton, sorghum, ground-nuts and sunflower.
- (b) Review the expected cotton lint requirements of Ethiopia until 1980; the present capacity of established ginneries; and advise on the viability of establishing a cotton ginery in the project area.
- (c) Consider the viability and feasibility of establishing an oil mill in the project area in the light of world and national markets for vegetable oils and possible production volumes in the project area.

D. ROAD ENGINEERING STUDY

- (a) Select and survey the alignment of about 200 km of roads in the area of the project proposed in the master plan (Part E).
- (b) Establish the design standards of the roads.
- (c) Survey suitable sites for road construction materials.
- (d) Select bridge sites and establish standards for bridge construction.
- (e) Propose construction methods; contractors or force account.
- (f) Prepare detailed cost estimates and if construction by contractor, tender documents.

E. MASTER PLAN AND INVESTMENT PROJECT

Conclusions drawn in carrying out the above will be used in the preparation of the Master Plan and investment proposal. Particular attention should be paid to:

- the effect of present land tenure systems on farming practices;
- the need for any improvement in tractor and farm machinery repairs and spare services;
- the existence of any limiting factors to the productive output of farm machinery;
- the need for training tractor operators;
- the probable optimum size of holdings, having subjected different sizes to economic and financial analysis, and taking into account desirable levels of farmers' cash incomes.
- the need for crop processing facilities, their capacity and location, and management.

The Master Plan and investment proposals should contain the more important relevant information described in the following report outline. The individual studies should form a series of annexes to the main report, and wherever necessary the text of this should refer to annexes. An annex to the report should list the studies of the project area previously made and which the consultants have studied.

### I. Introduction

Brief description of the scope of the project.

### II. Agricultural Background

- Brief description of the general economic and agricultural situation in the project area, and the problems associated with further development.
- Description of the main institutions concerned with agriculture in the project area, and any actions that Government may have already taken towards sponsoring development.

### III. The Project Area

Details of as many of the following points as are relevant to the proposed project:



Location

Location of the project and its relation to the main lines of communication and ports.

Population

- Population and its distribution;
- seasonal pattern of population distribution and its employment, including need for itinerant labor.

Climate

Rainfall, temperature and other climatic data.

Topography, Soils and Water Supply

The general topographic character of the area, and where relevant related to crop production, and water requirements of the population.

Soils

The results of the soil survey carried out and information on the suitability of project area soils for different crops.

Land Use

Present land utilization and the production pattern of the project area.

Land Distribution and Tenure

- Distribution and size of holdings by number and area;
- Land tenure situation;
- Any obstacle to economic farming caused by present land distribution and tenure.

Research

The institutions conducting research pertinent to agricultural development in the project area. Are they adequate? If not, recommendations for improvement to required standards.

Extension and Training

- Extension work being carried out in the project area;
- Numbers of extension workers under each category and their qualifications.

### Credit

- Description of each institution providing credit in the project area;
- Status and effectiveness of credit institutions;
- Part played by non-institutional credit (e.g. moneylenders);
- The purpose; amount; terms and conditions of the loans, and types of farmers to whom credit is extended.

### Cooperatives

Discussion of the situation concerning cooperatives in the various fields related to the project.

### Farms and Farmers

- Present farming methods;
- Standards of farm management;
- Cropping patterns and yields;
- Present use of farm inputs (fertilizers, pesticides, improved seeds);
- Obstacles to a greater utilization of these inputs (costs, lack of transportation or distribution facilities, lack of experimental data).

### Mechanization

- Types and numbers of tractors and allied machinery at present in use;
- Suitability of existing equipment for the work required;
- Economics of operating existing equipment, including output capabilities and operation costs;
- Main reason for mechanical failures;
- Supplies of spares and servicing facilities;
- Quality of operators and training requirements;
- Factors limiting the efficient use of equipment;
- Supply and storage of fuel;
- Recommendations for more efficient use of equipment.

### Marketing and Prices

- Present market outlets for the area (exports, local markets, processing plants; capacity of such plants);
- The need for processing plants - cotton ginnery and oil extraction - in the project area should be carefully appraised;
- The transport network, distribution and storage facilities available and any improvements required;
- Market prospects for commodities relevant to the project;
- Prices received by farmers and paid by them in the project area;
- Seasonal fluctuations;
- Forecast of future prices;
- An assessment of price policies for inputs and outputs relevant to the development of the project.

### Gross and Net Value of Present Production

Details of the estimated composition, volume and value of present production in the project area. A table should be given of total and per hectare gross value production, costs of inputs and net value of production. Farmer's family labor should be included in the costs but shown as a separate cost.

## IV. The Project

### General

Description of the project mentioning:

- Objectives of the project;
- Size and nature of project works.

### Proposed Works, Measures and Policies

- Description of the works, measures and policies proposed for the project;
- Detailed schedule of phasing, construction and dates on which measures will be implemented.

### Cost Estimates

Cost estimates should be given with a breakdown into foreign exchange and local currency. Items costed should specify developmental costs and any recurrent costs during the construction (development) period, which are to be capitalized under the project. A full breakdown of the project costs should be given including the basis of estimates, quantities, unit prices and provision for contingencies. Overhead costs should also be included. What are the annual costs of operation and maintenance excluding the sums capitalized during the developmental period? A year by year expenditure schedule should be included.

Estimates should be compared with costs experienced by other agencies locally and with costs for similar works elsewhere. The assumptions made for estimating costs, should be given, in addition to the methods used for calculating equipment and labor costs.

### Finance

An explanation should be given of the computation of foreign costs of equipment, materials and technical assistance. Also state how local costs would be financed.

### Organization and Management

Details of the following aspects of the proposed project:

- The legislative basis for project implementation;
- The coordinating and policy making body;
- The means by which the Government will be represented;
- The agency responsible for project implementation, its administrative, judicial and financial status, and the interests represented on its board of management if it should have one;
- Detailed staffing requirements, and organization chart;
- Present availabilities of different categories of staff, any training requirements, and the need to employ any expatriates;
- Method of carrying out any construction (contract, force account, etc.);
- Project administration in the project area;
- Organization of any ancillary works of services, and their timing;

- Measures that may be considered necessary to ensure effective participation by farmers;
- Arrangements for credit, and estimates of requirements during the first years of operation;
- Any other organizational and management issues evolving during project preparation and not covered by the above.

Increase in Farm Production and Farm Income

Evaluation of farm income from the farmers' point of view, before and after the project. For this purpose details of the following will be required:

- Main changes in land use and production pattern in the project area;
- Estimates of future production from the project area, by years;
- The conditions necessary for achieving expected yields (extension credit, etc.);
- Expected composition, volume and gross value of farm production under present conditions, and after project implementation;
- Farm production costs;
- Net farm production;
- Typical farm budgets, taking into account any charges and debt repayments;
- Tables for farm income in the area, with and without the project;
- Details of the number of farmers that will benefit from the project.

Debt Repayment and Financial Results

An explanation of how repayment of the costs of the project would be made should include:

- Any provisions for revenues, including all types of taxes;
- If on-farm works are contemplated under the project, full details of costs should be given;

- A cash flow table for a typical farm or for the whole project at the farm level, including debt repayments and assumptions regarding interest rates and debt repayment period;
- A cash flow table for the agency implementing the project.

Economic Justification

Details for the economic justification of the project, including:

- Sufficient data to calculate the internal rate of return on the investment;
- Assumptions made for construction time, rate of expenditure and life of the project;
- Incremental direct and indirect benefits and costs of the project;
- Any contribution made to export earnings or import earnings;
- Benefits to be derived from the project at the national level.

