BASIC DESIGN STUDY REPORT
ON
THE NDUNGU AGRICULTURAL DEVELOPMENT PROJECT
IN
THE UNITED REPUBLIC OF TANZANIA

MAY 1987

JAPAN INTERNATIONAL COOPERATION AGENCY

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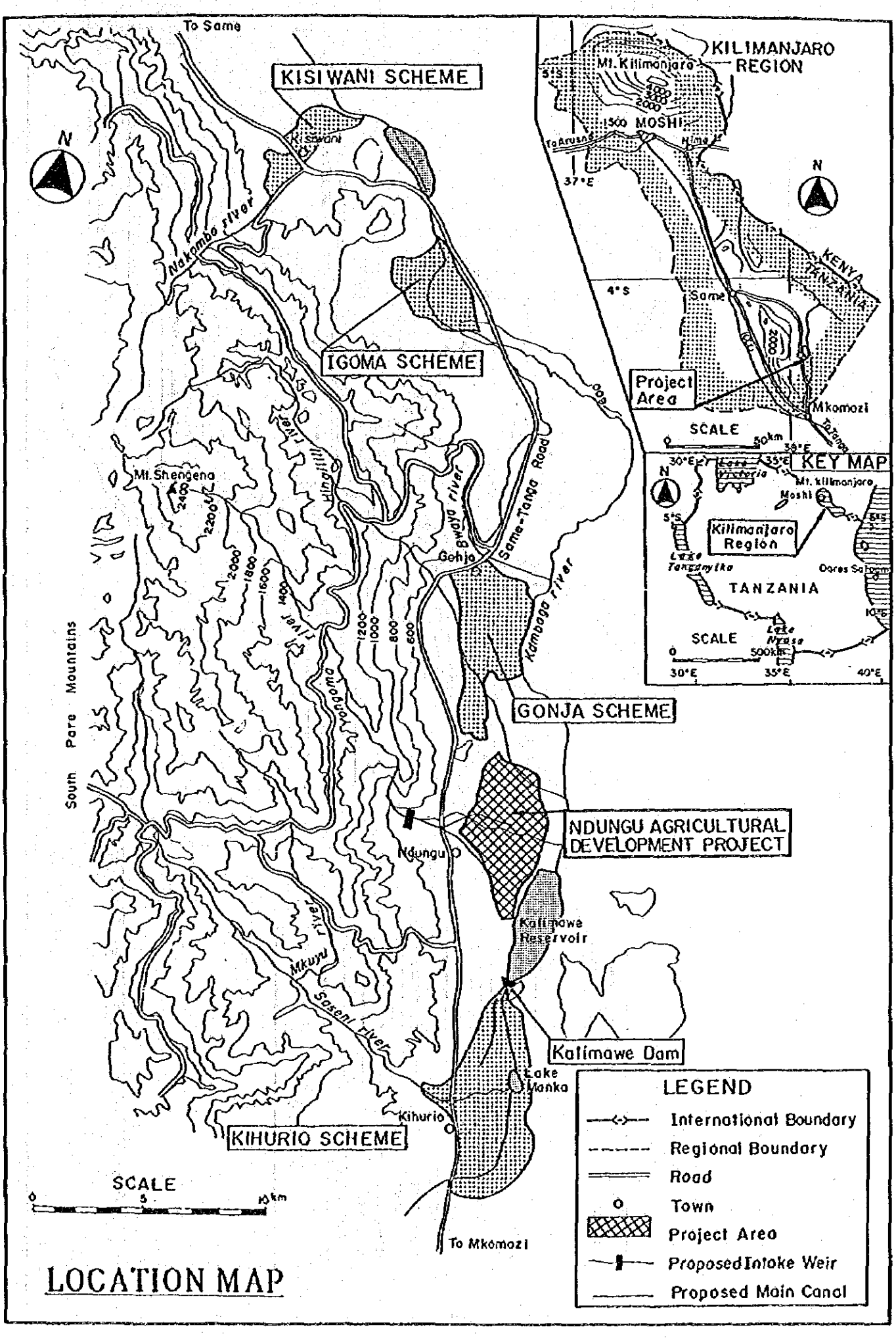
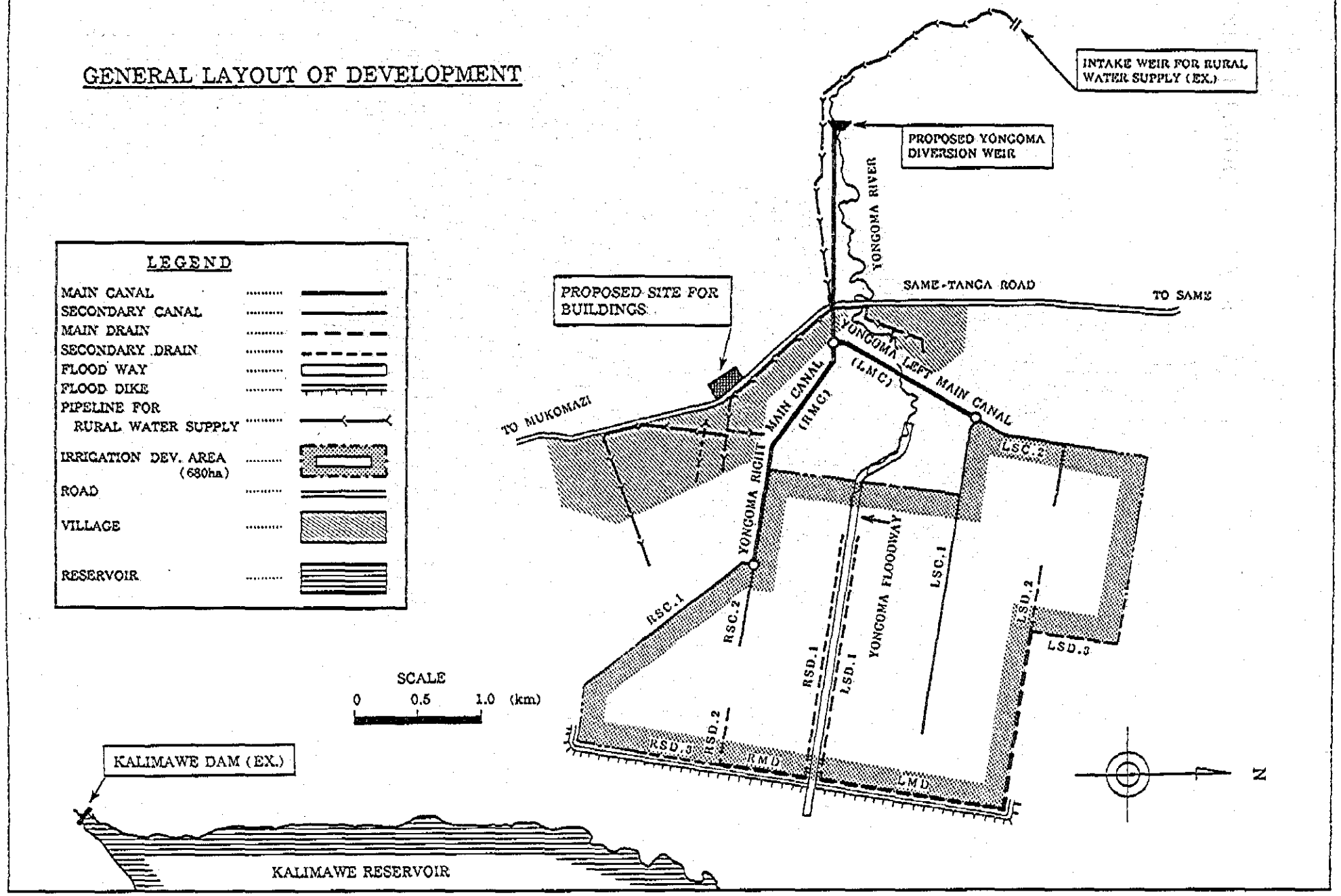
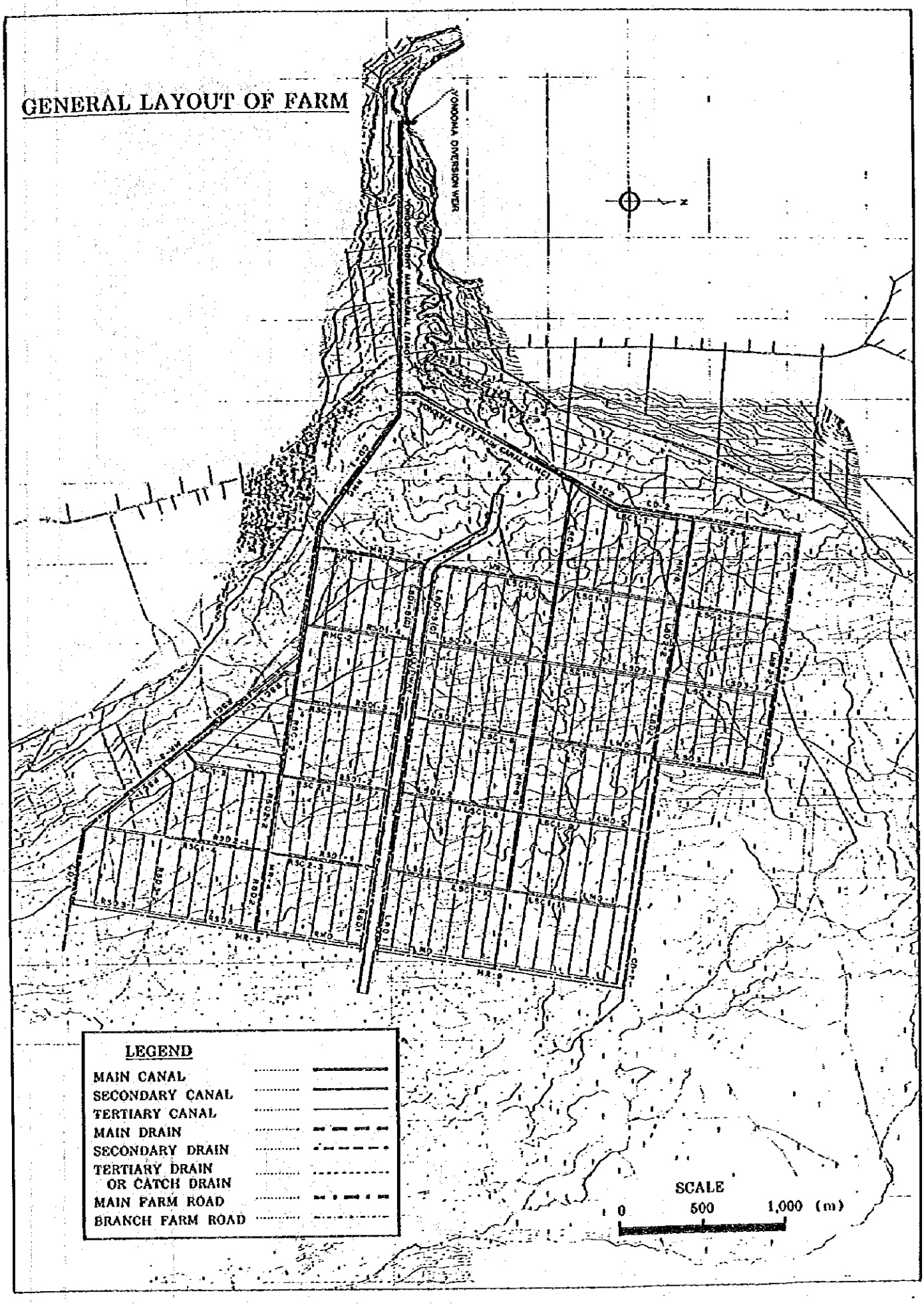
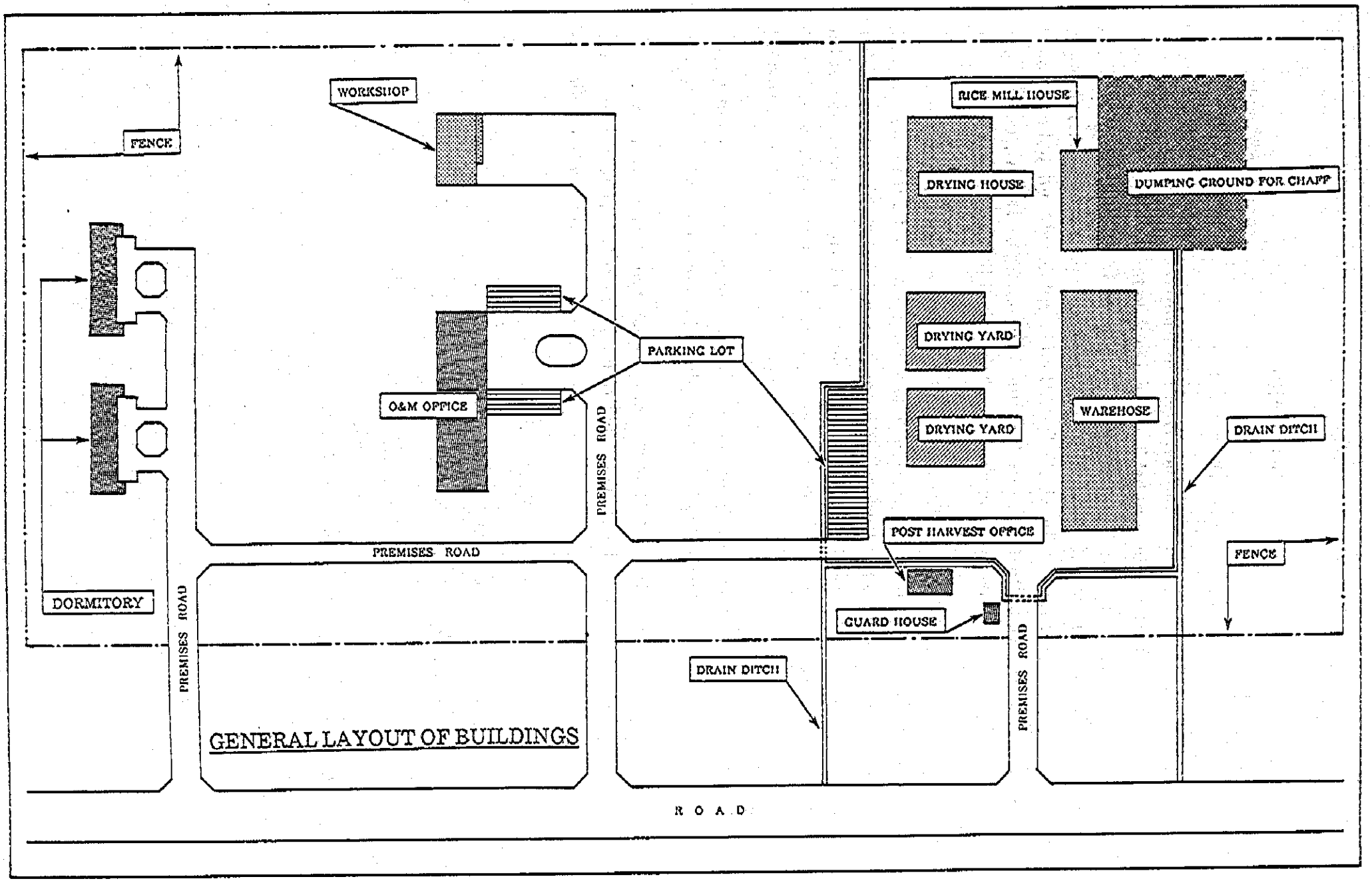

To Same
KISIWANI SCHEME
IGOMA SCHEME
GONJA SCHEME
KIHURIO SCHEME
NDUNGU AGRICULTURAL DEVELOPMENT PROJECT
Kisiwani
Nakombo river
Mt. Shengena
South Pare Mountains
Kihurio
Ndungu
Gonja
Same-Tanga Road
Kambaga river
Mkuyu river
Sasseni river
Kalimawe Reservoir
Kalimawe Dam
Lake Manka
To Mkomozi
SCALE
0 5 10km
LOCATION MAP
KILIMANJARO REGION
Mt. Kilimanjaro
MOSHI
To Arusha
37°E
4°S
Same
KENYA
TANZANIA
Project Area
Mkomozi
To Tanga
SCALE
0 50km
KEY MAP
30°E
35°E
40°E
Lake Victoria
Mt. Kilimanjaro
Moshi
5°S
Kilimanjaro Region
Lake Tanganyika
TANZANIA
Lake Nyasa
SCALE
0 500km
LEGEND
International Boundary
Regional Boundary
Road
Town
Project Area
Proposed Intake Weir
Proposed Main Canal

GENERAL LAYOUT OF DEVELOPMENT



GENERAL LAYOUT OF FARM




WORKSHOP
FENCE
RICE MILL HOUSE
DRYING HOUSE
DUMPING GROUND FOR CHAFF
PARKING LOT
O&M OFFICE
DRYING YARD
DRYING YARD
WAREHOSE
DRAIN DITCH
PREMISES ROAD
PREMISES ROAD
POST HARVEST OFFICE
FENCE
DORMITORY
PREMISES ROAD
GUARD HOUSE
DRAIN DITCH
PREMISES ROAD
GENERAL LAYOUT OF BUILDINGS
R O A D

PREFACE

In response to the request of the Government of the United Republic of Tanzania, the Government of Japan has decided to conduct a basic design study on the Ndungu Agricultural Development Project and entrusted the study to the Japan International Cooperation Agency (JICA). JICA sent to Tanzania a study team headed by Mr. Nobuyoshi SAKINO, Deputy Director, Construction Department, Kinki Regional Agricultural Administration Office, Ministry of Agriculture, Forestry and Fisheries from December 1 to December 30, 1986.

The team had discussions on the Project with the officials concerned of the Government of the United Republic of Tanzania and conducted a field survey in Ndungu area. After the team returned to Japan, further studies were made, a draft report was prepared and a mission to explain and discuss it was dispatched to the United Republic of Tanzania. As a result, the present report has been prepared.

I hope that this report will serve for the development of the project and contribute to the promotion of friendly relations between our two countries.

I wish to express my deep appreciation to the officials concerned of the Government of the United Republic of Tanzania for their close cooperation extended to the team.

May, 1987

Keisuke Arita

Keisuke Arita
President
Japan International Cooperation Agency

SUMMARY

SUMMARY

The Ndungu Agricultural Development Project, for which the Government of Tanzania has requested Japan's grant aid, is one of the five (5) priority schemes selected through the feasibility study (F/S) on the Mkomazi Valley Area Irrigation Development Project executed by the Japan International Cooperation Agency (JICA) in 1982/83. The Government of Tanzania intends to commence the development of the Ndungu area, as a model scheme for the promotion of agricultural development in the whole Mkomazi Valley area, in view of its comparatively small area of 680 ha and expected rather high investment returns.

In response to a request from the Government of Tanzania, the Government of Japan agreed to conduct a basic design study to examine the propriety of the project and to work out a specific basic design. Accordingly, a Basic Design Study Team was dispatched through JICA. The dispatched study team surveyed and investigated the project area to grasp the present conditions and constraints, collected the data required for the basic design study and had a series of discussions with the officials concerned of the Government of Tanzania, and then both sides exchanged the Minutes of Discussions.

Main works for which the Government of Tanzania requested Japan's grant aid in relation to the project are as follows:

i) Construction of a technical irrigation network consisting of a diversion weir, main and secondary irrigation canals,

ii) Construction of a drainage network including secondary drains,

iii) Construction of a farm road network including main and secondary farm roads,

iv) Improvement of river courses and construction of a flood dike,

v) Preparation of fields suitable for paddy cultivation equipped with terminal irrigation and drainage canals and roads,

vi) Construction of buildings and facilities for O&M,

vii) Construction of processing facilities such as drying and milling facilities,

viii) Construction of storage facilities,

ix) Construction of farmers' training facilities, and

x) Improvement of rural water supply system.

The Ndungu area is situated in a small basin in the Mkomazi Valley which is located in the southern part of Kilimanjaro Region. The project area comprised of alluvial plains and seasonal marshes formed mainly by the Yongoma river. The elevation of the alluvial plains ranges from 507 m to 520 m. The arable land in the Ndungu area is estimated at about 1,010 ha and comprises about 1,310 farm households, thus the average holding size is at present 0.77 ha / household. The farmers mainly cultivate paddy, maize and beans, and most of them still follow the traditional ways of farming. Most crop cultivation is practiced under the rainfed conditions, though there are traditional irrigation facilities at present to a small extent in the Ndungu area, and so crop production is not stable and the yields are still low.

Through the examination made on the contents of the request, the importance of the project was clarified. Project implementation will result in a significant increase in agricultural production through consolidation of the irrigation-centered farm infrastructure and such rural infrastructure as domestic water supply facilities. Consequently the living standard of farmers in the Ndungu area will be improved and the project should have great influence on the development of the whole Mikomazi Valley area which is less developed than the export crops production area in the highlands.

The importance of the project may be appreciated further from the following:

(1) Nearly 90% of the economically active population in Tanzania is engaged in agriculture directly or indirectly, thus the development of agriculture is indispensable for improvement of national living standards.

Tanzania's agriculture is dual-structured: cash crops for export such as coffee play an important role in earning foreign exchange, while such food crops as rice and maize are not achieving self-sufficiency and are regularly imported at the rate of about 200~300 thousand tons per year. Therefore, priority has always been given to increasing self-sufficiency in food crops through agricultural development in successive national development plans. Particularly in the Economic Recovery Program (ERP) for the period 1986-1990, top priority was given to increasing agricultural production. The Government of Tanzania intended to invest US$143 million for this purpose.

This Ndungu project is one of the important linking projects in the chain of ERP.

(2) The agricultural development of Kilimanjaro Region is being promoted systematically. Particularly successful activities have been the Lower Moshi Agricultural Development Project and the Kilimanjaro Agricultural Development Center (KADC), both of which have been carried out with the technical and financial cooperation of Japan. It is considered that agricultural development in the Region will be further accelerated by realization of this Ndungu project.

The main agricultural projects in the Region presently programed are as follows:

Lower Moshi Area	6,320 ha
Mkomazi Valley Area	4,060 ha
Hai & Rombo Area Groundwater Development	5,000 ha
Ruvu River System, Jipe Lake Area	6,000 ha

The Government of Tanzania and Kilimanjaro Region hold the view that concentrated development in a particular area is not desirable, and prefer the proportional development of the whole Region. Based on this principle, promising projects identified by F/S are planned to be started in sequence. This Ndungu project is ranked as second to the Lower Moshi Agricultural Development Project.

(3) The KADC is now playing an important part as the leading organization in the technical development of agriculture in the Region. Agricultural training for the personnel concerned, both officials and farmers, is being promoted by KADC, and the level of agricultural techniques in the Region is improving. The training of extension officers in the Ndungu area has also been taking place since 1984.

Moreover, the Region allocates about 40% of the regional budget for agricultural development.

As may be seen from above, the Government of Tanzania has been successfully supporting development of the Region.

The outline of the project is as follows:

(1) Location : Ndungu area, Same District, Kilimanjaro Region

(2) Beneficiaries : 1,250 farm households
(0.54 ha/household on an average in the target year 1995)

(3) Project features

1) Irrigation and drainage facilities

i) Water source : Yongoma river

ii) Development area : 680 ha (Maximum irrigable area in the rainy season)

iii) Main works

- Yongoma headworks : Fixed type
9.4 m (weir height)×25 m (length)

- Irrigation canals (Concrete block lining canal) : Main canals (4.8 km) and Secondary canals (5.5 km)

- Drainage canals (Earth canal) : Catch drains (9.7 km), Main drains (3.6 km) and Secondary drains (6.6 km)

- Farm roads : Main roads (27.7 km; morrum pavement), Branch roads (21.0 km; without pavement)

- On-farm development : Basically 30 m × 100 m

- Yongoma floodway : Total length 34 km

2) Domestic watar supply facilities

i) Water source : Yongoma river

ii) Predicted service population and design amount : 13,200 (in 1995), 13.8 ℓ/sec

iii) Main works

- Facilities	:	Replacement and extension of existing facilities
- Grit-chamber	:	2.0 m (width) × 6.8 m (length) × 0.8 m (height)

3) Buildings

i) O&M and training buildings

- O&M office (including training room)	:	Reinforced concrete block structure, single storeyed, floor area 360 m^2
- O&M domitory	:	Reinforced concrete block structure, single storeyed, floor area 244 m^2
- O&M workshop	:	Steel structure, single storeyed, floor area 116 m^2
- Guard house	:	Reinforced concrete block structure, single storeyed, floor area 12 m^2

ii) Postharvest facilities

- Drying house	:	Steel structure, single storeyed, floor area 459 m^2
- Sun-drying yard	:	Concrete floor, floor area 480 m^2
- Rice mill house	:	Steel structure, single storeyed, floor area 150 m^2
- Multi-purpose warehouse	:	Steel structure, single storeyed, floor area 720 m^2
- Office	:	Reinforced concrete block structure, single storeyed, floor area 45 m^2

4) Major equipment

i) O&M equipment	:	Bulldozer, back hoe, dump truck, etc. and tools for workshop

ii) Postharvest equipment

- Rice milling machine : Processing capacity 0.7 ton/hr, 1 set
- Dryer : Drying rate 0.4%/hr, 6 units
- Transportation truck : 4-ton cargo truck, 11 units

iii) Equipment for training : Photocopy machine, Blue printing machine, projector, white board

The RDD's office will become the execution agency for the project. After completion of the project, though RDD's office will also full the responsibility for the O&M works for the facilities, the practical O&M work will be undertaken by the specific organizations as shown below:

Facility	Overall Control	Organization in Charge
1. Irrigation and drainage facilities	RDD's office	O&M office for main and secondary canals and related structures, and farmers for on-farm facilities
2. Postharvest facilities	RDD's office	Vuasu Cooperative Union (VCU)
3. Training and meeting facilities	RDD's office	O&M office
4. Water supply facilities	RDD's office	Water development office, DED's office, Same

For implementation of the project, it will take 31 months from signing of the Exchange of Notes (E/N). The construction work is proposed to be divided into two (2) phases as shown below, because the work will cover many facilities such as the buildings and the rural water facilities, in addition to the irrigation and drainage facilities for the development area of 680 ha.

- The first phase : Construction of headworks and right main canals, development of the area (242 ha) to the right of the Yongoma river and river training works for the Yongoma river.

- The second phase : Construction of left main canal, development of the area (438 ha) to the left of the river, improvement of rural water supply system, construction of all buildings and procurement of all the equipment.

The Government of Japan will take charge of the construction work for the irrigation-centered farm infrastructure development for the area of 680 ha, domestic water supply facilities and related buildings and the procurement of the required equipment. The Government of Tanzania will take responsibility for site reclamation, the extension of electricity and water to the related facilities and the construction of the gates and fences. The preliminary cost of the said works to be executed by the Government of Tanzania is estimated at about Tsh. 1.5 million.

It is considered that the project will play an important and effective role not only in the agricultural and economic development in the Ndungu area, but also in the advancement of the Tanzania National Development Plan. The project benefits to be expected from the implementation of the Ndungu Agricultural Development Project are: directly i) increase of agricultural production, ii) improvement of farming conditions, iii) improvement of rice quality, and iv) improvement of living conditions, and indirectly i) reinforcement of cooperatives, ii) demonstration effects, and iii) improvement of social welfare. It is concluded, accordingly, that the Ndungu Agricultural Development Project is favorable and appropriate for Japan's grant aid program.

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ABBREVIATIONS

AfDB	:	African Development Bank
DADO	:	District Agriculture Development Office
DED	:	District Executive Director
EC	:	European Community
E/N	:	Exchange of Notes
EL	:	Elevation
ERP	:	Economic Recovery Program
FAO	:	Food and Agriculture Organization of the United Nations
F/S	:	Feasibility Study
GDP	:	Gross Domestic Product
HYV	:	High Yielding Variety
IDA	:	International Development Association
IMF	:	International Monetary Fund
IRRI	:	International Rice Research Institute
JICA	:	Japan International Cooperation Agency
KADC	:	Kilimanjaro Agricultural Development Center
KIDC	:	Kilimanjaro Industrial Development Center
KNCU	:	Kilimanjaro Native Cooperative Union
LV	:	Local Variety
NESP	:	National Economic Survival Program
NMC	:	National Milling Corporation
OECF	:	Overseas Economic Cooperation Fund
O&M	:	Operation and Maintenance
PVC	:	Polyvinyl Chloride
RADO	:	Regional Agriculture Development Office
RDD	:	Regional Development Director
SAP	:	Structural Adjustment Program
SCS	:	Selungo Cooperative Society
USDA	:	United States Department of Agriculture
VCU	:	Vuasu Cooperative Union

GLOSSARIES

1. Length and Height

mm	:	millimeter
cm	:	centimeter
m	:	meter
km	:	kilometer

2. Area

cm^2	:	square centimeter
m^2	:	square meter
ha	:	hectare
km^2	:	square kilometer

3. Volume

cm^3, cc	:	cubic centimeter (= mℓ)
mℓ	:	milliliter (= cc)
ℓ	:	liter (= 1,000 mℓ)
m^3	:	cubic meter

4. Weight

mg	:	milligram
g	:	gram
kg	:	kilogram
t	:	ton (= 1,000 kg)

5. Time

S, sec	:	second
min	:	minute
hr	:	hour

6. Electrical Measurements

V	:	volt
kV	:	kilo volt
Hz	:	hertz

7. Other Measures

%	:	percent
HP, Ps	:	house power
°C	:	degree centigrade
ppm	:	parts per million
No(s)	:	number(s)
μΩ	:	micro ohm
°S	:	south latitude
°E	:	east longitude

8. Currencies

US$	:	US Dollar
Tsh.	:	Tanzanian shilling

CHAPTER 1 INTRODUCTION

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The Government of the United Republic of Tanzania (hereinafter referred to as "Government of Tanzania") has been promoting a series of national development plans since its independence in 1961.

In the Second 5-year Plan (1969-1974), the Government of Tanzania framed the policy that assistance in the formulation of integrated development plans for major regions would be asked of developed countries, based on the principal policy of decentralization under which each region should be responsible for its own development and the Central Government would coordinate the whole. In line with the said policy, the Government of Tanzania requested the Government of Japan to extend its technical aid for the preparation of an integrated development plan for Kilimanjaro Region. In response to this request, the Government of Japan agreed to provide the necessary technical services for the study as a part of the technical cooperation program of the Government of Japan. The Japan International Cooperation Agency (JICA) has dispatched a series of study teams since 1974 to Kilimanjaro Region and subsequently submitted the Report on the Kilimanjaro Integrated Development Plan to the Government of Tanzania in October 1977. The plan envisaged various types of social and economic development covering such basic sectors as agriculture, small-scale industry, water resources, infrastructure, tourism, and education as well as health based on the regional socio-economic background and problems. In the Report, 38 concrete development projects were listed as having promising development potential.

Out of these 38 projects, six (6) priority projects were selected in the Outline of Japan's Possible Assistance in September 1978, through discussions between the Government of Tanzania and the Government of Japan. Afterward, Japan's assistance program was successfully implemented.

The selected projects and the present situation of Japan's assistance for these projects are listed below:

Project	Present Situation
1. Lower Moshi Agricultural Development Project	Under construction and to be completed in 1987 by OECF loan.
2. Mkomazi Valley Area Irrigation Development Project	Feasibility study (F/S) was executed in 1982/83 by JICA.
3. Development, Extension and Training of Agricultural Techniques	Kilimanjaro Agricultural Development Center (KADC) was established in 1981 under Japan's Grant Aid Program. Technical assistance is ongoing.
4. Promotion of Agricultural Mechanization	KADC was established in 1981 under Japan's Grant Aid Program. Technical assistance is ongoing.
5. Establishment of Kilimanjaro Industry Development Center (KIDC)	KIDC was installed under Japan's Grant Aid Program. Technical assistance is ongoing.
6. Kilimanjaro Transmission and Distribution Network Project	Construction work has been completed by OECF loan.

The Government of Tanzania has given a high priority to Kilimanjaro Region in the execution of the Regional Integrated Development Plan. Regarding agricultural development which is the core of the Regional Integrated Development Plan, the Government of Tanzania has laid the greatest emphasis on that in Kilimanjaro Region, giving a leading position to the successfully implemented two projects, i.e. KADC and the Lower Moshi Agricultural Development Project. As an example, Kilimanjaro Region received about 40% of the national agricultural development budget in fiscal 1985. In succession to the Lower Moshi Agricultural Development Project, the Mkomazi Valley Area Irrigation Development Project is expected to be executed as a part of the Regional Integrated Development Plan.

The Ndungu Agricultural Development Project, for which the Government of Tanzania has requested Japan's grant aid, is one of the priority schemes selected through the feasibility study (F/S) on the Mkomazi Valley Area Irrigation Development Project executed by JICA in 1982/83. The Government of Tanzania intends to improve the foundation for agricultural production in the Ndungu area as a model scheme for the future promotion of agricultural development in other areas in the Mkomazi Valley area.

In this connection, the reasons why the Ndungu area was selected among the five (5) alternative schemes formulated in the F/S report are; i) area of irrigation

development is comparatively small at 680 ha, ii) IRR shows the second highest out of the five schemes and construction cost per hectare is the smallest in the F/S report, iii) discharge of the Yongoma river, which is the water resource of the Ndungu area, is stable and iv) farmers in the area have long experience in paddy cultivation.

In response to the request of the Government of Tanzania, the Government of Japan agreed to conduct a preliminary survey to investigate the project framework and to define possibilities for cooperation, and JICA dispatched a Preliminary Survey Team headed by Mr. N. Sakino, Deputy Director of the Construction Department, Kinki Regional Agricultural Administration Office of the Ministry of Agriculture, Forestry and Fisheries to Tanzania from July 30 to August 11, 1986. Based on the investigation of the Preliminary Survey Team, both sides agreed that the consolidation of such rural infrastructure as postharvest facilities, farmers' training facilities and domestic water supply facilities would be included in the project framework in addition to the requested irrigation-centered farm infrastructure improvement for the effective promotion of the comprehensive rural development in the Ndungu area.

On the basis of the results of the preliminary survey, the Government of Japan decided to conduct a basic design study to examine the propriety of the project and to work out a specific basic design for the project, and dispatched the Basic Design Study Team headed again by Mr. N. Sakino to Tanzania from December 1 to 30, 1986. The team surveyed and investigated the project area to grasp the present conditions and constraints, collected the data required for the basic design study and had a series of discussions with the officials concerned of the Government of Tanzania, then both sides exchanged the Minutes of Discussions. In Japan, a further detailed study was done by the team based on the field work in Tanzania, and a specific basic design as well as execution, operation and maintenance plans were subsequently formulated. In the meantime, the team prepared the Basic Design Study Report on the Ndungu Agricultural Development Project (Draft).

JICA dispatched a Draft Report Explanation Team to Tanzania from March 29 to April 9, 1987. The Draft Report was discussed by the Transznia Authorities concerned and the team. This report was prepared taking into account the comments made by the Government of Tanzania on the said Draft Report.

CHAPTER 2 BACKGROUND

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2.1 General

Tanzania's territory extends over 945,100 km^2, of which only 41,000 km^2 or 4% is arable land.

Approximately 45% of the Gross Domestic Production (GDP) is derived from the agricultural sector, half of which depends on subsistence farming. About 90% of the population lives in the rural area, and agriculture employs nearly 90% of the economically active population.

The major exports of Tanzania are agricultural products such as coffee, cotton, sisal, tea, tobacco, cashew nuts and sugar. The amount of these products corresponds to 70% of total exports. Some of these export crops, however, have a tendency to decrease in quantity. In general, these export crops are produced mainly on large-scale estates and/or national farms, while most food crops are harvested by small farmers.

The recent economic growth rate in the agricultural sector has been stagnant. The annual growth rate of the agricultural sector's GDP during 1967-1977 was 2.7% on average. Though it declined to 1.5% during 1976-1980, the average growth rate showed a recovery during 1980-1984 at 2.5%. However, these growth rates were lower than the population increase rate.

Tanzania has been importing basic food crops since the end of the 1960s, and it is expected that the food supply situation in Tanzania will become worse particularly by reason of population growth. Therefore, the national agricultural development plan, which is now being actively promoted, aims for the accomplishment of food self-sufficiency, and must succeed.

Kilimanjaro Region is located in the northeastern part of Tanzania, and borders on Kenya to the north, Tanga Region to the southeast and Arusha Region to the west and covers an area of 13,210 km^2. This size corresponds to 1.4% of the area of the entire country. Out of the entire region, 2,820 km^2 or 21% is agricultural land, 512 km^2 or 4% is natural pasture and the remaining 75% is maintained as preserved forest, savanna and steppe.

About 160,000 ha or 57% of the agricultural land is estimated to be net cultivated land, of which 70% is cultivated by small-scale farmers, and 30% is large-scale estates.

Administratively, Kilimanjaro Region is divided into 5 districts i.e. Moshi, Hai, Rombo, Mwanga and Same. They are subdivided into 25 Divisions, 117 Wards and 358 Villages.

This Region can be divided into two distinctive areas, the so called highlands and lowlands, according to natural conditions such as climate and topography and the extent of sociological and economical development.

The highlands are located on the slopes of Mt. Kilimanjaro and the Pare mountains in belts from 800 to 1,000 m in altitude. This area is favoured with moderate temperatures and abundant rainfall. Under these conditions, intensive cultivation of coffee and bananas has been practiced for many years, and land use has probably reached its maximum. One of the most serious problems in this area however is that farm land has been divided into small plots and self-sufficiency in food has decreased due to the rapid increase in population. Accordingly, farmers are increasingly immigrating to the lowlands so as to obtain new farm land.

By contrast, the lowlands, which comprise the Ndungu area, are located below 800 m, are characterized by insufficient rain and high temperatures, and extend over the basins of the Pangani river, the Mkomazi river and the Arusha-Chini plain. Such food crops as maize, millet, beans and paddy are mainly produced in the lowlands by settlers, but most of the area is left uncultivated. Sisal and sugarcane estates however are operated on quite a large scale. Livestock production is also practiced extensively in this area using wild grasses in the savanna land.

Agriculture in Kilimanjaro Region has played an important role in both the national and regional economy. More than 90% of the regional population is engaged in agriculture either directly or indirectly. The Region is one of the main producers of cash crops in Tanzania, and among these coffee is predominant. At present some 14,000 to 29,000 tons of a high quality Arabica coffee is harvested annually. This production accounts for about 50% of total national production. Furthermore, the Region produces about 300 tons of cotton (lint) and about 1,700 tons of sisal.

Cultivated lands and the production of major food crops for the entire country and Kilimanjaro Region are shown below:

Cultivation Area and Production of Major Food Crops

Crop	Tanzania Total (1)		Kilimanjaro Region (2)			
	Area (10^3 ha)	Production (10^3 ton)	Area		Production	
			(10^3 ha)	(%)	(10^3 ton)	(%)
Maize	1,250	1,313	61.0	(4.9)	72.7	(6.9)
Rice	270	400	4.4	(1.6)	11.4	(2.9)
Wheat	60	80	3.2	(5.3)	4.0	(5.0
Millet	350	285	5.8	(11.6)	3.0	(1.1)
Pulses	697	295	23.4	(3.4)	9.1	(3.1)
Roots and Tubers	565	6,369	12.9	(2.3)	69.1	(1.1)

Source: (1) FAO Production Yearbook, 1984
(2) RDD's office, 1984/85

As seen in the above table, the proportion of total production provided by the Kilimanjaro Region is quite small in relation to the whole country. However, the development of Kilimanjaro Region where irrigation water is available is extremely important from the viewpoint of the national economy, because the possibility of expanding farms in the country is quite limited particularly regarding irrigation development, while Tanzania has been importing major food crops continuously as shown in the table below:

Imports of Maize and Rice

Crop		1982	1983	1984
Maize	(ton)	121,516	120,935	229,000
	(US$1,000)	23,732	25,451	47,000
Rice	(ton)	126,716	63,843	64,000
	(US$1,000)	49,214	32,148	31,000

Source: FAO Trade Yearbook

2.2 Outline of Related Development Plans

2.2.1 National Development Plan

The Government of Tanzania has had five (5) National Development Plans since the independence in 1961:

- First 3-year Plan (1961 - 1964)
- First 5-year Plan (1964 - 1969)
- Second 5-year Plan (1969 - 1974)
- Third 5-year Plan (1976 - 1981)
- Fourth 5-year Plan (1981 - 1986)

The fundamental purpose of economic development plans up to 1970s was that the growth rate during the target period should be over 6% per annum, based on the principle of promotion of the industrialization and the increase of agricultural production. In practice, however, the growth rates during the First, Second and Third 5-year Plans were 5%, 4.8%, and 0.4% respectively, being lower than the target, due to deficiencies in the supply of materials and also in the social infrastructure caused by insufficient governmental development funds and foreign currency.

To cope with the rapid economic decline towards the end of the 1970s, the Government of Tanzania suspended the Fourth 5-year Plan and introduced the National Economic Survival Program (NESP) in 1981 as an urgent countermeasure. During the period 1982-1985, the Government further adopted the Structural Adjustment Program (SAP) having the objectives of: i) increasing production, especially agricultural production, ii) recovery from the financial deficit and restriction of the money supply, iii) promotion of exports and iv) equalization of income distribution. However, achievement of these objectives has so far been limited.

Subsequently, the Economic Recovery Program (ERP) was launched in 1986 for the period 1986-1990. In the ERP, the targeted annual growth rate of GDP was set at 4.5% on average to be attained in the following manner:

- Achievement of food self-sufficiency through increased agricultural production,
- Gaining of foreign exchange by means of export promotion,

- Rehabilitation of major social infrastructure,
- Amelioration of the rate of operation in existing factories, and
- Improvement of the balance of revenues and expenditures in national finance.

Increasing agricultural production both in food crops and export crops was given first priority in the program. In order to attain the target, a development fund of US$143 million was projected to be invested mainly in; i) strengthening of extension services and research work, ii) stabilizing of farm inputs supply, iii) acceleration of irrigation development, iv) promotion of estate development and v) rehabilitation of the means for production of export crops. It can be said that the Ndungu Agricultural Development Project requested by the Government of Tanzania is one of the important linking projects in the chain of ERP.

However, no less than about 82% of the required funds for this program (totalling about US$4,574 million) depends on foreign funds. This means that the success or failure of ERP is basically conditioned by the economic assistance trend in foreign countries including international organizations.

From this point of view, it is hoped that restrained foreign aid from developed countries, especially European countries, will be expanded rapidly now that the problem of the rescheduling of debt has improved since the Government of Tanzania carried out a currency devaluation in April, 1984 as recommended by the IMF.

2.2.2 Present Condition of Agricultural Development

(1) Agricultural development plan

Based on the aforesaid 5-year Development Plan, the Government of Tanzania (Ministry of Agriculture and Livestock Development) established agricultural strategies in the announced development program of the "Agricultural Policy of Tanzania" in 1983 and the "Tanzania National Food Strategy" in 1984, in order to attain the independence of the national economy.

The "Tanzania National Food Strategy", prepared with the technical cooperation of FAO, provided a comprehensive prescription covering procedures of

production, processing and marketing for the three (3) target terms; short-term (1980-1985), medium-term (1985-1990) and long-term (1990-2000).

The main goals of the short-term plan were to:

- Improve the transport and storage facilities for the smooth conveying of food crops and farm inputs,
- Supply the proper amount of fertilizers, agricultural chemicals and farm implements in a timely manner for the small-scale farmers, and
- Rationalize the prevailing price policy so as to promote effective and economic food production.

Regarding the above items, improvement was being achieved as seen in the drastic relaxation in the price policy on farm products made in 1984.

The medium-term plan put stress on agricultural research for food crops and the promotion of improved seeds multiplication, and aimed at the provision of acceptable packages of techniques for various crops and areas. The improvement of existing small-scale irrigation systems and the maintenance of irrigation facilities in rural areas were also principal objectives.

In addition the following were included in the program:

- Strengthening of the agricultural extension and training service,
- Strengthening of the agricultural credit system, and
- Taking measures for the prevention of pre- and postharvest losses.

The long-term plan placed the highest priority on the expansion of irrigation systems. As for the irrigation development plan, which was emphasized in the "Tanzania National Food Strategy", it was projected that the irrigated area (see the table below) would be extended gradually by 38,500 ha during 1980-1985, 50,400 ha during 1985-1990 and 150,000 ha during 1990-2000 up to 380,000 ha in total or three times that at present. As the objective areas, six (6) irrigation zones in the respective regions of Mbeya, Morogoro, Kilimanjaro, Tabora, Mwanza and Rukwa were programed to be developed.

Present Irrigated Area in Tanzania

(Unit: ha)

1.	Traditional small-scale irrigation system	
	- Kilimanjaro	38,390
	- Mbeya	17,500
	- Arusha	15,347
	- Others	34,957
	Total	106,194
2.	Large-scale irrigation system (Governmental)	
	- Morogoro	9,622
	- Kilimanjaro	6,710
	- Others	34,957
	Total	20,372
3.	Large-scale irrigation system (Private)	700
	Grand-total	127,266

Source: Tanzania National Food Strategy

Irrigated farming has a long history in Kilimanjaro Region, particularly in the plantation areas. Out of the total arable land in the Region, about 45,100 ha or 28% are irrigated at present. This is a quite good exploitation if compared with only 4% of that in the case of Tanzania as a whole. However, most of the irrigation areas are categorized as traditional small scale systems as seen in the above table and irrigation development in most lowlying areas is still limited in its extent. Almost all cereal cultivation is practiced under rainfed conditions.

The agricultural development of Kilimanjaro Region is being promoted systematically. The main agricultural development projects in the Region presently programed are as follows:

Lower Moshi Area	6,320 ha	
- Rau River System	2,300 ha	(under construction)
- Miwaleni	2,000 ha	(F/S is executed)
- Himo River System	1,000 ha	(F/S is executed)
- Groundwater	1,020 ha	(F/S is executed)

Mkomazi Valley Area	4,060 ha	
- Kisiwani Scheme	360 ha	(F/S has been executed)
- Gonja Scheme	600 ha	(F/S has been executed)
- Ndungu Scheme	680 ha	(F/S has been executed)
- Kihurio Scheme	1,670 ha	(F/S has been executed)
- Igoma Scheme	750 ha	(F/S has been executed)
Hai & Rombo Area Groundwater Development	5,000 ha	(F/S has not been executed)
Ruvu River System, Jipe Lake Area	6,000 ha	(F/S has not been executed)

The Government of Tanzania and Kilimanjaro Region hold the view that concentrated development in a particular area is not desirable, preferring the proportional development of the whole Region. Based on this principle, the promising projects identified by F/S are planned to be started in sequence. This Ndungu project is ranked as the second one following the Rau River System in the Lower Moshi Area. The development of Miwaleni (2,000 ha) is under consideration as the next one in this connection.

(2) Administration

The administration of Tanzania consists of sixteen (16) Ministries. The Ministry of Finance, Economic Affairs and Planning is in charge of foreign economic cooperation.

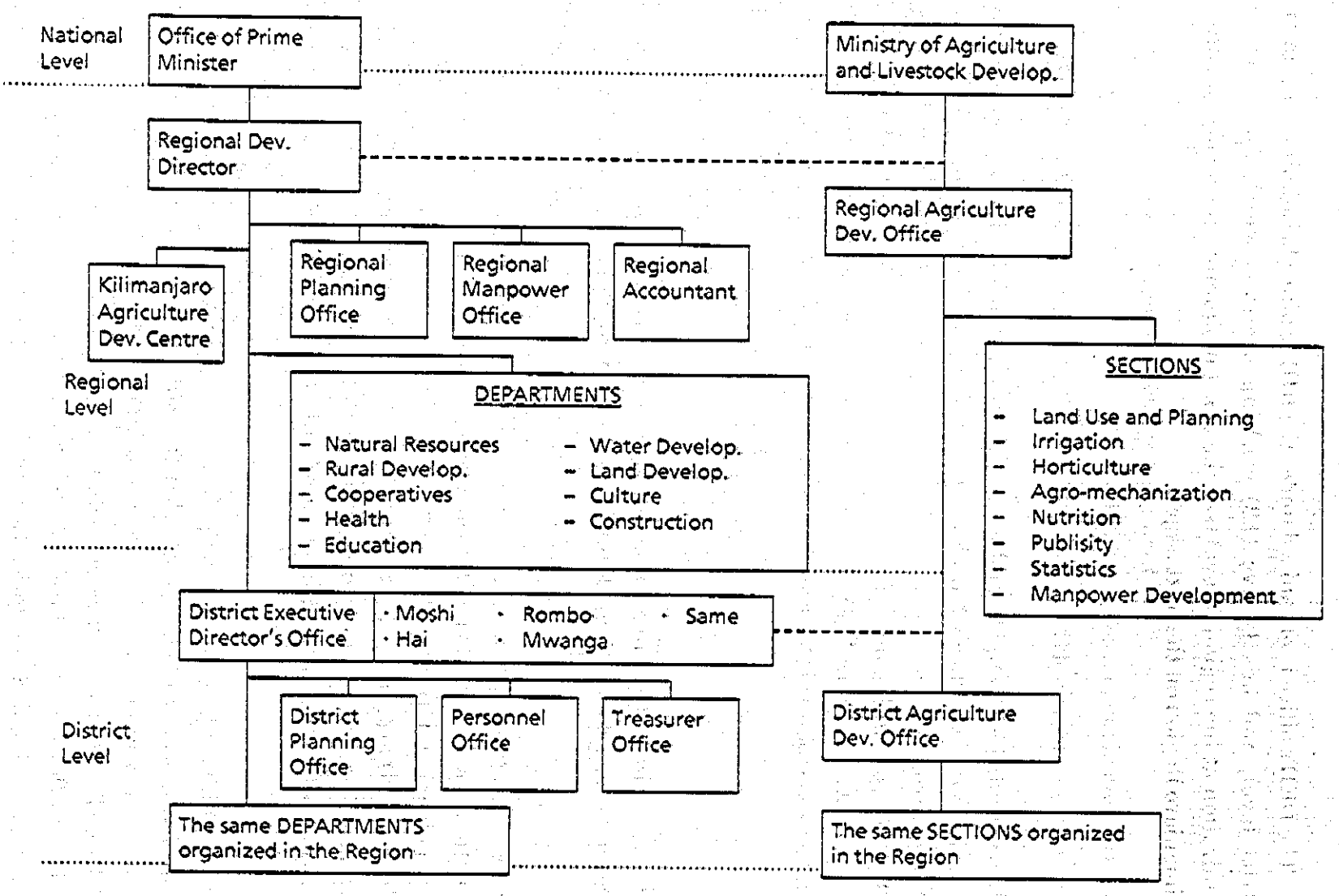
The Ministry of Agriculture and Livestock Development, and the Ministry of Local Government and Cooperatives are directly related to agricultural development. The former is responsible for agricultural research extension work and agricultural development schemes, and the latter is in charge of the promotion of the development of village communities and the Cooperative Union/Cooperative Society. Water supply is entrusted to the Ministry of Lands, Water, Housing and Urban Development.

All the development activities in the Region are the responsibility of the Regional Development Director's office (RDD's office), which is organized under the Office of the Prime Minister. RDD's office consists of three (3) executive divisions and nine (9) technical divisions under the control of RDD. The RDD's office takes charge of the District Executive Director's offices (DED's offices) which are located in each district. The agricultural administration is exclusively

executed by the Regional Agriculture Development Office (RADO) under the Ministry of Agriculture and Livestock Development.

The DED's office is organized under the RDD's office for administration at the district level, and has twelve (12) working sections which form the same organization at the regional level (see the chart of administrative organization in Kilimanjaro Region on the next page).

CHART OF ADMINISTRATIVE ORGANIZATION IN KILIMANJARO REGION



(3) Foreign aid Trends

The actual amount of foreign aid for Tanzania was US$696 million in 1982, consisting of US$484 million (70%) from bilateral aid, US$188 million (27%) from international organizations and US$24 million (4%) from OPEC countries.

The donor countries which gave the most grant aid to Tanzania in 1982 were Sweden, Holland, West Germany, Norway, England, Denmark and Canada in that order, and these seven countries provided about 72% of the total grant aid for Tanzania. As for loans, the international organizations provided as much as 61% of the total loan amount, mostly from IDA. Of bilateral aid in that year, Japan offered the largest amount (19%) among the donor countries.

Based on the principal policy of Tanzania, that each region should be developed under its own responsibility, the Government of Tanzania showed the way in the Second 5-year Plan (1969-1974) by asking developed countries for assistance in the formulation of integrated regional development plans. These requests were made region by region to various countries, i.e. Arusha and Mwanza Regions to Sweden, Pwani and Dodoma Regions to Canada, Mara and Zwa Magharibi Regions to Denmark, Morogoro and Shinyanga Regions to Holland, Kigoma Region to the World Bank, Tanga Region to West Germany and Kilimanjaro Region to Japan. These requests were made only for the formulation of the integrated development plan for each region, and it does not mean that aid to the said regions from other developed countries is restricted.

Aid in the agricultural sector has been extended by various countries and organizations partly because the stress has been shifted to the direct production sector since the Third 5-year Plan. It is noteworthy that the commencement of several small-scale irrigation projects such as the schemes in Tanga Region by West Germany, Mwanza Region by the EC and Dodoma Region by Italy have been decided. In Kilimanjaro Region, however, there is no agricultural aid program from countries other than Japan at present.

Recent major studies made for agricultural development in Tanzania are as follows:

	Name of Study	Donor	Year Commenced
1.	Small-scale paddy cultivation development project	AfDB	1982
2.	Irrigation development project for paddy cultivation in Morogoro Region	AfDB	1982
3.	Paddy cultivation development project in Dakawa	AfDB	1983
4.	Water supply project for Iringa, Mbeya and Ruvuma	Denmark	1983
5.	Pest control project	Denmark	1983
6.	Iringa development project	EC	1983

2.3 The Request and Preliminary Survey

2.3.1 The Request

Nearly 90% of the labour horce are engaged in agriculture in Tanzania, thus the development of agriculture is indispensable for the improvement of national living standards.

Tanzania's agriculture is dual-structured; cash crops for export such as coffee play an important role in earning foreign exchange, while such food crops as rice and maize are not achieving self-sufficiency and are regularly imported at the rate of about 2.4 million tons per year. Therefore, priority has always been given to increasing self-sufficiency in food crops through agricultural development in successive national development plans.

The Kilimanjaro Region, on which Japan concentrates its cooperation, is the main agricultural production area in Tanzania. The Government of Tanzania, therefore, has laid the greatest emphasis on its agricultural development so as to achieve self-sufficiency in food crops, and this has been actually advanced under the particular cooperation from Japan.

As a part of the National Development Plan, the Government of Tanzania intends to commence agricultural development of the Mkomazi Valley area, which

is comparatively less developed in the Region, following the completion of Lower-Moshi Agricultural Development Project (projected for April, 1987).

Based on the above mentioned background, the Government of Tanzania requested grant aid from the Government of Japan to promote the development of the Ndungu area, which had been selected out of the five alternative schemes for irrigation development covering a total area of about 4,100 ha in the Mkomazi Valley area, as a model scheme for the other areas in the Valley area. The request made by the Government of Tanzania was to execute such land consolidation as the improvement of irrigation and drainage facilities and farm roads, for the target area of 680 ha out of the 1,340 ha in the Ndungu area.

2.3.2 Preliminary Survey

The preliminary survey team dispatched by JICA in July/August 1986 had discussions with the concerned officials of the Government of Tanzania regarding the propriety of the request based on the results of the site survey and an analysis of collected data.

In a series of discussions, both sides agreed that the improvement of the below mentioned facilities will be examined in the objective Ndungu scheme in a basic design study as the object of the grant aid program of the Government of Japan, in addition to the initial request for the improvement of the irrigation-centered foundation for agricultural production for 680 ha.

It was also agreed that the name of the project would be modified from "the Ndungu Irrigation Scheme of the Mkomazi Valley Area Irrigation Development Project" as named in the initial request to "the Ndungu Agricultural Development Project".

The comparison of project features between the request of the Government of Tanzania and the recommendations of the Preliminary Survey Team is outlined below:

Item	Request of the Government of Tanzania	Recommendation of Preliminary Survey Team
1. Consolidation of farm infrastructure		
- Irrigation network with diversion	O	O
- Drainage network	O	O
- On-farm development	O	O
- Farm road network	O	O
- River improvement and flood dike	O	O
- Facilities and equipment for O&M	O	O
2. Consolidation of rural agro-facilities		
- Multi-purpose warehouse	O	O
- Post harvest facilities		
· Drying facilities	O	O
· Rice milling facilities	O	O
· Transportation facilities	O	O
3. Consolidation of rural environment		
- Village roads	O	X
- Domestic water supply facilities	O	O
- Training and meeting facilities	O	O
- Consolidation of school facilities	O	X
- Transportation facilities for medical care	O	X

CHAPTER 3 THE PROJECT AREA

CHAPTER 3 THE PROJECT AREA

3.1 Administration and Population

There are three villages in the Ndungu area, Ndungu, Msufini and Kalimawe, and these villages administratively form one ward named Ndungu ward. Each village organizes the Village Council as its smallest administrative unit. All the activities of the Council are properly steered by the three core positions of village chairman, secretary and manager.

Since the last population census was taken in 1978, no further census has been taken in Tanzania, though one is planned for 1987. Therefore, the population in the project area is estimated based on the information obtained in the Ndungu ward office as shown below:

Village	Population
Musufini	1,930
Ndungu	6,130
Kalimawe	2,020
Total	10,080

Total households in the Ndungu area are estimated at about 2,000 at present. Total farm households related to the arable land of 1,010 ha in the area is also estimated at 1,310. The number of farm households in the development area of 680 ha (gross development area is estimated at 750 ha taking the right-of-way, e.g. construction of canals and roads into consideration) is projected at about 970 consisting of a population of 4,850 at present.

3.2 Natural Conditions

3.2.1 Location and Climate

The project area is situated at around lat. 4° to 4°35'S. and long. 38°E. The climate in the area is classified as a tropical savanna type. The area is affected by the north-east monsoon which provides most of the rainfall in the area. Based on rainfall distribution, a year can be divided into two seasons. The rainy season lasts from November to May and the dry season from June to October. More than 90% of

the annual rainfall occurs in the rainy season and amounts to about 660 mm on an average.

The monthly mean temperature at the Kalimawe meteorological station ranges from 22°C to 28°C with little seasonal variation. The monthly mean maximum and minimum temperatures recorded are 34.1°C and 16.2°C, respectively.

It is necessary to consider the above mentioned climatic conditions for the formulation of cropping patterns and the construction plans of the project.

3.2.2 Topography

The project area is comprised of alluvial plains and swales. The alluvial plains extend over the area between Ndungu village and the Kambaga river and were mainly formed by the Yongoma river. The slope of the alluvial plains is about 1:350 on an average and elevation ranges from 507 m to 520 m. Swales are located in the northern part of the Ndungu area.

3.2.3 Soils and Land Classification

The soils and land suitability in the project area are classified as shown in Table 3.2.1. The soil classification is made according to the soil taxonomy system defined by the U.S. Department of Agriculture (1975), and the land suitability classification is made in accordance with the U.S.B.R. standard (1967).

The land capability map which is prepared based on Table 3.2.1 is shown in Fig. 3.2.1, and land suitability in the project area is summarized in the following table.

(Unit: ha)

Land Class	For Paddy Cultivation	For Upland Crop
I	645	375
II	470	475
III	5	265
IV	-	220
VI	320	5
Total	1,340	1,340

As seen in the table, 1,020 ha or about 76% of the study area (1,340 ha) are classified into class I, II and III for paddy cultivation.

The irrigation development area would be demarcated according to the above mentioned land classification.

3.2.4 Runoff of the Yongoma River

Because no discharge data is available for the Yongoma river, the monthly discharge of the river is estimated by applying the average monthly specific discharge of the Hingilili and the Saseni river (but RDD's Office started water discharge observation in 1983). The average monthly mean discharges of these tributaries are summarized below:

(Unit: m^3 / sec)

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Average
Hingilili (55.8 km^2)	1.70	1.20	1.48	1.80	1.37	1.00	0.72	0.68	0.64	0.61	1.35	2.52	1.26
Yongoma (70.5 km^2)	1.87	1.25	1.55	1.74	1.23	0.85	0.60	0.54	0.49	0.47	1.14	2.48	1.18
Saseni (198.5 km^2)	4.39	2.76	3.43	3.39	2.01	1.21	0.83	0.60	0.50	0.49	1.62	4.99	2.18

Based on the above discharges, the annual runoff of the Yongoma river at the site of the newly established water level gauge station is calculated at about $37 \times 10^6 m^3$.

3.3 Infrastructure

3.3.1 Roads

The Same - Tanga road running just beside the project area is all-weather gravel paved. Due to insufficient maintenance, however, the road condition is not always favorable. Heavy rain during the rainy season damages the road and small automobile traffic is sometimes suspended. Busses are the major transportation for the villagers to the district and the regional capital cities.

3.3.2 Electricity Supply and Communication

The power transmission line runs from the Same substation to the transformer substation in neighbouring Gonja village with a power pressure of 33 kv. The power is decreased to 11 kv at the said transformer substation and transmitted to the Ndungu area. The power is distributed to the village beneficiaries through two current transformers installed on electric poles.

3.3.3 Domestic Water Supply

There exist public water supply facilities for Msufini and Ndungu village. The water is taken from the Yongoma river and supplied to the service area by the gravity method. The facilities have been used for 20 years since 1967 and have seriously deteriorated. The water supply capacity of the existing facilities can not cope with the present water demand which has been augmented due to the increase of population. In Kalimawe village, there are no water distribution facilities. Domestic water for the village depends on the Kalimawe reservoir.

3.3.4 Other Facilities

In the Ndungu area, a market, primary schools, a medical office and a church are operating. Ndungu village has an important role as a rendezvous for the neighboring villagers.

3.4 Present Conditions of Agriculture

3.4.1 Land Tenure and Holdings

Basically, all land ownership in Tanzania reverts to the state. In general, however, most local farmers cultivate their farm land according to traditional cultivation rights.

In the project area, the average holding size is calculated at 0.77 ha per farm household based on the estimated arable land of 1,010 ha and the related farming households of 1,310 farms to the project area. Generally, these farmlands consist of small plots, from 200 to 800 m^2 in size, scattered in a few places or in several

locations. Fragmentation of land holding has proceeded recently due to population growth.

3.4.2 Land Use

The agriculture in the project area has been exploited by spontaneous farmers, and arable land has been reclaimed close to the potential maximum possible under the present natural conditions. This agricultural setting in the project area is primarily characterized by the individual and small scale land holding and cereal crop production, in contrast with the perennial crop plantation by small holders in the mountainous area.

The present conditions of land use in the project area are approximated as follows:

(Unit: ha)

	Land Use	Rainy Season		Dry Season	
Arable Land	1,010				
- Irrigated land	(280)	Paddy	170	Paddy	-
		Upland	100	Uplasnd	140
		Fallow	10	Fallow	10
- Elevated rainfed land	(270)	Upland	250	Upland	-
		Fallow	20	Fallow	20
- Lowlying rainfed land	(460)	Paddy	210	Upland	200
		Fallow	50	Fallow	50
Non-agricultural Land	280		-		-
Roads/Rivers/Others	50		-		-
Total	1,340				

3.4.3 Cultivation and Production

(1) Cropping pattern

The present agricultural setting in the area is broadly classified into two farm types, namely:

i) Upland crop cultivation and
ii) Paddy cultivation.

Upland crop cultivation could be further classified into two sub-types, i.e. intensive farming (double cropping each year) under irrigated conditions and extensive farming (single cropping each year) under rainfed conditions. In both types of farming, maize and beans are cultivated as the main crops.

Paddy cultivation is mainly practiced in the lowlying area where the land has been developed as irrigable land and irrigation water is substantially available for paddy growing. In this paddy cultivation, two types of farming are identified mainly from the viewpoint of their production system. The first type follows the double cropping system. In this type, paddy is the staple product in the rainy season cropping followed by maize in the dry season. The second type is characterized by the single cropping of paddy by the use of seasonal flooding supplemented by irrigation through the traditional furrow. The above mentioned present cropping pattern is illustrated in Fig. 3.4.1.

(2) Farming practices

Many farmers still refer traditional farming techniques, though irrigated farming has been introduced to a certain extent. The tractor hire services provided by the VCU and DED's office cover about a half (500 ha) of the arable land for soil preparation. The remaining work is done by manpower with small hand hoes. Use of animal power for soil preparation is uncommon in this area.

Maize seeds are generally sown in small holes prepared by hand hoes. The regular planting spaces are at one hill per m^2. In the case of the cultivation of high-yielding maize, some farmers sow seeds using 100 cm x 30 cm as the plant space, in accordance with Government recommendations. Most farmers, however, still use their own judgment on traditional plant spacing.

As for paddy cultivation, soil puddling and leveling are practiced by the use of hand hoes. Regular transplanting using 25 cm x 15 cm as the plant space is made in common. Nurseries are grown for about one month in small beds.

Other than the above farming practices, attention is paid only to weed control by the farmers. Fertilizer and chemical use are limited in the project area at present.

(3) Crop yield and production

Crop	Planted Area (ha)	Yield (ton/ha)	Production (ton)
1. Maize			
1st Cropping Maize/1			
Irrigated/HYV	30	1.5	45
Irrigated/LV	70	1.0	70
Rainfed/LV	210	0.6	125
2nd Cropping Maize/2			
Rainfed/LV	40	0.6	25
Rainfed/LV/4	170	0.6	100
3ed Cropping Maize/3			
Irrigated/HYU	40	1.5	60
Irrigated/LV	100	1.0	100
Rainfed/LV/4	30	0.6	20
Total	690		545
2. Paddy			
Irrigated/LV	170	1.8	305
Rainfed/LV	210	1.8	380
Total	380		685
3. Beans/5	480	0.4	190

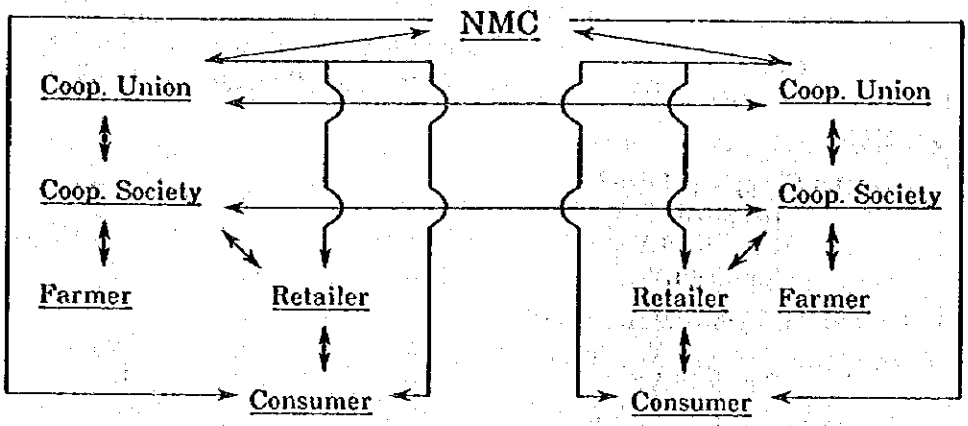
Note: /1: Rainy season maize, mixed cropping with beans
/2: Rainy season maize, single cropping
/3: Dry season maize, mixed cropping with beans
/4: Cropping in the lowlying land
/5: Mixed cropping with maize

3.4.4 Marketing

(1) Marketing system

The Government of Tanzania revivified the Cooperative Union/Cooperative Society in the marketing system in 1984, though it was once abolished in 1976, to introduce a freer marketing system into the market for agricultural products. Due to this change, various marketing corporations, which had handled most farm products exclusively, were abolished or reduced their business activities. In the case of the marketing of major food crops such as rice, maize and beans, the National Milling Corporation (NMC), which was the former sole agency for these crops reduced its business to selling activities only in the urban areas, and most of the marketing activities for these crops were handed over to the Cooperatives.

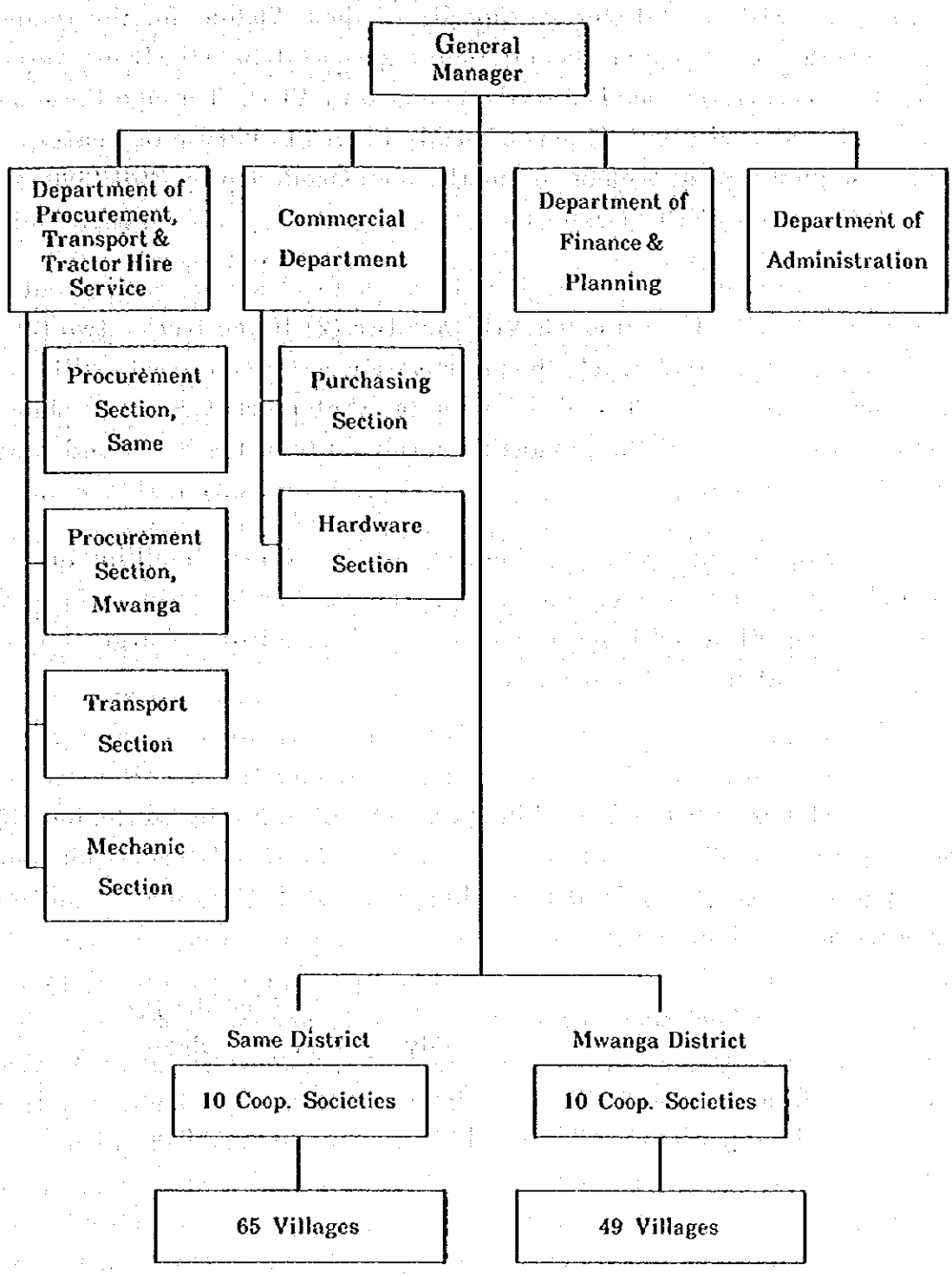
The above mentioned new market system is illustrated as shown below:



In Kilimanjaro Region, the Vuasu Cooperative Union (VCU) and the Kilimanjaro Native Cooperative Union (KNCU) were established in 1984. The former takes charge of the two (2) districts of Same and Mwanga and the latter has the three (3) districts of Moshi, Hai and Rombo. Under the said two Cooperative Unions, 90 Cooperative Societies are further organized and cover the total 358 villages in the Region.

The project area is within the jurisdiction of VCU and its head office is located in Same town. Under VCU, there are 20 Cooperative Societies, of which 10 Societies are in Same district and the other 10 societies in Mwanga district. As shown in the organization chart on the next page, VCU consists of four departments and takes charge of the sale of farm inputs and the necessities of life and agricultural credit services, in addition to marketing services for agricultural products.

ORGANIZATION CHART OF VUASU COOP. UNION



The Selungo Cooperative Society (SCS) under VCU has direct responsibility for the marketing of agricultural products in the Ndungu area. The SCS has two buying posts with a total storage capacity of about 70 tons for the temporary keeping of the collected products until their transportation to the Same warehouse (2,300 tons' capacity) which is directly managed by VCU. Through these buying posts, SCS collected about 75 tons of paddy in the 1985/86 crop season. This amount occupies about 25% of the total amount collected by SCS (300 tons) or about 15% of that by VCU (500 tons).

Transportation of the products to Same or to Moshi are carried out using trucks owned by VCU. Although VCU has two (2) 10-ton trucks, two (2) 7-ton trucks and one (1) 5-ton's truck, the present transportation capacity still does not meet the requirements. The VCU estimates that present capacity should be doubled to transport all the production surpluses from the Same and Mwanga districts.

As for the postharvest processing facilities, five (5) small milling houses are privately equipped in the project area. These are used for the milling of paddy and maize for the villagers' home consumption. The milling charge is fixed at TSh. 1.00/kg both for paddy and maize.

(2) Prices

Basically, the buying and selling prices of agricultural products handled by the Cooperatives follow the official prices set by the Central Government. The buying prices (farm gate prices) and selling prices of VCU for major food crops in Same district are shown below:

(Unit: Tsh/kg)

	Paddy	Maize	Beans
Buying price of VCU	9.60	6.30	14.40
Selling price of VCU	14.33	10.00	20.40

3.4.5 Agricultural Support Services

Institutional support services, i.e. agricultural extension work, farm input supply, marketing services and credit services in the Ndungu area are mainly taken by the District Agriculture Development Office (DADO) and VCU.

With regard to the agricultural extension work, a total of two (2) agriculturalists is assigned in the Ndungu area. They serve farmers particularly with improved farming practices under the direction of DADO. However, due to substantial under-staffing of the extension offices and insufficient facilities for the target operations the services are still undesirable to propagate such farming techniques effectively. The RADO and DADO recognize such circumstances and have a plan to increase extension staff upto five (5) personnel in connection with implementation of this project.

The SCS is in charge of farm inputs supply, marketing and credit services under the jurisdiction of VCU in the Ndungu area. The SCS was organized in 1984 under the structure of VCU, and covers three (3) villages in the Ndungu area and four (4) villages in the Gonja area. In this command area of SCS, it is estimated that farm house holds are about 2,950 in total (1,310 farms in the Ndungu area and 1,640 farms in the Gonja area) and that farm area is about 2,050 ha in total (1,010 ha in the Ndungu area and 1,040 ha in the Gonja area). The SCS supplied about three (3) tons of chemical fertilizers and five (5) tons of improved seeds in 1985/86. As for chemical fertilizers, the average application rate is estimated at about 1.5 kg/ha based on the said supply amount and the farm area. Since almost no fertilizer was supplied in 1982/83, it can be said that farm input supply using the channel of cooperatives has been successfully commenced. For the farm input supply, agricultural credit can be applied for the farmers by SCS and loan amounts totaled about Tsh. 207,000 or about Tsh. 70.00/farm household on the average in 1985/86. Though this amount is not sufficient, credit services in the Ndungu area have shown remarkable progress, because agricultural credit had not been introduced to the project area before the establishment of SCS. Tractor hire services are also available through VCU and DADO using tractors (75 HP) provided by the Government of Japan. For Same District, eight (8) tractors are available from DADO and 17 tractors from VCU. These services cover about 500 ha annually in the Ndungu area, and this corresponds to about 50% of the total farm area.

CHAPTER 4 PROJECT CONCEPT

CHAPTER 4 PROJECT CONCEPT

4.1 Objectives of the Project

In the Ndungu Agricultural Development Project, the foundations of agricultural production such as irrigation and drainage, postharvest, training and meeting and domestic water supply facilities will be improved, with the objectives of:

i) increasing agricultural production, so as to contribute to incresing the food self-sufficiency rate of Tanzania,

ii) contributing to improvement of the living standard and social welfare of farmers, and

iii) contributing to the future promotion of irrigation development in the entire Mkomazi Valley area, giving the project a role as a leading model scheme in it.

4.2 Assessment of the Project

4.2.1 Justification

The request made by the Government of Tanzania is shown in detail in Section 2.3. In relation to the request, the importance of the project's implementation is justified in this Section based on the National Development Plans and the present socio-economic and agricultural conditions at National and Regional levels as well as in and around the project area.

1) The Project vis-a-vis the National Development Plan

Nearly 90% of the total laobur horce of Tanzania is engaged in agriculture, thus development of agriculture is indispensable for improvement of national living standards.

Tanzania's agriculture is dual-structured, the cash crops for export such as coffee playing an important role in earning foreign exchange, and food crops such as rice and maize not achieving self-sufficiency but rather being regularly imported at the rate of about 2.4 million tons per year.

Therefore, priority has always been given to increasing self-sufficiency in food crops through agricultural development in successive national development plans. Particularly in ERP for the period 1986-1990, top priority has been given to increasing agricultural production. The Government of Tanzania intends to invest US$143 million for this purpose. This Ndungu project is one of the important linking projects in the chain of ERP.

2) The Project vis-a-vis the Agricultural Development Plan

The agricultural development of Kilimanjaro Region is being promoted systematically. Particularly successful activities have been the Lower Moshi Agricultural Development Project and KADC, both of which have been carried out with the technical and financial cooperation of Japan. It is considered that agricultural development in the Region will be further accelerated by realization of this Ndungu project.

The Government of Tanzania and Kilimanjaro Region hold the view that concentrated development in a particular area is not desirable, preferring rather proportional development of the whole Region. Based on this principle, promising projects identified by F/S are planned to be started in sequence. This Ndungu project was ranked second to the Rau River System in the Lower Moshi area.

3) Social and economic impacts

The project is regarded as a model scheme which may have great influence on the development of other schemes in the Mkomazi Valley area.

The project is expected to increase agricultural production significantly through the consolidation of an irrigation-centered farm infrastructure. In this way, it is expected to improve the living standards of farmers in the lowlands where development is inferior to the export crops production area in the Pare mountains.

In addition to the improvement of living standards, project implementation is expected to have the following social and economic impacts on the Valley area as well as on the Region as a whole:

- The project will contribute to the activation of farmers' economic lives through the improvement of farm roads to be constructed along irrigation canals,

- There are already simple domestic water supply facilities in the Ndungu area. However, the supply capacity of the facilities is not sufficient for the requirements of the villagers. At present, villagers have to walk a long way to obtain water from the river and no purification facilities are available. Rehabilitation of the water supply facilities and provision of a storage reservoir will remove the aforesaid constraints prevailing in the Ndungu area.

- In the Ndungu area, which is a rather new village culster, there is no meeting facility, though some neighboring villages have such facilities. Consequently, meetings for village management must be held in a public facility such as a school. If the training and meeting facilities to be provided under this project are used for village meetings, without interfering with the original purpose of farmers' training, smoother functioning of village operations would be expected.

4) Support structure of the project

The KADC is now playing an important part as a leading organization in the technical development of agriculture in the Region. Agricultural training for the personnel concerned, including officials and farmers, is being promoted by KADC, and the level of agricultural technique in the Region is being progressively improved. A training program for extension officers in the Ndungu area has also been in operation since 1984.

The successful implementation of the Lower Moshi Agricultural Development project assisted by OECF is encouraging further agricultural development by the Government of Tanzania, and the Region allocates about 40% of the regional budget for agricultural development.

Thus technical support is being given to the farmers of the area and financial support to the Regional Government.

5) The project vis-a-vis the Cooperatives

The Government of Tanzania puts great stress on the promotion of the Cooperative Union/Cooperative Society system as one of its most important agricultural policies. In Kilimanjaro Region, two Cooperative Unions, i.e. KNCU and VCU were already established and had commenced their activities in 1984. The VCU, which has its head office in Same District, started such activities as the collecting and shipping of farm products. However, all the products are handled in the form of paddy, because there is no rice milling facility in VCU. Actual operation and management of postharvest facilities will be entrusted to VCU under RDD's control after implementation of the project. Therefore, it is expected that the activities of VCU will be reinforced.

As mentioned above, the consolidation of the farm infrastructure, postharvest facilities and social infrastructure is considered to be appropriate not only for the improvement of living standards of the rural population, but also from the viewpoint of the regional and national economy.

4.2.2 Assessment of the Project

(1) Farm infrastructure

In the project area, the biggest constraint on agriculture at present is the uncertainty of irrigation water availability, and so most crop cultivation is practiced dependent on rainfall conditions. However it is possible to remove this constraint by construction of a technical irrigation network to make the maximum use of available water resources in the area. Under such improved conditions, improvement of the cropping pattern and farming practices and more intensive use of farm land will be realized, and so it is expected that agricultural production in the area will be increased significantly.

The farm budget analysis presented in the Appendix shows that the average farm household has no net reserve at present and is at a subsistance level. This condition is expected to be solved by the consolidation of the farm infrastructure, and consequently the living standards of farmers will be improved.

In conclusion, it can be said that the consolidation of the farm infrastructure, i.e. the irrigation and drainage system, farm roads, river improvement and flood dikes, O&M facilities and equipment is necessary for agricultural development in the Ndungu area, in the light of the aforementioned significance of the project.

(2) Postharvest facilities

The consolidation of the postharvest facilities will also significantly remove problems which occur at present such as: delays in the collection and shipment of farm products caused by deficient means of transportation, quality deterioration of products because of insufficient drying and storage losses due to a lack of proper storage facilities.

As for public postharvest facilities, there are at present only two (2) buying posts in the Ndungu area under SCS, while the farm products, particularly paddy, are expected to increase significantly through project implementation.

It is considered that the consolidation of postharvest facilities such as a rice-mill, dryer, warehouse and transportation equipment is necessary in the project area.

1) Drying facility

Drying of farm products, particularly paddy, is done mostly by sun-drying on jute-mats spread on gardens or roads. However, with such a sun-drying system, it will not be possible to dry the increased production resulting from the project. To avoid quality deterioration, it is necessary to dry paddy down to the safe moisture content of about 14% for storage and for market from the estimated moisture content of 17~20% at the time of harvest.

In light of the above mentioned situation, a machine-drying facility is clearly required for safe and swift paddy drying. In addition to the machine-drying facility, a sun-drying yard paved with concrete will also be required to cope with emergencies such as fuel shortages as have happened in the past in this Region.

2) Rice milling facility

The VCU, which takes charge of the collection and shipping of farm products in the area, does not have a rice milling facility, and all the products from VCU are shipped in the form of paddy.

The existing five (5) rice mills in the Ndungu area, all small and privately owned, are now processing paddy and maize only for the farmers' home consumption. It would not be possible for these machines to cope with the paddy surplus to be collected by VCU. Therefore, a rice milling facility will also be required in the Ndungu area.

Management of the rice milling facility by VCU under the control of RDD's Office will contribute not only to increasing the farmers' incomes, but also to the improvement of VCU's financial status. Further, construction of this facility will make it possible to supply high quality rice to the population within the jurisdiction of VCU, particularly in Same and Mwanga Towns.

3) Multi-purpose warehouse

There are only two (2) buying posts having a total storage capacity of 70 tons as public storage facilities in the Ndungu area, while the production surplus to be collected with implementation of the project is estimated at about 2,600 tons of paddy. Therefore, additional warehouse capacity is clearly necessary for the safe storage of farm products, particularly for paddy.

Further, the improved farming practices to be carried out under technical irrigation will require a supply of farm inputs such as seeds and fertilizers as and when required, and so again storage space is necessary to store the said farm input.

4) Transportation facilities

For the functional operation of the aforesaid postharvest facilities, systematic collection and shipping arrangements will be indispensable. Though transportation of farm products is conducted with the trucks of VCU, their capacity is totally inadequate even under the present conditions (refer to Section 3.4.4).

Accordingly, it is necessary to consolidate and coordinate transportation facilities for the conveyance of farm products from the field to the warehouse and from the warehouse to consumers.

(3) Training and meeting facility

Present farming practices in the Ndungu area are traditional and extensive. The farmers therefore are not accustomed to the modern irrigated farming to be introduced by the project. Consequently, training operations and maintenance need to be appropriately introduced. In a technical irrigation system, functional water management is extremely important for efficient water use to avoid such problems as water shortages in the terminal systems.

Therefore, the introduction of farmers' training to the project area is indispensable, in addition to the consolidation of the farm infrastructure, for the achievement of the target production. However, no suitable facilities are available in the Ndungu area for conducting farmers' training and meetings. Accordingly, it is necessary to equip a training and meeting facility in which information on proper farm management and water management for each crop season can be conveyed to representative farmers in the area based on the farming schedule to be prepared by the O&M office.

(4) O&M related facilities

The O&M of the irrigation and drainage facilities will be an essential feature under the conditions of the project. In Tanzania the Government normally takes responsibility for the O&M of main and secondary canals and structures related to these canals, while the farmers themselves are responsible at the on-farm level. For the project O&M to be undertaken in this way, the following organizations will have to be established:

i) Ndungu O&M office

A Ndungu O&M office of the Government of Tanzania will be required to take charge of the O&M of all the project facilities related to the irrigation and drainage system and to ensure the fair distribution of the irrigation water and the satisfactory operation of the drainage system. In addition, the office will provide technical and administrative guidance on O&M to the undermentioned Water Users' Group. The

office headed by a Director will be organized under RDD's office and will be composed of the following four (4) Sections:

Director
- Operation section (water management)
- Maintenance section (maintenance of major facilities)
- Agronomy section (farm guidance)
- Administration section (accounts and general)

ii) Water Users' Group

The present farmers' organization established for the water management of traditional furrows will be re-organized into the Water Users' Group by the time of completion of the construction work. This group will be the organization responsible for the water management to be done by farmers themselves. The fields will be divided into blocks according to the units of the secondary canal, and the blocks will be further divided into sub-blocks according to the units of the tertiary canal. To achieve proper water management, representative farmers will be assigned in each block and sub-block to be the Block Leader or Sub-block Leader.

It is necessary to include in the project all facilities and equipment required for efficient O&M work to be carried out by these two (2) organizations.

It is also necessary to provide lodging facilities for the experienced Tanzanian experts who will provide guidance for the local staff of the O&M office and for the farmer leaders who will also require instruction, because there is no such accommodation in the Ndungu area.

(5) Domestic water supply facilities

The existing domestic water supply facilities in the Ndungu area are seriously dilapidated and their capacity is inadequate to meet the present water demand. Accordingly, improvement of the existing facilities will be an essential part of the future rural development plan.

A water supply pipeline to Kalimawe village, which has no water supply facilities and is located about 5 km from Ndungu village, is not included in the project because of its high construction cost. However, the capacity of the facilities to be improved are to be designed so as to cover the estimated water demand of

Kalimawe village, because the Regional Government of Kilimanjaro itself intends to expand the pipeline up to Kalimawe village in the near future.

4.3 Outline of the Project

4.3.1 Organization of the Project's Execution

The RDD's office will become the execution agency for the project. However, the actual work of the execution of the project will be undertaken by a sub-office tentatively named the "Ndungu Agricultural Development Office" to be organized under RDD.

Subordinate organizations of RDD's office or entrusted by RDD's office will be responsible for the practical O&M work to be allotted to the respective organizations as shown below, though RDD will be responsibile for all O&M works of the related facilities after implementation of the project.

Facility	Overall Control	Organization in Charge
1. Irrigation and drainage facilities	RDD's office	O&M office for main and secondary canals and related structures, and farmers for on-farm facilities
2. Postharvest facilities	RDD's office	VCU
3. Training and meeting facilities	RDD's office	O&M office
4. Water supply facilities	RDD's office	Water development office, DED's office, Same

4.3.2 Outline of the Project

The project will be executed in the Ndungu area, Same District, Kilimanjaro Region. The direct beneficiaries will be the 680 ha of small farms to be developed by the project occupied by an estimated 1,250 farm households with a population of 6,300 in the target year of 1995 in which agricultural production will be attained its maximum, and therefore an average holding size will be at about 0.54 ha (population increase rate of 3% per annum is applied for the estimation).

The outline of the project is shown in the following tables.

OUTLINE OF THE PROJECT (1/3)

Item	Main Features	Reference
I. Land Consolidation for Agricultural Development		
(1) Water Resource	Yongoma River	
(2) Development Area	680 ha	Maximum irrigable area in rainy season.
(3) Main Features		
1) Irrigation Facilities		
- Yongoma headworks	Catchment area : 70.5 km² Type : Fixed type Weir height×length : 9.4m×25m Scouring sluice gate : 2.5m×2.0m	Design flood discharge : 149 m³/sec Design intake discharge (max.) : 0.9 m³/sec
- Irrigation canals	Type : Concrete block lining Total length : Main canals 4.8 km Secondary canals 5.5 km	Design discharge : Main canals 0.9~0.4m³/sec Secondary canals 0.6~0.1m³/sec
- Related structures	Turnouts, culverts, Measuring devices, Aqueduct, Spillways, etc.	
2) Drainage Facilities		
- Yongoma floodway	Type : Earth canal with two types of sections Total length : 3.4 km	Design flood discharge : 121 m³/sec (20-year return period) or 53 m³/sec (2-year return period)
- Catch drains	Type : Earth canal Total length : 9.7 km	Design discharge : 13.4~8.5 m³/sec
- Drainage canals	Type : Earth canal Total length : Main drainage canals 3.6 km Secondary drainage canals 6.6 km	Design discharge : Main drainage canals 2.2~0.4 m³/sec Secondary drainage canals 1.7~0.1 m³/sec
- Related structures	Drops, Culverts, Drainage gates, etc.	
3) Main Farm Roads	Type : Morrum pavement Road width : Width 5.0 m Pavement width 4.0 m Pavement thickness 15.0 cm Total length : 27.7 km	Pavement with crushed weathered rocks or pumice stones
4) On-farm Development (Land reclamation for paddy cultivation)	Plot size : 30×100m or 20×100m Irrigation canals : Tertiary canals (14.8km) and water courses Drainage canals : Tertiary drains (13.0km) and field drains Farm roads : Branch roads (21.0km) and field roads Related structures : Division boxes, farm outlets, culverts, farm access, etc.	Basically 30m×100m, 20m×100m for only steep land Earth canal Earth canal Width : 4.0 m, without pavement

OUTLINE OF THE PROJECT (2/3)

Item	Main Features	Reference
II. Rural Water Supply		
(1) Water Resources	Yongoma River	
(2) Service Population	13,200 persons (1995)	Designed amount : 13.8ℓ/sec, Daily max. supply amount per capita : 90ℓ/day
(3) Main Features		
1) Intake Facilities		
- Intake	Utilization of existing intake weir with minor rehabilitation	
- Grit-chamber	Type : Reinforced concrete structure Width×length×height : 2.0m×6.8m×0.8m	
2) Distribution Facilities		Ductile cast-iron pipe (Dia. 200mm, 1,250m), PVC pipe (Dia. 200~100mm, 5,850m)
- Distribution pipe	Total length : 7.1 km	
- Aqueduct	No. : 1	
- Related facilities	Sluice valves, Air valves, Drain valves, etc.	
3) Service Facilities		Utilization of existing service pipes with a partial increase
- Service pipe	Total length : 7.1 km	PVC pipe (Dia. 50mm, Ave. length 200m)
- Service tap	Type : Reinforced concrete structure No. : 8	Dia. 20mm × 2 taps
III. Architecture		
(1) Postharvest Facilities		For 6 drying machines (drying rate 0.4%/hr)
1) Drying house	Type : Steel-structure, single storeyed Floor area : 459 m²	17.0m × 27.0m × 3.5m (Width×length×height, the same below)
2) Rice mill house	Type : Steel-structure, single storeyed Floor area : 150 m²	For 1 of rice mill set (0.7 tons/hr) 7.5m × 20.0m × 4.2m
3) Multi-purpose Warehouse	Type : Steel structure, single storeyed Floor area : 720 m²	For farm products and farm inputs 15.0m × 48.0m × 6.9m
4) Sun-drying Yard	Type : Concrete floor Floor area : 480 m²	Floor only 240m², (15.5m × 15.5m) × 2 floors
5) Office	Type : Reinforced concrete block structure, single storeyed Floor area : 45 m²	Office, storage, etc. 5.0m × 9.0m × 3.4m
6) Guard house	Type : Reinforced concrete block structure, single storeyed Floor area : 12 m²	3.0m × 4.0m × 3.2m
(2) O&M and Training Facilities		
1) O&M Office (including meeting room)	Type : Reinforced concrete block structure, single storeyed Floor area : 360 m²	Manager's room, Office room (2), Meeting room, Training room, etc. 10.0m × 36.0m × 4.2m
2) O&M Dormitory	Type : Reinforced concrete block structure, single storeyed Floor area : 244 m²	Bed room (8), Dining kitchen (4), etc. (6.8m × 22.0m × 3.4m) × 2 units
3) O&M Workshop	Type : Steel-structure, single storeyed Floor area : 116 m²	For small repair of O&M machineries 8.0m × 14.5m × 5.4m

OUTLINE OF THE PROJECT (3/3)

Item	Main Features	Reference
IV. Related Major Equipment		
(1) Postharvest Equipment		
- Flat bed type dryer	6	Drying rate : 0.4%/hr Holding capacity : 2 tons/dryer
- Rice milling machines	1 set	Processing capacity : 0.7 tons/hr (Paddy cleaner, destoner, paddy husker with separator, rice whitening machine, bran collector, fine broken rice separator, etc.)
- Transportation truck	11	4-ton cargo truck
- Others		Platform scale (8), grain moisture meter (8), repair tools, etc.
(2) O&M Equipment		Equipment required for operation and maintenance of irrigation and drainage facilities, farm roads and farm of 680 ha.
- Bulldozer	11-ton : 1	
- Back hoe	0.3 m³ : 1	
- Cargo truck	4-ton : 1 (with 3-ton crane)	
- Wheel loader	0.8 m³ : 1	
- Concrete mixer	0.1 m³ : 1 (with engine)	
- Submergible pump	φ80 mm : 1 (with generator)	
- Dump truck	4-ton : 1	
- Pick-up truck	1-ton : 2 (4-wheel drive)	
- Plate compactor	3Ps : 1	
- Station wagon	2 (4-wheel drive)	
- Bicycle	5	
- Spare parts	1 set	
(3) Tools for Workshop		Equipment required for repair of the above mentioned O&M equipment and the transportation trucks.
- Hand tools	1 set	
- Measuring tools	1 set	
- Electric tools	1 set	
- Air equipment and tools	1 set	
- Hydraulic and electric tools	1 set	
- Welding equipment and tools	1 set	
- Lubricating tools	1 set	
- Engine service tools	1 set	
- Tire service tools	1 set	
(4) Equipment for Training		
- Photocopy machine	1 set	
- Blue printing machine	1 set	
- Projector	1 set	
- White board	1 set	