

There is the trend in Tanzania that the aid requests for an individual region is allotted to a limited donor country. It is because that formulation of a specific region's comprehensive development plan was requested to a specific donor in the third 5-year Plan.

2.2.3 Marketing Facilities Development Plan

It has been pointed out that insufficient grain godowns at the village level and farmer level is one of the main causes of domestic lack of food. Grains purchased by village Cooperative Union from farmers sum to between 50 tons and 200 tons per year, and most of them are stored in poor godowns or outdoors. It was only at the time of serious famine that the policy regarding grain storage was adopted for recent 40 years. Department of Grain Storage was established in 1949, and the construction of godowns for principal grain (maize, millet, sorghum and cassava) was commenced in 1949. Great godowns were constructed in the food shortage area by the Government in early 1950s. The Government troubled with food shortage in 1973 and 1974, and food surplus in 1978 and 1979, entered upon the improvement of grain marketing system.

There was a negotiation to hand over NMC's godowns at region and district level to Cooperative Union in parallel with the reform of marketing system. The godowns, however, have not been handed over smoothly yet, and are still insufficient at village level.

The improvement plan of godowns have been promoted with the aid of such organizations as World Bank, IDA and FAO. Still it is reported that more storage capacities (260,000 tons) are required at the village level, and out of them 200 godowns for 60,000 tons of grain should be built in Iringa Region.

(1) Foreign-aided Storage in Iringa Region

- 1) Village-level godowns, of which capacity is around 300 tons, were constructed since the latter half of 1962 aided by EEC and FAO in cooperation. Seventy-five (75) houses were built in total, and six (6) were in Iringa Region out of them.
- 2) It is planned that EEC will extend the aid to construct 200 houses of village-level godowns in Tanzania, and the first phase construction will be commenced at the middle of 1988. The site is not settled yet, but it is expected that Iringa Region will have some godowns.

- 3) BEC granted sixty (60) houses of godown with a capacity of 300 tons to Iringa Region other than above.
- 4) BEC and FAO are the only organizations which have extended or will extend aid to Iringa Region for the time being.

(2) Storage Facility Construction Plan in Iringa Region

- 1) Iringa Regional Development Director's Office has a plan to construct storage facilities, which will be the property of Cooperative Union, starting construction at 1986/87 through 5 years. The godowns to be built comprise 22 houses with 600 ton capacity each and 4 houses with 2,000 ton capacity each. The construction sites are as follows:

a) Iringa Mufindi Cooperative Union (IMUCU) Jurisdiction

Iringa district:	1.	Kilolo	(2,000 tons)
	2.	Bomalangombe	(600 tons)
	3.	Usavila	(600 tons)
	4.	Idodi	(600 tons)
Mufindi district:	1.	Mapanda	(600 tons)
	2.	Kibengu	(600 tons)
	3.	Ifwagi	(2,000 tons)
	4.	Makalala	(600 tons)
	5.	Mtambulla	(600 tons)

b) Njombe Ludewa Makete Cooperative Union (NJOLUMA) Jurisdiction

Njombe district:	1.	Mbega	(600 tons)
	2.	Wanging'ombe	(600 tons)
	3.	Kifanya	(600 tons)
	4.	Matembwe	(2,000 tons)
	5.	Kipengere	(600 tons)
	6.	Mahongole	(600 tons)
Ludewa district:	1.	Maholong'wa	(600 tons)
	2.	Itundu	(2,000 tons)
	3.	Ludewa	(600 tons)
	4.	Mayonga	(600 tons)
	5.	Mkiu	(600 tons)
	6.	Mawengi	(600 tons)

Makete district:	1.	Matamba	(600 tons)
	2.	Ikuwo	(600 tons)
	3.	Mang'oto	(600 tons)
	4.	Bulongwa	(600 tons)
	5.	Misiwa	(600 tons)

2.3 General and Agricultural Condition of Iringa Region

2.3.1 General Condition of Iringa Region

Iringa Region occupies the northern part of the southern highlands of Tanzania. It covers an area of 56,000 km², located 500 km southwest from the capital, Dar es Salaam. It borders on Ruvuma Region to the south, on Morogoro Region to the east, on Dodoma and Singida Regions to the north and on Mbeya Region to the west.

The altitude varies from 500 m to 3,000 m, and the land mainly consists of gently undulating hilly area in Iringa Region. Highlands with an altitude of 1,500 to 2,000 m is extending south of the region capital, Iringa town, and is cultivated with maize mainly. Ruaha National Park occupies the north-western part of the region. The grassland gets more dominant as the altitude gets lower.

(1) Climate

Climate of Iringa Region generally varies with altitude and location. Climate through the year can be broadly divided into 4 types. There is much rain under the influence of north-east monsoon between December and February. Intense rain is brought by the winds from both northern and southern hemisphere in March and April. It is the dry season Influenced by the south-east monsoon, which brings cool and dry wind from south Africa area, between June and September. Rainy season begins in November.

Rainfall varies with altitude. The driest areas are in the north of the Region at altitudes of around 500 m. In these areas average annual rainfall is 550 mm. Conversely, at an altitude of 2000 to 2,500 m, rainfall is as high as 1,600 mm. Rainfall in intermediate zones falls between these two extremes.

Temperature varies with altitude, with the hottest temperatures occurring in the lowlands of the north of the Region. Frosts occur in the mountainous areas above 1,800 m between July and August.

(2) Administrative Unit and Population

Iringa Region administratively consists of 6 Districts, 30 Divisions, 103 Wards and 617 Villages. The area and population of each district is as shown below.

District	Area ¹ (km ²)	Population Growth rate ² (%)	Population ³ (1,000)	Percentage (%)	Population Density (persons/km ²)
Iringa (urban area)	180	2.9	114	10	630
Iringa (rural area)	15,420		346	30	22
Mufindi	8,315	3.5	218	19	27
Njombe	11,000	2.6	294	25	27
Ludewa	5,450	3.0	96	8	18
Makete	4,290	0.4	93	8	22
Total	44,650	2.9	1,161	100	26

Note : ¹: excluding Ruaha National Park and Kilonbelo forest reserve
²: estimated value between 1978 and 1986
³: estimated value of 1986

Source : IRADEP

Total population of Iringa Region is around 1.2 million. Forty (40)% of regional population live in Iringa District, and ten (10)% of that live in Iringa urban. It is estimated that other urban areas have five (5)% of regional population, and rural areas hold eighty-five (85)% of that. The number of the persons per household in each district is given below.

(Unit: persons/household)

District	Family size	Labour force
Iringa (rural area)	5.7	2.9
Mufindi	6.0	3.0
Njombe	5.6	2.9
Ludewa	5.7	2.8
Makete	5.8	3.0

Source: IRADEP

2.3.2 General Condition of Agriculture

(1) Agro-ecological Zones

The whole land in Tanzania can be broadly classified into seven (7) zones based on agroclimatic characteristics (See Fig. 3, Source: Tanzania/FAO Crop Monitoring and Early Warning Project).

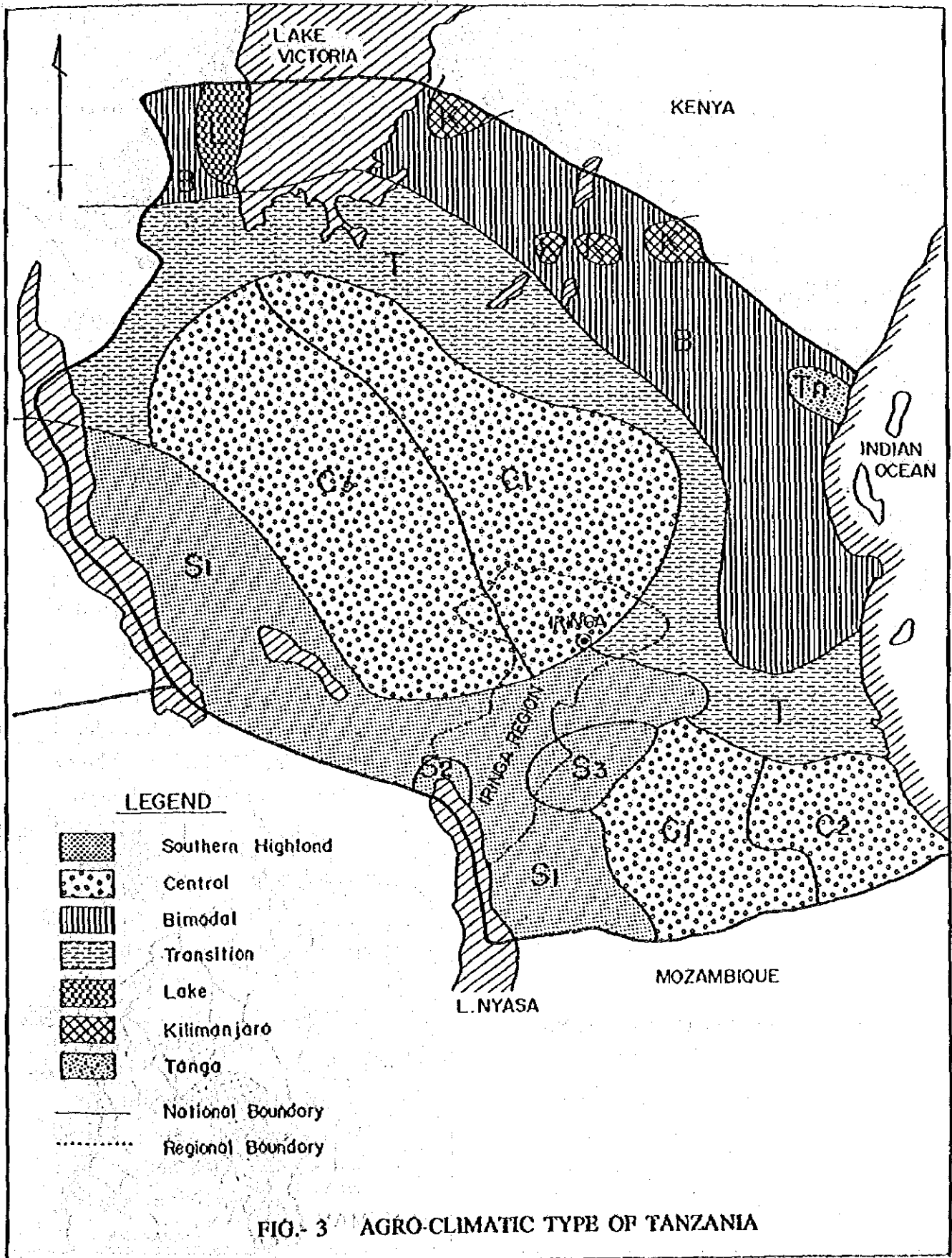
- Southern Highlands
- Central
- Bimodal
- Transition
- Lake
- Kilimanjaro
- Tanga

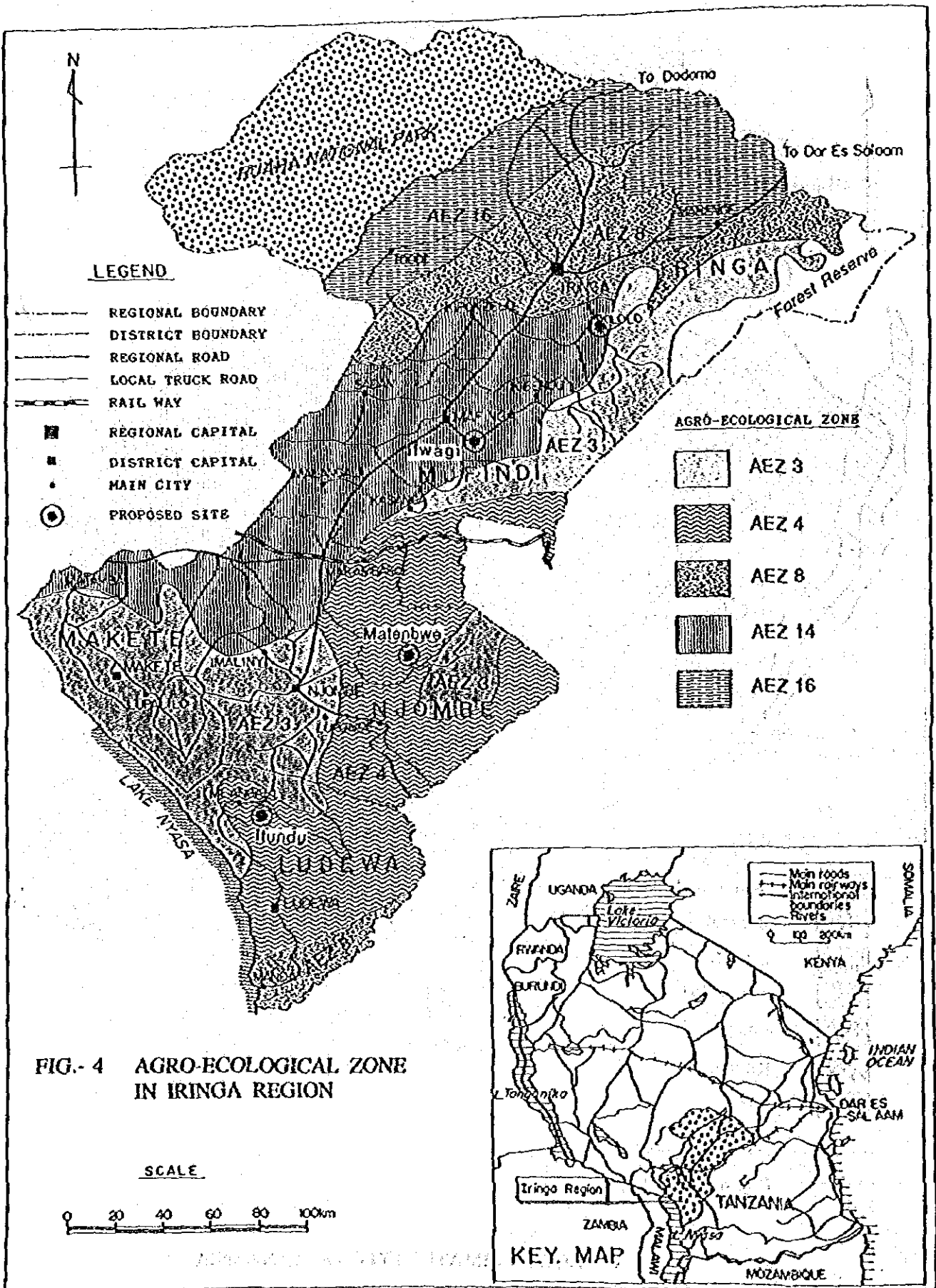
Such zones as Southern Highlands, Lake, Kilimanjaro and Tanga are the most suitable for maize cultivation under rainfed condition. Most land south of Iringa, regional capital, belongs to Southern Highlands zone in Iringa Region.

The land of Iringa Region can be further classified into 5 zones from agro-ecological viewpoint. The zones are shown in Fig. 4, and main features of each zone are tabulated below.

Agro-ecological Zone	Climate	Annual Rainfall (mm)	Area (km ²)	Percentage to Whole Area (%)
Zone 16	Warm tropical climate; 500 m altitude, most arid part of the region	500	5,950	13
Zone 8	Warm tropical climate; cooler and more humid than zone 16	800	6,950	15
Zone 14	Moderately cool tropical climate; transitional between zones 16 & 8 and zones 3 & 4	900 - 950	10,550	23
Zone 4	Moderately cool tropical climate	1,200	10,000	22
Zone 3	Moderately cool tropical climate; coolest and most humid of the region	1,400	12,650	27

Source: IRADEP





Zone 16 covers the northern and northwestern part of Iringa District, and only small parts of the zone are cultivated, mainly in the various alluvia. These alluvia are intensively cultivated, principally with maize. Locally small irrigation schemes allow the cultivation of rice, vegetables, sugar cane and other crops.

Zone 8 covers great parts of the Iringa District and the southern part of Ludewa District. Considerable parts of the zone are intensively cultivated, especially around Iringa Town. Maize is the dominant upland crop. The alluvia, especially in the flood plain of the Little Ruaha near Iringa and Kalenga, are cultivated with vegetables.

Zone 14 occupies most of the Mufindi District and smaller areas in the north of Njombe and the south of Iringa District. The zone is typified by extensive grasslands characterized by clump shrubs on termitaria. Relatively little of the zone is cultivated. Although the cultivation intensity is generally low, it is somewhat higher in the vicinity of major settlements. Maize is the dominant crop.

Zone 4 covers the greater parts of Njombe and Ludewa Districts and a small portion of the Mufindi District. This zone is typified by extensive grasslands. Grazing is the dominant activity and only little land of the zone is cultivated. Some tea plantations exist in the higher parts of this zone. Extensive wattle plantations are found north of Njombe along the main road to Iringa.

Zone 3 largely corresponds to the high-altitude areas of the region. This zone covers the eastern parts of Iringa and Mufindi Districts, parts of Njombe, small parts of Ludewa District and almost the entire Makete District. With its most humid climate of the region, Zone 3 is characterized by humid forest remnants. Most of the land, however, is occupied by a very low shrubland. Extensive grasslands also exist.

In general, relatively little of the zone is cultivated. Somewhat more cultivation occurs around the towns. Cultivated crops include maize, wheat, potatoes, tea, pyrethrum and wattle. The most extensive tea plantations exist in Mufindi District, and smaller plantations are scattered in the southern part of Njombe District. Pyrethrum cultivation is restricted to altitudes above 1800 m.

(2) Farm Products

Iringa Region with Ruvuma, Mbeya and Rukwa Regions are the few regions where there are surplus farm products. Grain such as maize, wheat, tea and pyrethrum are the main crops. The main products of Iringa Region and their contribution to the whole national farm products are shown below.

Crop	Iringa Region		1984/85 National Production (000 tons)	Iringa's Share in National Production (%)
	1984/85 Production (000 tons)	Value of Production (million Tsh) ¹		
Food Crops				
Maize	575	2,300	2,093 ⁴	27.5
Wheat	15	60	83 ⁴	18.1
Pulses	38	304	358 ⁴	10.6
Millet	26	104	1,024 ⁴	2.5
Cash Crops				
Tea ²	7.6	146	18.2	41.8
Flue-cured tobacco	1.4	35	11.5	12.2
Pyrethrum	1.0	20	1.6	62.5
Coffee ³	0.1	4	36.3	0.3
Total		2,973		

Note : ¹: Expressed in 1984/85 official producer prices
²: Made tea
³: Green beans
⁴: FAO Production Yearbook

Source : IRADEP (Grain production of Iringa Region is based on data of Regional Agriculture Office (See ANNEX 2-1).

Maize production in Iringa Region through the 1984/95 crop season (between July 1 and June 30) was 575,000 tons or 28% of national production. Such crops as wheat, tea and pyrethrum also contribute to a large share in the national production, with 18%, 42% and 63% respectively. The quantities of food crops sold from Iringa Region to other regions through NMC are as follows:

Crop	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88 ¹
Maize	26,000 (94%)	24,900 (96%)	24,000 (98%)	39,500 (96%)	36,400 (98%)	48,700 (96%)
Wheat	1,300	700	400	800	400	300
Pulse	300	100	Nil	Nil	400	700
Sorghum	100	300	Nil	700	Nil	200
Paddy	-	-	Nil	Nil	-	700
Total	27,700	26,000	24,400	41,000	37,200	50,600

Note : ¹: Forecasted.

Source : NMC Iringa Branch Office
The figures in parentheses show the share in total marketed grain by NMC.

Maize occupies the largest part in total grain marketed by NMC, being between 96% and 98%. Maize sold to other regions is between 26,000 and 36,000 tons from 1983 through 1987. Wheat and pulse share the second places, but only less than 1,000 tons are marketed. Those figures in the formal marketing in which farmers sell grain to NMC via cooperatives, but there is no doubt that sales on the parallel market, though it is illegal, are greater than those to NMC. Most of the grains marketed by NMC Iringa are procured from Cooperative Unions in Iringa Region.

Although members of the Cooperative Union are authorized to deal directly with such other in the whole country, trade dealing with other regions is made exclusively through NMC.

2.4 Background and Contents of the Request

2.4.1 Background of the Request

Tanzania economy is almost entirely dependent on the agricultural sector. Agricultural production and its related activities account for about 40 percent of GDP, represent 70 to 80 percent of all exports and employ more than 90 percent of labour force. Since independence in 1961, Tanzania has given high priority to the development of the agricultural sector, to improve its economy and the living standard of its population.

Despite the efforts made by the Government, Tanzania has been facing great difficulties in maintaining sufficient food supply from its own resources for an expanding population as well as an acute shortage of foreign currency to import food grains. In order to overcome these difficulties, the Tanzanian Government worked out an integrated National Food Strategy in 1983 with the assistance of FAO, seeking to raise the nutritional level of the population; to meet future food needs; to provide greater security against temporary shortage and famine.

The National Food Strategy comprises the short, medium and long-term plans, covering the period up to 2,000. Over the whole plans, the equitable distribution of food resources has been given the highest priority. To attain this aim, major emphasis has been placed on the improvement of transport and storage infrastructure to facilitate the movement and storage of food grains and agricultural inputs.

Accordingly, the Government of Tanzania plans to improve the agricultural storage and transportation system in Iringa Region, and has requested the Government of Japan to extend a grant aid for the implementation of its plan.

2.4.2 Contents of the Request

The request which has been confirmed through discussions with the Government of Tanzania is to provide for improvement of agricultural storage and transportation system in Iringa Region, as summarized follow:

(1) Contents of request

a) Agricultural Multi-Purpose Godown

- Sites : Kilolo, Ifwagi, Lupembe* and Itundu
- Type : Single story with prefabricated steel frame
- Numbers : 4 Nos. (proposed const. site; Kilolo, Ifwagi, Matembwe, Itundu)
- Storage capacity : 2,000 tons each (total: 8,000 tons)

* This site is located in Matembwe village in Lupembe ward.

b) Equipment for Transportation

- Cargo truck : 4 nos. of 7-ton capacity (including spare parts)

c) Feeder Road Improvement

- Type : Morrumbete road
- Effective width : 4.0 m
- Total length : 65.0 km

d) Equipment for Road Maintenance

- Bulldozer : 1 no. of 17-ton class capacity
- Motor grader : 1 no. of 9-ton class capacity
- Tippers : 2 nos. of 7-ton class capacity
- Spare parts : One set

e) Technical Cooperation

- Fields : Marketing, Grain storage and transportation planning
- Term : Two years after completion of the Project
- No. of staff : Several

f) Additional Request

In addition to the above, the Government of Tanzania strongly requested the related facilities for effective operation and management of the proposed godowns, grain quality control equipment and a backhoe as road maintenance equipment.

(2) Executing agency

RDD's office will be responsible for the implementation of the Project and will act as a coordinating body with other relevant organizations. Management and maintenance of the proposed godowns and the improved feeder roads will be conducted as follows.

- a) After the implementation of the Project, the Cooperative Unions (IMUCU and NJOLUMA) will be responsible for the management and maintenance of the proposed godowns and related facilities entrusted by the RDD's office. Iringa - Mufindi Cooperative Union (IMUCU) will take charge of the operation and maintenance of Kilolo and Ifwagi godowns, and Njombe - Ludewa - Makete Cooperative Union (NJOLUMA) will take charge of Matembwe and Itundu godown.
- b) Civil Department of the RDD's office will be responsible for maintenance of the improved feeder roads. Equipment for road maintenance will be put under the control of the Civil Department.

CHAPTER 3

CHAPTER 3 THE PROJECT AREA

3.1 General

The objective area of the Project is defined where their farm products and inputs are handled in the proposed godowns.

Such data as administrative organization, area and population of each objective area are shown below.

Godown Construction Site	District	Ward	Area (km ²)/1	Nos. of House-holds	Population ('000)/1	Nos. of Cooperatives
Kifolo	Iringa	Bomalangonbe	230	2,300	13.1	-
		Idete	520	2,000	11.4	-
		Dabaga	470	1,400	8.0	-
		Ukumbi	620	4,500	26.7	10
		Ukwega	700	1,200	6.8	-
			(2,540)	(11,400)	(45.0)	
Ifwagi	Mufindi	Ikonongo	510	1,500	9.2	-
		Mtwango	110	1,200	7.0	4
			(620)	(2,700)	(16.2)	
Matembwe	Njombe	Lupembe	430	2,400	13.4	-
		Kidcembwe	290	1,000	5.6	4
			(720)	(3,400)	(19.0)	
Itundu	Ludewa	Lulo	130	1,000	6.4	-
		Mlangali	230	1,800	10.0	-
		Mawengi	160	900	5.2	11
		Lupanga	160	1,000	5.2	-
			(680)	(4,700)	(26.8)	

(1: Source: Agricultural land use planning section, Iringa Regional Development Director's Office

3.2 Natural Condition

3.2.1 Location and Topography

The project areas comprise mainly hilly terrain with general undulations.

The location, elevation and land slope of each area are summarized in the following table:

Project Area	Location		Elevation (m)	Land Slope (%)
	S-Latitude	E-Longitude		
Kilolo	8° - 8°15'	35°40' - 35°50'	1540 - 1960	3 - 4
Ifwagi	8°15' - 8°25'	35°15' - 35°25'	1820 - 1900	1 - 6
Matembwe	9°10' - 9°20'	34°45' - 35°10'	1600 - 1870	0.5 - 6
Itundu	9°45'	34°30' - 34°40'	1600 - 1880	3 - 8

3.2.2 Meteorology, Hydrology and Soils

(1) Meteorology

The monthly meteorological data of each area are shown in ANNEX 3-2. The climate is characterized by the distinct rainy and dry seasons. The rainy season extends from November to May and the dry season from June to October. More than 90% of the annual rainfall occurs in the rainy season. The monthly mean maximum and minimum temperatures are recorded in November and in July, respectively.

The annual rainfall and monthly mean temperature of each area are summarized below.

Project Area	Annual Rainfall (mm)	Monthly Mean Temperature (°C)	
		Max.	Min.
Kilolo	720 - 950	27.7	7.4
Ifwagi	1,300	24.2	7.4
Matembwe	1,200 - 1,600	24.5	6.2
Itundu	1,100	24.3	6.9

(2) Hydrology

Kilolo and Ifwagi area extend on the Little Ruaha river basin, Matembwe area extends on the Ruaha river basin. The Little Ruaha and Ruaha river join with the Great Ruaha river at the northern part of Iringa district.

River flow is markedly seasonal, with high sediment load during the rainy season. Itundu area extend on the Malisa river basin, it is one of the small rivers draining into Lake Nyasa.

(3) Soils

The typical soils distributed in the project area are summarized in the following table.

Name of Road	Soil
Iringa-Kilolo	red clay and yellow loam
Mafinga-Itwagi	dark yellow clay
Mjombe-Matembwe	red clay
Mkiu-Itundu	red clay

3.3 Existing Infrastructure in the Project Area

3.3.1 Transportation

The Iringa region is traversed in an east-western direction by the Tanzania-Zambia Railway (TAZARA), which connects Zambia with Dar es Salaam, Capital of Tanzania. The Makambako railway station is located in Njombe district.

Air Tanzania Corporation (ATC) provides flight service between Dar-es-Salaam and Iringa Airport twice a week, but few people make use of the flight due to its irregular schedules.

TANZAM Highway between Dar es Salaam and Zambia is the main road in the Iringa Region. The TANZAM Highway traverses the central part of the region from north to south and is branched into two at Makambako, i.e. Makambako - Mubeya Highway and Makambako-Songea Highway.

Most roads in the project area connect with the above highways. Due to poor drainage facilities and no asphalt pavement, roads are damaged after heavy rain and transportation is sometimes suspended. Busses are used as the major transportation mean for the villagers in the project area.

3.3.2 Electric Power Supply and Communications

In Tanzania, commercial electric power is supplied by the state owned Tanzania Electric Supply Co., Ltd. (TANESCO). In addition, other electric supply companies, which have minor diesel generators, are found in various parts of the country.

Major power station, their type and available capacity in the region are shown below.

Name/Location	Type	Available Capacity (kW)	Owner
Tosamaganga	hydro	1,220	TANESCO
Iringa Urban	diesel	700	TANESCO
Wemba/Njombe	hydro	100	Benedict. Fathers
Bulongwa	hydro	180	Bulongwa Hospital

Apart from the above mentioned power stations, a large number of minor diesel-electric generating units are spread over the region and are operated by missions, farms or government posts, like police stations, etc.

The main transmission grid of TANESCO, the so-called coastal grid, interconnects Tanga, Moshi, Arusha, Dar es Salaam, Morogoro, and eastern and northern areas in Tanzania with 132-220 kV transmission lines. This grid is being extended from Kidatu south-westwards via Iringa and Mufindi to Mbeya with a 220-130 kV line as a transmission network.

No commercial electric power is supplied to Kilolo, Ifwagi, Matembwe and Itundu village in the project area by the TANESCO though, Iringa town, Makambako town, Njombe town and its surrounding areas are supplied with electric power from the national grid. Regarding communications, Tanzania Post & Telecommunication Corporation (TPTC) engages in the undertaking of postal, telegram, telephone and telex services in the country. A branch office is set up at Iringa town to control the whole region.

No telephone line is available at Kilolo, Ifwagi, Matembwe and Itundu village in the project area. However, the following number of existing telephone lines are available in Iringa, Mafinga, Njombe and Ludewa town. There is not enough telephone line for establishment of new telephone.

Iringa town	:	600-line
Mafinga town	:	90-line
Njombe town	:	160-line
Ludowa town	:	100-line

The Tanzania Posts and Telecommunications Corporation has revised the local call charging system from a flat rate to a time consumed whereby all calls made between subscribers on the same exchange was timed effective 1st January, 1988.

3.3.3 Public Domestic Water Supply

A major Tanzania Government policy decision was taken in 1971 regarding water supply that a piped water supply will be provided to the rural areas so that by 1991 all Tanzanians will have ease of access to a public domestic water point. Along the policy, public domestic water supply systems were provided in Kilolo, Ifwagi, Matembwe and Itundu village. Water is obtained from streams or springs, and then it is pumped up to concrete made reservoir tanks with a cylindrical shape (Approx. 5 meters in diameter, 2 meters in height) located on top of hills, and it gravitates to the village depending on the topography. Water is filtrated through coarse gravel at intake for water treatment.

3.4 Present Condition of Agriculture

3.4.1 Land Use

Present land use condition was clarified with the use of 1/250,000 land map and field reconnaissance as shown below.

(Unit: km ²)				
Project Area	Arable Land	Grass Land	Others	Total
Kilolo	851 (34%)	204	1,485	2,540
Ifwagi	250 (40%)	296	74	620
Matembwe	122 (17%)	441	157	720
Itundu	172 (25%)	351	157	680

Note: /1: Others include forests, coppices, plantations, etc.

The percentage of arable land to total area is relatively high in Kilolo and Ifwagi. The east half of Kilolo area is covered with coppices, and the cultivated land is mainly located in the west half. In Ifwagi area cultivated land is scattered around Ifwagi Village. Cultivated land in Matembwe Village is located in the west of Matembwe Village and the north of Kidegembe, and that in Itundu area extends north and south centering around Itundu Village.

Farmers mainly grow maize in these areas. Wheat is hardly cultivated.

3.4.2 Cropping Pattern

The cropping pattern in these areas is very simple. The single crop of maize under rainfed condition is common in the areas. Pulse is also cultivated mainly for home consumption but the planted area is negligible, large part of arable land is left idle. Seeding usually commences in the middle of November, at the onset of the rainy season, and harvesting is carried out around June and July.

3.4.3 Farming Practice

The recommended maize varieties, all are hybrid or composite, in Tanzania and the farming practice are shown below. Recommended seeding rate, planting density and fertilizer operation rate is 25 kg/ha, 75 cm x 60 cm, and N:P:K = 120:120:0 (kg/ha) respectively. The growth duration of maize is relatively long, 110 days at the shortest and 185 days at the longest. Present fertilizer application rate is around N:P = 50:100 (kg/ha) based on farmers interview. Some fields are not applied fertilizers. Manual weeding is practiced twice or three times per one crop. Tractors or draft animals (oxen) are hired for land preparation. Agro-chemicals are applied only once or twice per crop season to control stalk borers. Plants are left in the field even after maturity till they get all dried. Farmers begin harvesting when grain moisture content drops to about 12%. It usually takes around one month between maturity and harvest.

Item	Hybrid				Composite	
	H6302	H614	H622/ H632	H511/ H512	UCA/ KILIIHA	KATUMANY KITO
Applicable altitude (m)	1,500-2,100	1,500-2,100	1,000-1,700	900-1,800	900-2,100	0-800
Nos. of rainy months	5-7	5-7	4-6	3-4	4-6	2-3
Rainfall (mm)	850	850	850	500-850	850	300-850
Seeding time	middle of Nov.	middle of Dec.	middle of Dec.	middle of Dec.	middle of Dec.	Jan.
Seeding rate (kg/ha)	25	25	25	25	20	20
Planting density (cmxcm)	75x60	75x60	75x60	75x60	75x60	75x30
Fertilizer rate (N:P:K, kg/ha)						
with a little rain	-	-	-	80:25:0	80:25:0	80:25:0
with much rain	120:20:0	120:20:0	120:20:0	120:20:0	120:20:0	-
Growing duration (days)	185	140	140	140	110-135	90
Average yield (tons/ha)	7.0-8.0	5.5-7.8	5.3-6.6	3.3-5.2	5.3-6.6	2.5-2.5

Source: IRADEP

3.4.4 Unit Yield and Production

Many different data on unit yield of maize exist. IRADEP reports that the unit yield in Iringa Region is 1.1 tons/ha on the average, and 1.7 tons/ha at the best. It is also reported to be 1.5 tons/ha in areas with adequate rain, and 0.6 tons/ha in areas with little rain. According to the data collected in this study, on the other hand, the unit yield is 1.8 tons/ha in whole Iringa Region on an average of five years. While FAO data show that the average between 1979 and 1985 is 1.2 tons/ha. The cultivated area and production of maize in the objective area are estimated as follows:

Project Area	Planted Area ¹ (km ²)	Production (1,000 tons)	
		2	3
Kilolo	22,800	25	41
Ifwagi	5,400	6	10
Matembwe	6,800	7	12
Itundu	9,400	10	17

Note: 1 : Assuming that planted area is 2 ha/household.
2 : In case that unit yield is 1.1 tons/ha.
3 : In case that unit yield is 1.8 tons/ha.

3.5 Agricultural Support Service

Agricultural extension organization in Iringa Region is shown in Fig.-5. The Regional Agricultural Development Officer (RADO) comes from the Ministry of Agriculture and Livestock Development, and the budget is controlled by the Regional Development Director (RDD). Agricultural extension service is supervised directly by the District Agricultural Development Officer (DADO) of each district. Extension service is carried out by the agricultural extension workers such as agriculture field officers, auxiliaries and field attendants about 15% of these agricultural staff belong to agricultural offices.

Agricultural staff in Iringa Region are given below.

Post	Regional Office	Iringa	Mufindi	Njombe	Makete	Ludewa	Regional Total
Field Attendant	14	2	4	5	7	2	34
Auxiliary	1	31	18	38	23	23	120
Agricultural Field Officer (Cert)	10	31	13	8	8	8	79
Agricultural Field Officer (Dip)	16	20	17	11	6	6	75
Agricultural Officer	6	1	1	0	0	0	9
Total	47	85	53	62	31	39	317
Academic Qualification	Field Attendant	None					
	Auxiliary	3-month short training course					
	Ag. Field Officer	Certificate					
	Ag. Field Officer	Diploma					
	Ag. Officer	B. SC					

The ratio of villages covered by an agricultural extension worker varies between 1.4 villages in Ludewa district and 3.9 villages in Mabete district, as shown below:

District	Number of Staff	Number of Wards	Number of Villages	Village to Staff Ratio	
				All Staff	Excluding District Office Staff
Iringa	85	25	172	2.0	2.3
Mufindi	53	14	133	2.5	3.1
Njombe	62	24	133	2.1	2.7
Makete	31	15	93	3.0	3.9
Ludewa	39	20	47	1.2	1.4
Total	270	98	578	1.8	2.3

Source: IRADEP

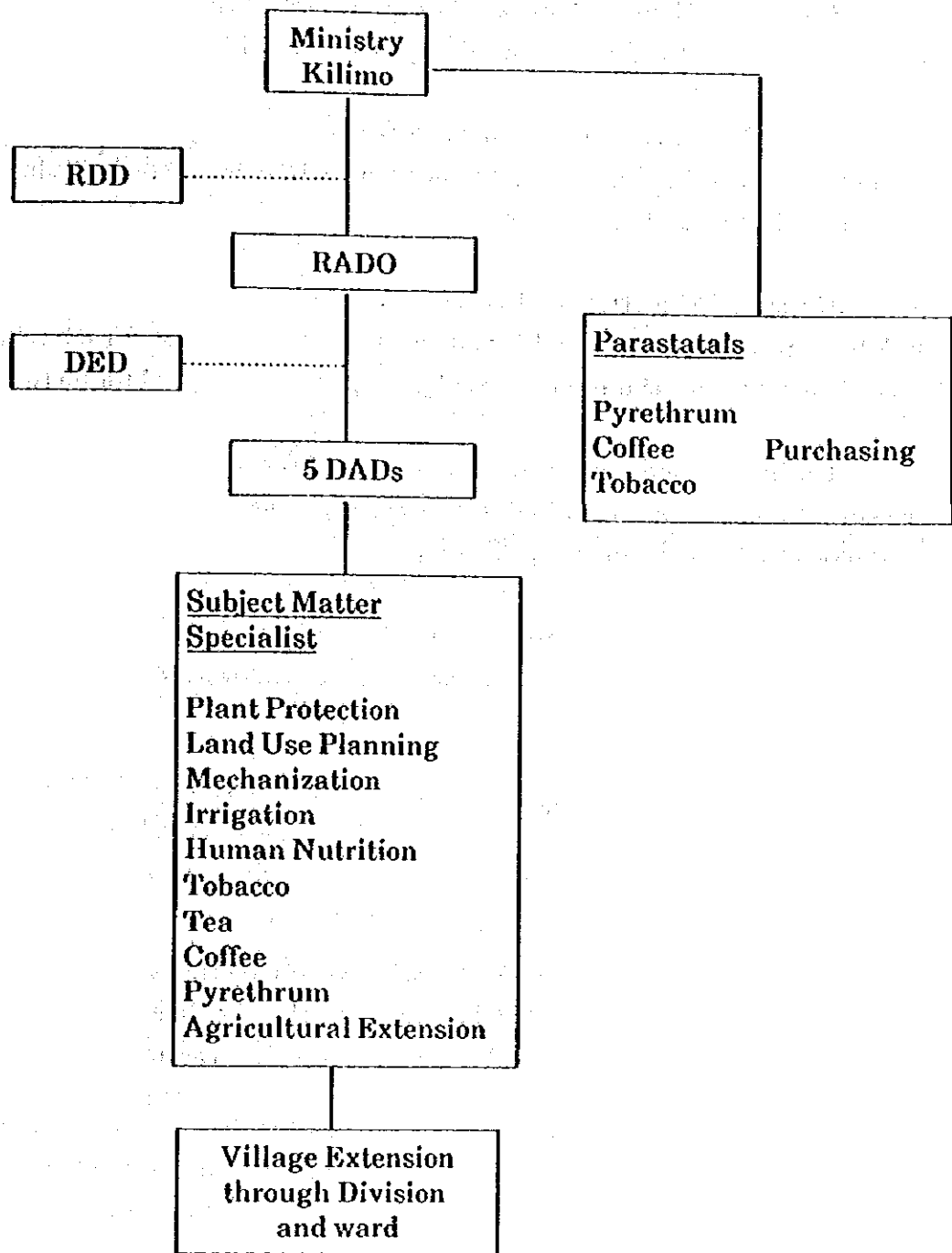


FIG. - 5 AGRICULTURAL EXTENSION SYSTEM IN IRINGA REGION

Cooperative Union and respective Crop Authority, being responsible for marketing of specific crop, can be listed as agricultural support system in Iringa Region.

Iringa Region has three (3) training centers providing villagers, such as technical training courses to Ichenga Farmers Training Centre, Ulambwe Farmers Training Centre and Training for Rural Development Centre.

Uyole Agricultural Center (UAC) has the mandate for agricultural research and training in Mbeya, Ruvuma, Rukwa and Iringa Regions. UAC supports seven sub-stations, and two (2) of them are located in Iringa Region at Igeri (Njombe District) and Ismani (Iringa District).

Fertilizers, agro-chemicals and farm equipments are supplied through such organizations as Tanzania Fertilizer Company (TFC), Tanganyika Farmers Association (TFA) and Agricultural and Industrial Supplies Corporation (AISCO).

Agricultural credit is provided by the Cooperative and Rural Development Bank (CRDB). Large commercial farmers are able to make their own arrangement with the National Bank of Commerce (NBC).

3.6 Marketing and Storing

3.6.1 Marketing

A number of parastatal corporations, known as crop authorities, were responsible for all the marketing procedures of farming products. However, the institution was revised in 1984, and the corporations were abolished or reduced. The following corporations are functioning at present:

<u>Corporation</u>	<u>Abbreviation</u>
- Sugar Development Corporation	SUDECO
- Cashewnut Authority of Tanzania	CATA
- Tanzania Cotton Authority	TCA
- Tanzanian Sisal Authority	TSA
- Tobacco Authority of Tanzania	TAT
- Coffee Authority of Tanzania	CAT
- Tanganyika Pyrethrum Board	TPB
- Tanzania Tea Authority	TTA
- General Agricultural Products Exporting Co.	GAPEX
- National Milling Corporation	NMC

National Milling Corporation (NMC) used to be responsible for the marketing of staple foods such as maize, pulse, sorghum and wheat. The function of NMC was limited to marketing and storage of grains in urban area and between regions by the revision of the system. On the other hand, cooperatives abolished in 1976 were re-established in 1984 and started free marketing with Rural Cooperative Societies and Cooperative Unions.

The new marketing system of staple grain in Iringa Region is shown in Fig.-6. One of the main alterations is that the cooperatives are authorized to trade directly with other cooperations. However, trade with other cooperatives or unions in other regions are not prevailing at present. The trading is done mainly through branch offices of NMC. As shown in Fig.-6 farmers' surplus grain are collected at the buying post, in most cases of Rural Cooperative Society's godown, and are purchased by NMC through branch offices of cooperative union. Funds to purchase crops are provided to the unions by NBC.

Agricultural inputs are supplied mostly on credit to small farmers mainly by the cooperatives. CRDB had been responsible for distribution of inputs until this role was handed over to the cooperatives (see Fig.-7).

Two (2) cooperative unions, were established in Sep. 1985, in Iringa Region. They are Iringa/Mufindi Cooperative Union Limited (IMUCU Ltd.) and Njombe/Ludewa/Makete Cooperative Union Limited (NJOLUMA Ltd.). Their head offices are located at Iringa Town and Njombe Town respectively and the branch offices at each district. The typical organization chart of the unions is shown in Fig.-8. Each union is governed by twelve directors under the General Meeting, which is made up of representatives of the Rural Cooperative Societies. Executing organization, composed of Department of Personnel/Administration, Accounts,

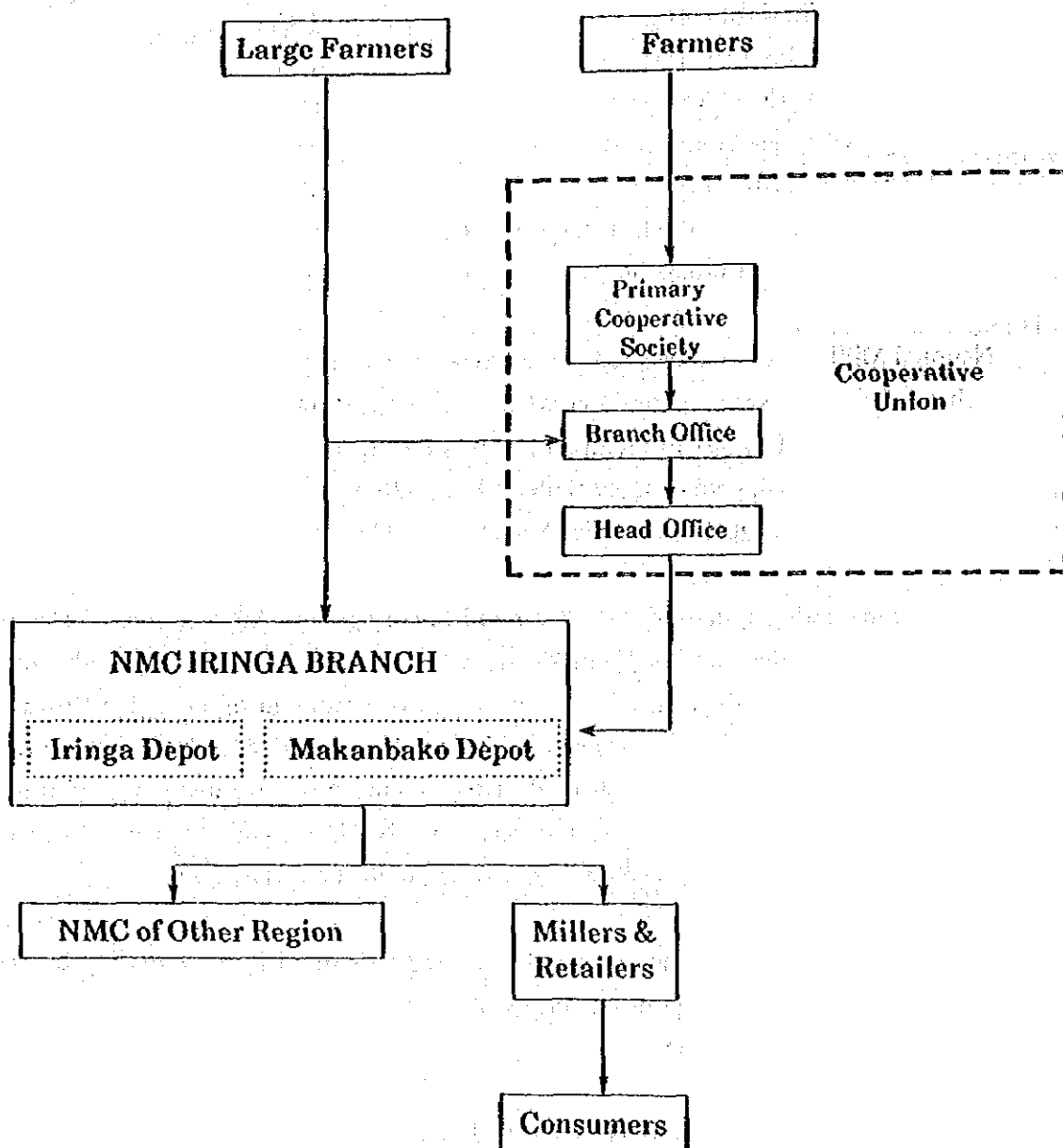
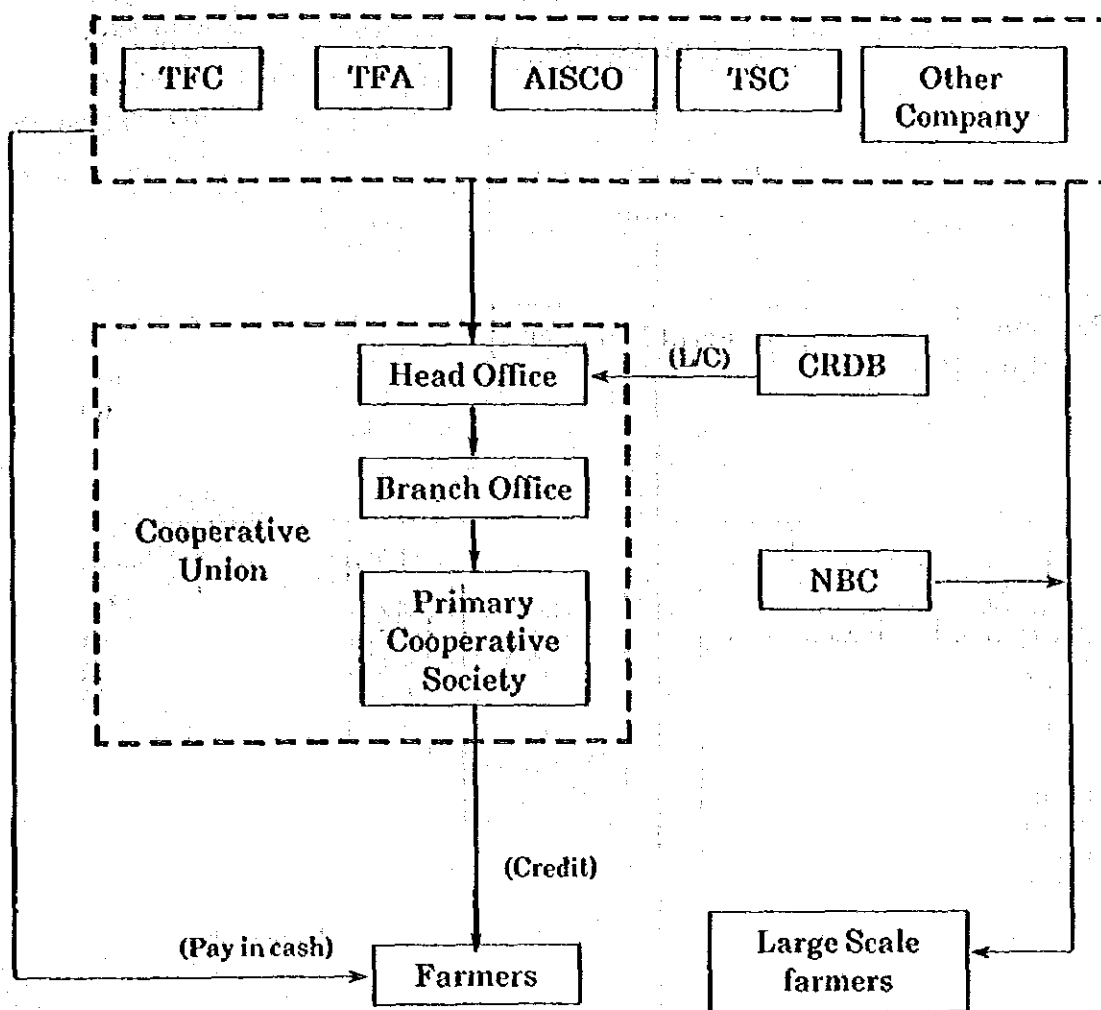


FIG.- 6 GRAIN MARKETING SYSTEM IN IRINGA REGION



TFC: (Tanzania Fertilizer Company)

TFA: (Tanganyika Farmers Association)

AISCO: (Agricultural and Industrial Supplies Corporation)

TSC: (Tanzania Seed Company)

NBC: (National Bank of Commerce)

FIG. - 7 MARKETING SYSTEM OF AGRICULTURAL INPUTS IN IRINGA REGION

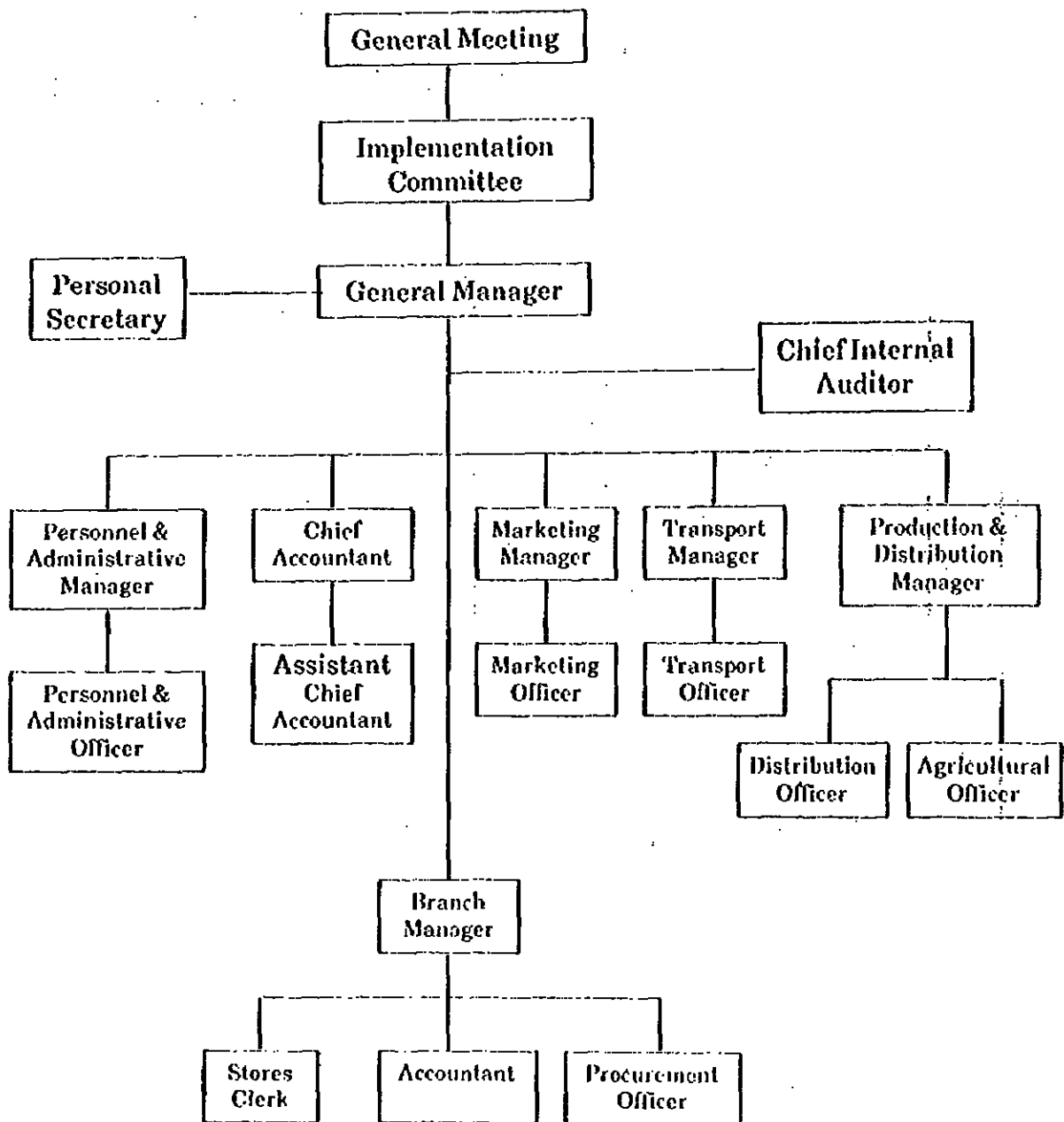


FIG.- 8 GENERAL ORGANIZATION CHART OF COOPERATIVE UNION LIMITED

Marketing, Transport and Production/Distribution, are managed by the General Manager. In addition, the branch manager is assigned to each district, and the Divisions of Accounts, Storage Administration and Marketing are controlled by him. The cooperative unions concerning the Project area are as follows:

Project Area	Cooperative Union	Branch Office	Number of Cooperatives	Number of Villages
Kilolo	IMUCU	Iringa	10	24
Ifwagi	IMUCU	Mufindi	4	18
Matembwe	NJOLUMA	Njombe	4	7
Itundu	NJOLUMA	Ludewa	11	12

Iringa branch office of IMUCU is in charge of marketing in Kilolo area and covers 10 cooperatives and 18 villages. Mufindi branch office of IMUCU is responsible for marketing in Ifwagi area with 4 cooperatives and 18 villages. Matembwe and Itundu areas are managed by Njombe and Ludewa branch offices respectively under NJOLUMA.

(2) Market Quantity

The quantities of grain and agricultural inputs, fertilizers, handled by cooperatives in each region are as follows:

Area	Grain/ Fertilizer	Quantity Handled (tons)		
		1985/86	1986/87	1987/88 ¹
Kilolo	Grain	4,270	3,840	6,880
	Fertilizer	620	1,430	4,200
	Total	4,890	5,270	11,080
Ifwagi	Grain	860	730	1,440
	Fertilizer	460	460	520
	Total	1,320	1,190	1,960
Matembwa	Grain	2,000	2,230	3,640
	Fertilizer	340	920	1,350
	Total	2,340	3,150	4,990
Itundu	Grain	3,850	4,920	7,290
	Fertilizer	670	1,820	1,940
	Total	4,520	6,740	9,230
Total	Grains	10,980	11,720	19,250
	Fertilizers	1,470	3,200	3,810
	Total	13,020	16,350	27,260

Note : ¹ : Forecasted
Handled grain is mainly maize
Agricultural inputs are mainly fertilizers

Source : Branch Offices of Cooperative Unions

Quantities of grain and fertilizers handled by the cooperative unions has been increasing year by year. In total, quantities of grain in 1987/88 was twice of that in 1985/86 and the quantities of fertilizers increase four times from 1985/86 to 1987/88.

The handled quantity of the objective areas and the NMC Iringa Office is tabulated below. According to this table, the project areas supply around 30% of the grain handled by the NMC branch office annually.

Item	(Unit: tons)	
	1985/86	1986/87
(1) Handled Quantity by NMC (maize)	39,500	36,400
(2) Handled Quantity in Objective Area	11,000	12,000
(2)/(1) x 100	27.8%	33.0%

Supply of farm inputs in and around the areas is shown below. Supply sufficiencies of farm inputs in Mulangali and Lupembe areas are about 50%, which is considerably lower than

these in Iringa and Makambako areas. Poor marketing facilities and road condition are the main reasons for the low sufficiency as well as limited amount of fertilizers.

Inputs	Iringa District	Makambako Area	Ludewa/Mrangari Area ¹	Lupembe Area ²
(No. of surveyed village)	7	13	21	12
1. Nitrogen fertilizers:				
Requirement (ton)	400	1,390	1,740	580
Supply (ton)	310	1,300	880	310
Sufficiency (%)	78	94	49	53
2. Phosphatic fertilizers:				
Requirement (ton)	200	1,020	760	280
Supply (ton)	120	680	190	160
Sufficiency (%)	6	67	25	57
3. Insecticides:				
Requirement (ton)	25	110	110	40
Supply (ton)	3	70	20	8
Sufficiency (%)	12	64	18	20
4. Hybrid seed:				
Requirement (ton)	36	150	170	54
Supply (ton)	22	61	32	15
Sufficiency (%) ⁶¹	61	41	19	28

Note : Amount of nitrogen was converted into calcium ammonium sulphate.

Source : IRADEP, Survey was made in 1985/86.

¹ : Including proposed site of Itundu

² : Including proposed site of Matembwe

3.6.2 Existing Godowns and Related Facilities

(1) General

1) Godowns

The total capacity of village-level godowns in Iringa Region is estimated at about 60,000 tons (1985/86). Out of 617 villages in Iringa Region, 200 villages have about 200 godowns with an average capacity of 300 tons as shown below.

District	Number of Godowns	Common Capacity (tons)	Total Capacity (tons)
Iringa	50	250-300	14,000
Mufindi	41	250-300	10,000
Njombe	66	500-600	20,000
Makete	18	200+	5,000
Ludewa	25	450-600	13,000
Total	200		62,000

Source: IRADEP

The number and capacity of the godowns in the project area are given below.

Area	Number of Village	Number of Godowns	Total Capacity (tons)	Average Capacity (tons)
Kilolo	24	15	3,450	200
Ifwagi	18	9	2,500	300
Matembwe	7	5	2,300	500
Itundu	12	10	3,400	300

(See Annex 2-1)

Village-level godowns are insufficient. According to interviews with persons concerned, at the time of harvesting, all the godowns are full, and further schools and churches are also used for storing maize. Moreover, maize are stored in open-air covered with tarpaulin at that time. Aside from the village-level godowns, there are other godowns managed by the branch offices of Cooperative Unions as shown below:

Cooperative Union Branch Office	Location of Godown	Capacity (tons)
Iringa	Iringa Town	800
Mufindi	Ruaha Town	500 300
Njombe	Njombe Town	1,000 500
Ludewa	Itundu Village	700 ^{1/1}

Note: ^{1/1} Ludewa branch office use the other 700-ton godown owned by the village.

2) Related Equipment

Equipments for measurement and quality control of grain are insufficient for the godowns managed by villages or Cooperative Unions. Maize moisture content is checked by on manual sensibility in RCSs and Cooperative Unions. Accordingly, NMC sometimes refuses to purchase grain because of its high moisture content. Iringa branch office of NMC is in charge of grain fumigation with their own equipment when requested by Cooperative Unions. However, it is impossible to respond to all the requests timely, and grain suffer from damages by insects in the godowns of Cooperative Unions' branch offices. Each Cooperative Union plans to set up fumigation teams, composed of 4 staff respectively, but the plans faces difficulties with lack of funds.

3) Truck

Grain and agricultural inputs are mainly transported by Unions owned trucks. The vehicles of Cooperative Unions are as follows: The table shows that most of the trucks has a carrying capacity of more than 10-tons.

They are mainly used for transportation between godowns along the main road and NMC godowns. The transportation capacity is not sufficient, the unions sometimes have to hire trucks from private transportation company or NMC.

Cooperative Union	Vehicle		
IMUCU	10 (tons)	x	3
	25 (tons)	x	1 (with a trailer)
	7	x	2
	Pick-up	1	x 6 (2 of them are not available)
	Tractor		4 (1 of them are not available)
NJOLUMA	10 (tons)	x	6 (trucks)
	7 (tons)	x	3
	Pick-up	2 (tons)	x 2
		1 (ton)	x 3
	Tractor		4 (2 of them are trailers)

4) Storage Loss of Grain

Grain storage loss, especially from insects has been recognized as large among the persons concerned. However, no detailed data are available on damage from insects or mold. FAO estimated the storage loss at about 30%, while UAC in Mubeya estimated it at 10% during storage at the farmers level.

(2) Architectural Features

Outlines of the existing agricultural godowns for grain in and around the project area are shown in Table 1. The features and the problems occurred may be summarized as follows:

1) Features

- Jute bag stacking storage system is adopted in all the existing godowns except for the Iringa NMC grain silo. Loading and unloading is also handled with bags.
- Jute bags which size is approximately 70 cm in width by 112 cm in length, are used for storing grains.
- A unit bond of stack is commonly of 5 bags on a wood dunnage having a size of approximately 6 ft by 6 ft by 6 inch in depth. These bags are stacked 20 bags to 30 bags high.
- Stacking is carried out by hand at the village level godowns, while, in the NMC godowns a slat-conveyor is utilized for stacking.
- Fumigation is carried out in and outside the godowns by using plastic or canvas sheet covers. The godowns, therefore, are not sealed from air, and have opening for ventilation.
- Ventilation of the godowns is practiced through the openings at the top of the wall.
- Sunlight is generally provided from skylights on the roof. No window is installed on the walls to ensure security.
- No supplemental facilities such as office, guard house, truck scale, etc. are provided at the village level godowns.

TABLE - 1 GENERAL OUTLINE OF EXISTING GODOWNS

Items	Kilolo	Itundo	NMC iringa	NMC Makaribako	NMC Vwawa
1 Capacity (ton)	200/300	700	12,000	7,000	6,200
2 Floor Space	126/136	560	4,900	2,200	1,900
3 Materials of Structure	Wooden	Steel Flame	Steel Flame	Steel Flame	Steel Flame
4 Main Materials	Galvanized iron roof and wall, concrete floor	Galvanized iron roof, wall and wall siding (2.75 m in height) concrete floor	Asbest straight roof, concrete block wainscot concrete floor	Galvanized iron roof, wall and concrete block wainscot concrete floor	Vinyl chloride iron roof and wall concrete floor
5 Owner	Village / cooperative union	Cooperative union	NMC	NMC	NMC

- The NMC godowns at Iringa and Makambako are provided with office, guard house, truck scale, outdoor concrete floor and equipment store house. Electricity and water supply system are also installed in these godowns.
- The NMC godowns are equipped with portable type fire extinguishers.

2) **Problems occurred**

- Grains stored in the village level godowns are conspicuously infested by insects.
- No insect screens are installed on the openings for ventilation at the all existing godowns. With exception of the Vwawa NMC godown, no rodent proofing device is provided at the doors.
- At the Vwawa godown, the ground of the compound changes into mud after rain because no drain ditches are provided in the site. A part of the wall sidings are damaged by falling the stacks, etc., since no concrete or concrete block wainscots are provided on the exterior walls.
- Since no office space is available in the Vwawa godown, inspection and quality control rooms are utilized for office room

3.6.3 Present Road Condition

(1) **Feeder Roads Subject to Improvement**

The "feeder road" used in this report means road extending from the highway (asphalt pavement road) to the proposed construction site of the agricultural storage facilities.

Iboma-Mkiu road in Itundu site was excluded from the project because BEC has planned to improve the road this year.

(2) **Present Condition of Feeder Road**

Survey on the present condition of roads and related structures was carried out for the following items:

Road Name	Distance (km)	Number of Structures		
		Concrete Bridge	Timber Bridge	Culvert
Iringa-Kilolo	31.0	3	-	13
Mafinga-Ifwagi	22.5	2	1	-
Kibera-Matembwe	54.0	-	1	-
Mkiu-Itundu	11.5	-	2	3
Total	119.0	5	4	16

The major items surveyed are road width, surface condition, surface drainability, location and condition of structures and past record of flood. The results of the survey are shown in ANNEX 3-3.

The findings are briefly described below.

- Almost all roads run on hilly terrains. The roads are unpaved with the formation width varying from 3.5 to 6.0 meters.
- Due to insufficient maintenance works, road surface has deteriorated with the development of pot holes, corrugations and ruts. The primary factor of such deterioration is the overflow of water resulted from poor drainage facilities.
- Due to clayey or loamy soil characteristics of subgrade course, road surface is heavily rutted and very slippery in rainy days. The road become impassable during heavy rains.
- There are 5 concrete bridges and 4 wooden bridges on the feeder roads. All wooden bridges have wet stone masonry abutments with cracks and are in dangerous condition. However, there is no past record of damages from floods.
- Mafinga bridge (concrete bridge) on Mafinga-Ifwagi road is submerged and become impassable every rainy season. Water comes up to 0.5 meters high above the road surface, 80 meters in length, lasting for about two months.
- The other four concrete bridges are in good condition. Two of them are submerged in rainy season, but it lasted for less than two days according to past record of flood.

- Most culverts consist of corrugated pipes and pipes with less than 800 mm diameter are clogged up due to difficulties in maintenance.
- Horizontal alignments are generally good, although there exists steep grade more than 7 percent in some bridge approach.

(3) Maintenance of Feeder Road

Feeder roads subject to improvement are classified into 4 classes; trunk roads, regional roads, district roads and branch road. The following table shows the length of the roads classified into these categories::

(Unit: km)

Road Name	Total	Road Length (km)			
		Trunk Road	Regional Road	District Road	Branch Road
Iringa-Kilolo	31.0	-	31.0	-	-
Mafinga-Ifwagi	22.5	-	15.4	7.1	-
Kibena-Matembwe	34.0	-	33.6	-	0.4
Mkiu-Itundu	11.5	9.9	-	-	1.6
Total	119.0	9.9	100.0	7.1	2.0
Whole Iringa Region	4,883	871/1	981	1,909	1,122

Note: /1: 498 km Asphalt pavement road

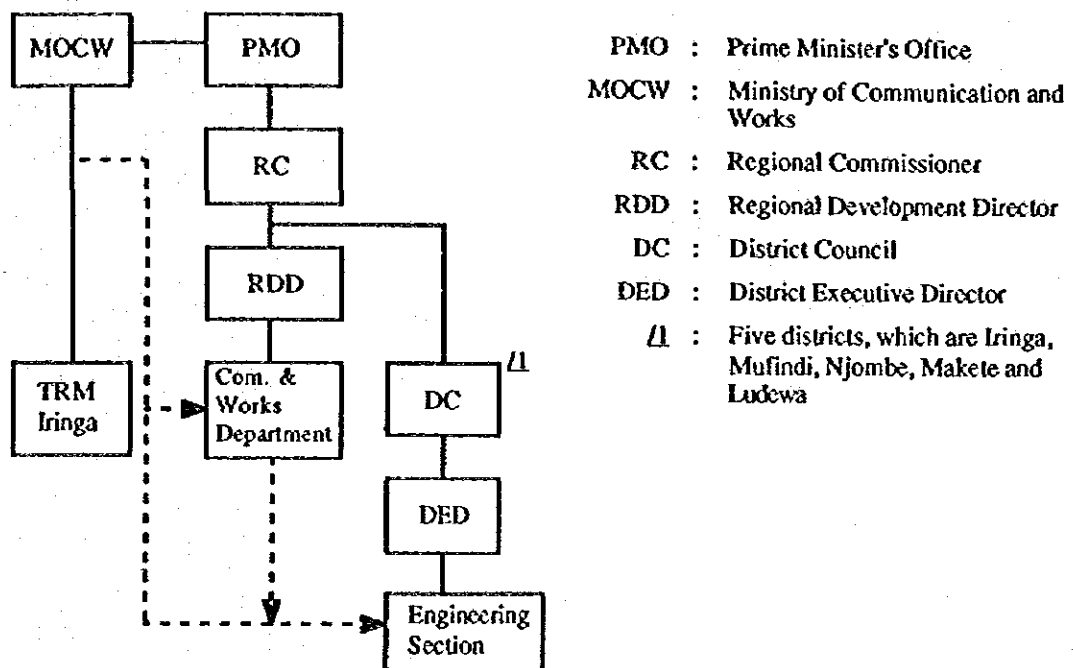
Maintenance of the trunk roads in each region is generally under the control of the Trunk Road Maintenance office (TRM) of the Ministry of Communication and Works (MOCW). Civil Department of RDD office has responsibility for the maintenance of regional road, while district and branch roads are maintained by the Engineering Section of District Council (DC). Above offices have maintenance equipment and workshop.

Due to the lack of maintenance equipment compared with roads length, however, all road in Iringa region except for asphalt pavement roads are maintained by the above three offices altogether.

The numbers of road maintenance equipment and the road maintenance system in Iringa Region are shown below.

(As of April 1988)

Name of Equipment	TRM Iringa	Region	Total of Five Districts	Total
- Grader	1	1	1	3
- Bulldozer	2	-	-	2
- Roadroller	2	-	-	2
- Tractor-shovel	3	-	-	3
- Dump truck	-	1	6	7
- Tank lorry	1	1	-	2



Road Maintenance System in Iringa Region

CHAPTER 4

CHAPTER 4 THE PROJECT

4.1 Objectives of the Project

The objectives of the project aim at the improvement of food security, within the context of Tanzania Government's integrated National Food Strategy set up in 1983. Works involved are the improvement of the transport and storage infrastructure so as to reduce the post-harvest losses of grains by securing the smooth transportation of grains, to increase agricultural productivity and to give farmers incentives to cultivate more lands. In order to achieve the above objectives, the following works; construction of the agricultural multipurpose godowns and its related facilities, feeder roads improvement, transportation and road maintenance equipment will be granted by the Government of Japan.

4.2 Assessment of the Request

4.2.1 Assessment of the Project

(1) Necessity of the Project

The content of Tanzania's request and the significance and adequacy of the Project have been studied based on the present condition of the national development plan, agriculture in Tanzania and Iringa Region and present condition in the objective area.

1) Necessity of improvement of marketing

Marketing problems such as insufficiency of godowns in producing area and transit points cause congestion of agricultural products and hamper the proper supply of farming materials in Tanzania. the Government of Tanzania plans to construct additional transit godowns, village-level godowns and rehabilitate village roads, and has requested aids from donor countries and organizations

Grain supplies are insufficient in many areas including Dar Es Salaam in Tanzania, in spite of grain surplus in a few regions such as Iringa Region. Accordingly, main goals are to effectuate stable supply of grains to food shortage area and to prevent grain loss occurring through marketing procedure. There is a strong necessity to improve the marketing system of agricultural products and materials.

2) **Necessity of transit godowns**

Cooperatives and cooperative unions are responsible for the marketing of grain and agricultural materials intended for small-scale farmers in the project areas. Transit godowns are required to be constructed at important points where large trucks can access in order to realize efficient transportation between village-level godowns and godowns in the trading center. Transportation will move smoothly with the use of large trucks between the transit godowns and the trading center and middle and small trucks between transit godowns and village-level godowns. It is expected that the freight congestion will be checked through the construction of transit godowns.

3) **Necessity of equipped tools**

Large quantity of grain are damaged by insects because grain is stocked in the open air and equipped tools such as grain moisture meter and fumigation tools are not enough. The condition will be greatly improved by the construction of godowns equipped with grain moisture meter and fumigation tools.

4) **Necessity of the feeder road improvement**

Poor road conditions in the project area interfere with the transportation of grain, fertilizer, etc., especially in the rainy season, because of slippage on the loam-soil road surfaces and overfloodings on the bridges. The deteriorated wooden bridges are sometimes very dangerous for the heavy trucks. Therefore it is indispensable to improve the road condition to improve the transportation system in the project area.

5) **Necessity of reinforcement of transport capacity**

It is required to reinforce transport capacity from village-level godowns to transit godowns. However, the trucks owned by cooperative unions, mainly large trucks with more than 10-ton capacity, are not suitable for this purpose. Middle-sized trucks with less than 7-ton capacity should be more practicable.

6) Necessity of O&M equipment for feeder road

The number of O&M equipment for road in Iringa Region is insufficient as stated in Chapter-3. It is required to procure O&M equipments for excavation & loading, spreading & levelling, and compaction works.

7) Technical cooperation

It was confirmed that the technical cooperation by Japanese experts is not required for the operation and maintenance of the proposed facilities and equipment.

(2) Receiving Conditions for the Project

RDD's office will be responsible for the execution of the Project and operation and maintenance of the constructed road. On the other hand, the cooperative union will be in charge of operation of godowns and equipment. It is expected that the execution, operation and maintenance of the Project will be carried out smoothly since these organizations are systematically integrated. It is expected that fumigation, which needs technique, will be well conducted after the training of cooperative union's staff by NMC and Ministry of Agriculture and Livestock Development.

(3) Overlap with Other Projects

The projects to construct godowns in Iringa Region for which EEC and FAO extended aid do not overlap with the Project. The Project does not also overlap with EEC's project to rehabilitate road between Iboma and Songea.

(4) Components of the Project

Agricultural products are sold under a well-organized marketing system in the project area. However, there are problems on grain storage and distribution of farming materials since related facilities, transportation vehicles and feeder roads are insufficient.

There are some areas suffering from shortage of foods in Tanzania, and they expect prompt inflow of foods from the area where there are surplus foods. It is necessary for farmers to establish a system under which they can sell products quickly so that they may reduce storage loss and avoid selling grain cheaply through illegal marketing systems. The

improvement is expected to stimulate farmers and contribute to stabilize farmers' financial condition.

The following basic components should be included in the Project in consideration of the content of the request and aforesaid present condition:

- 1) Construction of multi-purpose transit godowns for agricultural products and materials
- 2) Construction of related facilities and offices for operation and maintenance of the proposed godowns
- 3) Equipment of required tools for grain quality control
- 4) Reinforcement of transport capacity between village-level godowns and proposed godowns
- 5) Improvement of feeder road between proposed godowns and trunk road
- 6) Reinforcement of maintenance equipment for road to be improved

4.2.2 Assessment of Facilities and Equipment Requested

Facilities and equipment requested have been assessed regarding the following items based on the content of the request.

(1) Agricultural Multi-purpose Transit Godowns

It was requested that the transit godowns will have 2,000 tons capacity respectively. The main purposes of the godowns are to consign collected grain to the trade center smoothly and to distribute agricultural materials to each cooperatives at proper time.

The quantity of grain, mainly maize, produced, consumed, marketed in the area and handled by cooperative unions have been estimated respectively on monthly base. Then the godown capacities for grain have been decided based on grain quantity handled during the busiest month. On the other hand, the quantity of fertilizer required in the objective area has been estimated. The godown will store one-third of the total required fertilizer based on the pre-condition that the total quantity will be transacted within three (3) months.

The proper capacities have been estimated as 2,700 tons, 1,700 tons, 2,200 tons and 2,200 tons for Kilolo, Ifwagi, Matembwe and Itundu respectively on the basis of the above conditions (see following table). The godowns will be of normal temperature considering that the storage period will be short and the construction site is located on the highland, where it is rather cool and dry.

The construction site of each godown is judged to be suitable because the place is easy of access and there is no problem for land procuring as it is owned by a public body.

(Unit: tons)				
Item	Kilolo	Ifwagi	Matembwe	Itundu
1) Grain				
a) Production	41,000	9,700	12,200	16,900
b) Consumption	16,300	3,900	4,900	6,700
c) Balance	24,700	5,800	7,300	10,200
d) Grain handled by cooperatives	7,400	4,600	5,800	8,200
e) Largest amount of collected grain on monthly base	2,400	1,500	1,900	2,600
d) x 32%				
2) Fertilizer				
a) Supply	700	600	700	900
b) Largest amount of handled fertilizer on monthly base	250	200	250	300
a) x 1/3				
3) Required Capacity				
- Grain	2,700	1,700	2,200	2,900
- Fertilizer	250	200	250	300
4) Present Capacity				
	0	0	0	700
5) Proposed Capacity¹				
	2,700	1,700	2,200	2,200

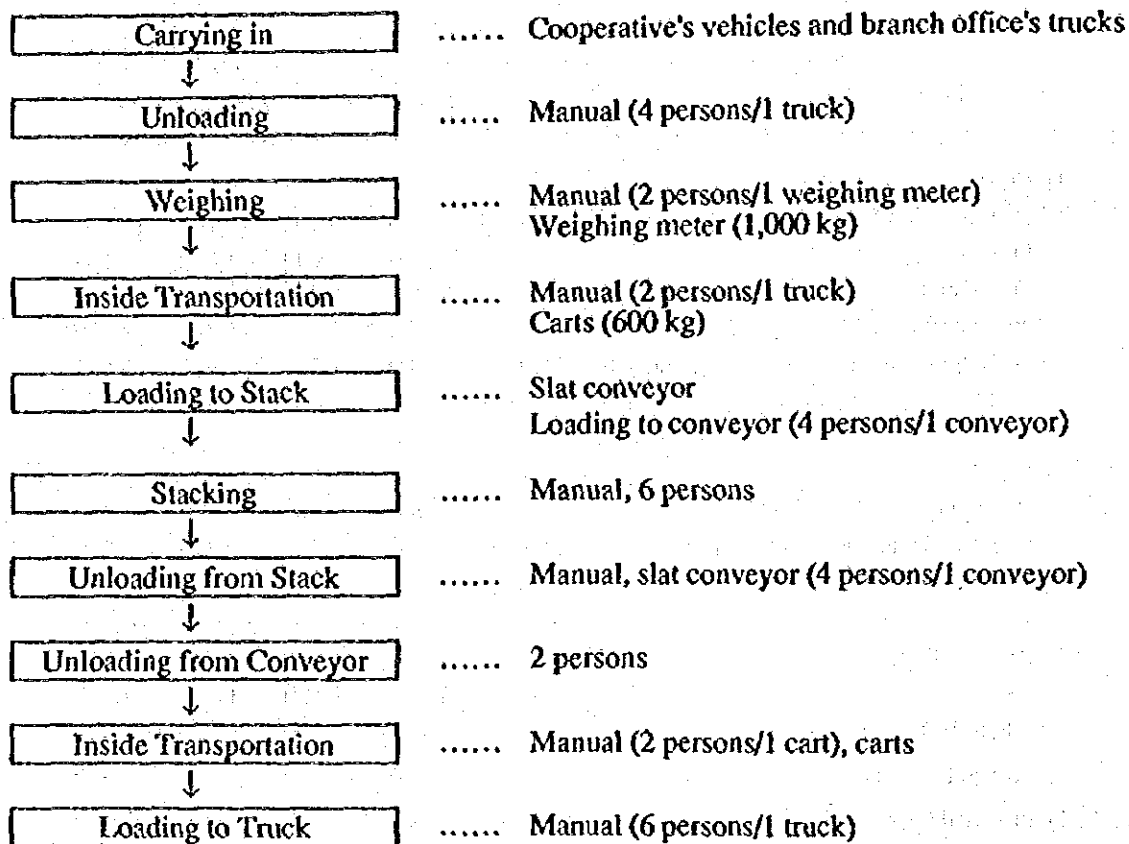
Note: ¹: See ANNEX 2-3 for detail

(2) Related Facilities

Construction of related facilities such as office buildings is indispensable so that O&M staff could be stationed permanently. However, there is no need to build quarters for the staff because houses are available in the village.

(3) Facilities and Equipment for Labor

The work on the marketing system depends mainly on manual labor at present. Grain is handled in jute bags (90 kg), and fertilizer in plastic bags (50 kg). In the transit godowns it is proposed to use carts for inside transportation and slat conveyor for stacking and unloading from stack. The fundamental work flow is as follows: Grain will be weighed when it is carried into the transit godowns and when sold to NMC godowns. Fertilizer will not be weighed on carrying both in and out.



(4) Quality Control Instrument

(a) Grain moisture tester

Grain will be carried into the proposed godowns after moisture measurement by cooperatives. However, no cooperatives are equipped with grain moisture tester, and measurement of moisture content depends on staff's experience and sixth sense. Grain moisture tester is indispensable to improve the present condition.

Grain moisture tester will be lent to each cooperative, and they will check the moisture content when they purchase grain from farmers. Proposed godowns will be equipped with simple grain moisture testers, which are battery-operated because of no electricity supply. One of them will be used for spot-check of the grain and the rest will be for the use of cooperatives. The branch offices of cooperative unions will be equipped with moisture testers of infrared lamp type. They will be electricity-operated, precise and easy to handle, and used to check the accuracy of the simple ones.

(b) Fumigation instrument

Grain will be fumigated to lessen blight loss. The grain to be carried into the proposed godowns will be fumigated in the godowns of the village cooperatives. Gasproof sheet fumigation method will be applied taking account of that the godowns are not airtight, that the capacity is around 300 tons and that aluminium phosphate (sold as phostoxin), which is easy to handle and produces hydrogen phosphate, will be used. The proposed godowns will be provided with instrument, and the fumigation will be conducted by the fumigation team of the cooperative union branch office. The quantity of the grain to be fumigated at one time is proposed to be 300 tons.

(5) Transport Vehicles

Medium-sized truck is suitable for transportation of grain and fertilizers between proposed transit godowns and cooperative godowns taking into consideration of the road condition. Required number of the trucks were calculated in preparation of the increased loads after completion of the Project.

(6) Feeder Road Improvement

Present poor condition of the feeder roads prevent the smooth operation of vehicles which transport the agricultural products to outside the Project area. Considering the Project objectives, which will be attained through the effective shipment of grain by the medium to large-sized trucks, the feeder road should be all-weather type.

It was confirmed, through the discussion with Tanzanian government officials concerned, that the feeder road would be all-weather type all along the line so that transport trucks may be used even during the wet season. Improvement of road with 71.7 km in length

and rehabilitation/replacement of seven (7) bridges are required according to the survey on the present condition. The road portions to be improved will be paved with gravel. Improvement of drainage facilities is also indispensable.

Feeder Road	Total Length (km)	Road Length to be Improved (km)	Nos. of Road Section to be Improved	Nos. of Bridges to be Rehabilitated/ Replaced
Iringa - Kilolo	31.0	19.8	2	1
Mafinga - Ifwagi	22.5	12.8	3	3
Kibera - Matembwe	54.0	27.6	2	1
Mkiu - Itundu	11.5	11.5	1	2
Total	119.0	71.7	8	7

(7) O&M Equipment of Feeder road

Road maintenance is indispensable to achieve the goal of the Project, and proper O&M equipment is required. Two (2) dump trucks, one (1) bulldozer, one (1) motor grader are requested. It is judged that one backhoe for excavation and loading of pavement materials is necessary additionally. The bulldozer will be of medium-size and all other equipment of small-size type. The dump trucks will be used with backhoe, so two (2) units of dump truck will be required as not to reduce work efficiency.

4.3 Outline of the Project

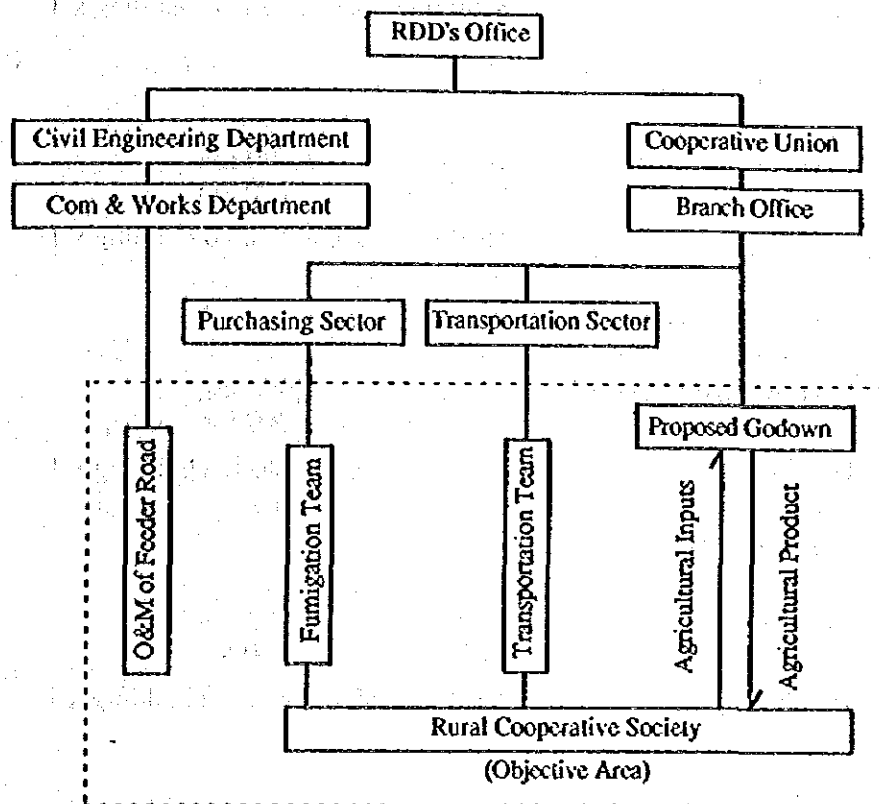
4.3.1 Organizations for Project Execution and Operation

The executing agency of the Project is the Regional Development Director's office (the RDD's office). The office is therefore expected to be responsible for coordination with the related organizations for the Project's execution. The organization for operation and maintenance of facilities and road after the completion of the Project is as follows:

- (1) Cooperative unions will be responsible for operation and maintenance of agricultural multi-purpose godowns, related facilities and under present organization, entrusted by the RDD's office. They will entrust the execution to branch offices.

- (2) The Civil Engineering Department of the RDD's office will be in charge of O&M of the objective road, which include national road, regional road, district road and village road, under RDD's control. The O&M equipment therefore will be placed at the above Department.

The operation organization after the execution of the Project is illustrated below.



4.3.2 Outline of Facilities and Equipment

An outline of the storage facilities and equipment to be granted under this Project is as follows:

(1) Agricultural Godowns

The proposed godowns to be constructed in each site shall have the following functions:

- To store grain safely and reduce post-harvest loss during storage period,
- To handle smoothly frequent arrival and delivery of grain as transit godown,

- To perform the management of arrivals/delivery of grain accurately and
- To store not only grain but also agricultural inputs.

(a) Kilolo Godown

Max. storage capacity : Grain 2,400 ton
Fertilizer 300 ton

Building : Steel framed, one-storied building x 1

(b) Ifwagi Godown

Max. storage capacity : Grain 1,500 ton
Fertilizer 200 ton

Building : Steel framed, one-storied building x 1

(c) Matembwe Godown

Max. storage capacity : Grain 1,900 ton
Fertilizer 300 ton

Building : Steel framed, one-storied building x 1

(d) Itundu Godown

Max. storage capacity : Grain 1,900 ton
Fertilizer 300 ton

Building : Steel framed, one-storied building x 1

(2) Supporting Facilities

The following facilities will be planned to be constructed for relevant operation and maintenance of the godowns:

(a) Office Building

This building will accommodate the following rooms for the staff concerned.

Required room : Store keeper room
Store keeper assistant room
Accountant room
Labour room
Storage

Building : Concrete block framed, one-storied building, 1 building for each site

(b) Guard House

Required room : Guard room
Rest room

Building : Concrete block framed, one-storied building, 1 building for each site

(3) Equipment

(a) Transport vehicle : 7-ton truck x 9 units

(b) Stacking equipment

Cart : Carrying capacity 600 kg x 61 units

Slatconveyer : Capacity 65 tons/h x 10 units

(c) Weighing meter : Measuring capacity 1,000 kg x 17 units

(d) Quality control instrument

Grain moisture tester : Electric resistant type x 39 units

Infrared lamp type x 4 units

Fumigation instrument : 7 units

(e) Fire extinguisher : Dry chemical portable type x 32 units

4.3.3 Outline of Feeder Road Improvement

An outline of the feeder road and equipment to be improved and granted is as follows:

(1) Location, Length and Work Item of Road to be Improved

Location	Length (km)	Work Item
(a) Iringa to Kilolo agricultural godown site		
0.0 km (Iringa) - 7.9 km	7.9	- Gravel pavement with drainage facilities
19.1 km - 31.0 km (Site)	11.9	- Gravel pavement with drainage facilities and rehabilitation of concrete, bridge
Sub-total	19.8	
(b) Mafinga to Ifwagi agricultural godown site		
0 km (Mafinga) - 2.7 km	2.7	- Gravel pavement with drainage facilities and replacement of bridge with raising up to road surface
9.2 km - 11.2 km	2.0	- Gravel pavement with drainage facilities and rehabilitation of concrete, bridge
14.1 km - 22.5 km (Site)	8.1	- Gravel pavement with drainage facilities and replacement of timber bridge
Sub-total	12.8	
(c) Kibena to Matembwe agricultural godown site		
23.7 km - 26.5 km	2.8	- Gravel pavement with drainage facilities
29.2 km - 54.0 km (Site)	24.8	- Gravel pavement with drainage facilities and replacement of timber bridge
Sub-total	27.6	
(d) Mkiu to Itundu agricultural godown site		
0.0 km (Kiu) - 11.5 km (Site)	11.5	- Gravel pavement with drainage facilities and replacement of two (2) timber bridges
(e) Total	71.7	- Gravel pavement with drainage facilities and replacement/rehabilitation of seven (7) bridges

(2) O & M Equipments of Feeder Road

Following equipments are necessary for the maintenance of the feeder road.

- Bulldozer
- Motor grader
- Dump truck
- Backhoe

4.3.4 Outline of the Construction Site

(1) Proposed Site

(a) Kilolo Site

- Site condition

The proposed construction site for the godown is atop a hill with an elevation of about 1,920 m above sea level and about 4 km away from Kilolo village which is located about 35 km from Iringa town, the capital of Iringa Region. The site is a long and narrow land in the northwest and southeast direction with an area of approximately 50 m by 160 m and faces the regional road having about eight (8) meters wide. The site is covered with tropical grass. There is no existing building and structure at the site. The surrounding of the site is cultivated as farmland. The site is gently a sloped land with about 2% gradient from the northwest to the southeast and about 30 cm to 50 cm above the adjoining road.

The right of use of the site is presently held by the Kilolo village authority. However, no problem is expected in acquiring the right.

- Subsoil condition

According to the result of the test pit, the topsoil is red sandy loam from the surface to 30 cm in depth, and there is a layer of loam below this subsoil. Judging from the result of survey by using a cone penetrometer, the bearing capacity of the subsoil is from 14 tons/m² to 23 tons/m² at about one (1) meter below ground level.

- Infrastructure

A water reservoir tank (5 m in diameter and 2 m in height, cylindrical type) for the public domestic water system is located at the opposite of the rural road adjoining the southeastern side of the site. A water supply pipe, which is 50 mm in diameter, is available along the road. However, no water is available at present because the pump has been damaged. Another service facilities such as electric power supply, telephone lines and drainage system are not available in and around the village.

(b) Ifwagi Site

- Site condition

The proposed construction site for the godown is located on the northward of Ifwagi village which is about 25 km away from Mafinga town, the capital of Mufindi District. The elevation of the site is approximately 1,850 m above sea level. The site is gently sloped land with about 3% gradient from the south to the north and about 60 cm to 100 cm above the road.

The site is a little bit long and narrow land in the north and south direction with an area of approximately 200 m by 160 m and faces the district road having about six (6) meters wide on the western side of the site. The site is covered with grass and scattered trees along the road. The surrounding of the site is cultivated as farmland. The right of use of the site is presently held by the Ifwagi village authority. However, no problem is expected in acquiring the right.

- Subsoil condition

According to the result of the test pit, the topsoil is dark gray soil from surface to 30 cm in depth and the soil below this subsoil is a layer of loam. Judging from the result of survey by using a cone penetrometer, the bearing capacity of the subsoil is from 10 tons/m² to 20 tons/m² at about one (1) meter below ground level.

- Infrastructure

No water is supplied at present because the water supply pump has been damaged though a water supply pipe is buried at about 500 m away from the site. Other service facilities such as electric power supply, telephone line and drainage system are not available in and around the village.

(c) Matembwe Site

- Site condition

The proposed construction site for the godown is located about 2 km to the west of Matembwe village which is about 60 km away from Njombe town, the capital of Njombe District, to the east. The elevation of the site is approximately 1,600 m above sea level, almost the same elevation as the surrounding area. The site is a flat land with an area of approximately 47 m by 88 m and faces a road on the east of the site. This existing road is not paved and approximately eight (8) meters wide. There are buildings such as a fodder factory and private houses around the site. The right of use of the site is presently held by Matembwe village. However, no problem is expected in acquiring the right.

- Subsoil condition

According to the result of the test pit, the topsoil is dark gray soil from surface to 30 cm in depth and, there is a red loam layer below this subsoil. Judging from the result of survey by using a cone penetrometer, the bearing capacity of the subsoil is from 10 tons/m² to 18 tons/m² at about one and half meters below ground level.

- Infrastructure

There are a water reservoir tank and a water supply pipe at about 200 m away to the north of the site. As for electric power supply, a 380 V transmission line is buried along the existing road. However, the property of the electric power facilities belong to the fodder factory. Other service facilities such as telephone lines and drainage system are not available in and around the village.

(d) Itundu Site

- Site condition

The proposed construction site for the godown is located on a hill top and about 3 km to the east of Itundu village which is located about 90 km from Njombe town to the southwest. The elevation of the site is approximately 1,700 m above sea level. The site is a long land lying from north to south with an area of approximately 40 m by 90 m, and faces a feeder road of

approximately 4 m to 5 m in width on the west. The site is covered with grass. There is no existing building and structure at the site. The surroundings of the site is cultivated as farmland and dotted with private houses. The site is gently sloped land with about 3% gradient from north to south and almost as the same elevation as the surrounding area. The right of use of the site is presently held by the Itundu village authority. However, no problem is expected in acquiring the site.

- **Subsoil condition**

According to the result of the test pit, the topsoil is red sandy loam from surface to 30 cm in depth and there is a red loam layer below this subsoil. Judging from the result of survey by using a cone penetrometer, the bearing capacity of the subsoil is from 10 tons/m² to 13 tons/m² at about one meter below ground level.

- **Infrastructure**

No water supply pipe is available in and around the site, though public water supply facilities are provided in the center of Itundu village. Other service facilities such as electric power supply, telephone line and drainage system are not available in and around the village.

(2) Advantages of the Proposed Site

The proposed construction sites prepared by the Government of Tanzania are the most suitable for the construction of the godowns for the following reasons;

- (a) Being located almost at the center of the grain field to be covered by the proposed storage facilities, transport distance of the grain from buying posts to the facilities will be minimal.
- (b) Being adjacent to feeder roads connected to trunk roads, or to rural roads connected to feeder roads within rather short distance, there will be no access problems.
- (c) Being located atop of hills away from the center of the village, it will be possible to get sufficient airing and natural lighting into the godowns.
- (d) Areas of the sites and bearing capacities of subsoils are strong enough for the construction of the proposed facilities.

CHAPTER 5

CHAPTER 5 BASIC DESIGN

5.1 Basic Concept :

(1) Agricultural Storage Facilities :

The proposed storage facilities will be designed based on the following basic concepts;

- 1) The facilities will be planned in line with the objectives and the functions stated in the previous chapter;
- 2) Indigenous building materials and construction methods will be utilized in building as much as possible. However, in general, the availability of materials in the Tanzania market is uncertain regard to in volume, kind and cost. So such materials as may pose difficulty are proposed to be imported from Japan;
- 3) Local conditions such as climate, traditional practices and the construction situation will be taken into consideration in the planning;
- 4) The proposed godowns will be of prefabricated steel structure for the following reasons:
 - Steel structure frames are generally utilized in the existing godowns with a storage capacity of not less than 700 tons;
 - The prefabrication method for all building frames is effective to achieve the minimum construction period within the limit of the Japan's Grant Aid Program;
 - There are very few local contractors able to fabricate the steel structures.
- 5) The facilities will be designed for easy and cheap to maintain and also to diminish the scope of the work to be undertaken by the government of Tanzania;
- 6) No utilities such as electric services and domestic water supply will be installed in the proposed facilities for the following reasons:

Since no commercial electric power either from TANESCO or other suppliers is available in and around the proposed construction sites, skylights will be provided on the roof of the proposed godowns in order to afford good visibility within the godowns without the use of electric lighting, and slat conveyors will be equipped with gasoline engines;

Public domestic water supply systems are provided in all the villages being targeted for to construction of the godowns, Kilolo, Ifwagi, Matembwe and Itundu. However, no water is available in Kilolo and Ifwagi due to damage of intake pumps. The proposed site in Itundu is located beyond the area of the water supply, and the operation of the existing domestic water supply facilities owned by the village is hardly reliable;

No electric lighting and domestic water supply systems are installed in the existing godowns and office buildings of the Unions in and around the project area.

(2) Feeder Road Improvement

The design for the improvement of feeder roads in the Project will be carried out on the following basic concept, in consideration of the results of the field surveys and the objective of the Project.

- 1) The deteriorated wooden bridges will be replaced culverts and the culverts should be designed by taking such factors as economical construction cost and so forth into consideration;
- 2) Two (2) concrete bridges which have past record of slight flood damages, though they are in good state at present, will be rehabilitated as submersible bridges;
- 3) The portions of feeder road to be improved will be of gravel metalling with drainage facilities, because of the road surface is slippery with many ruts.

(3) Operation and Maintenance Equipment

The selection of operation and maintenance equipment and the determination of the required quantity are made in accordance with the following concept:

- 1) The designs and technical specifications of equipment have to follow Japanese standards, because all the equipment to be provided is made in Japan;
- 2) The equipment should be easily and economically operated and maintained. Complicated, extremely high grade equipment should be avoided;
- 3) Minimum requirements can be estimated; and
- 4) Standard models should be adopted, so that spare parts will be easily obtained for future O & M works.

5.2 Basic Design of Storage Facilities

5.2.1 Design Condition

(1) Scale of Godowns

The required storage capacity of the proposed godowns is as mentioned in Chapter 4. The proposed godowns will be utilized to store mainly maize. Handling of maize at the godowns including receiving, storing and dispatching will be done in jute bags having with a standard size of approximately 70 cm in width by 112 cm in length. One bag of maize is about 90 kg. The required storage capacity for grains will be estimated according to the figures for maize.

A typical unit bond stack in Tanzania is of 56 bags on a wood dunnage having a dimensions of approximately 6 ft. by 6 ft. by 6 inches in depth. These bags are commonly stacked 20 bags to 30 bags high though, 22 bags high is adopted for the proposed godowns in consideration of their function as transit godowns, i.e. high efficiency of stacking and dispatching.

The weight of grains per unit storage area is 2,956 tons/m² (90 kg/bag x 5 bags x 22 bags high = 9,900 kg + (1.83 m)²). In consideration of the alley space that approximately thirty percent of the total floor space is used as alleys around the stacks as shown in the stack arrangement in Sub-Clause 5.2.2, the storage capacity of grains per unit floor area will be 2.069 tons/m² (2,956 tons/m² x 0.7). Whereas, the weight of fertilizers per unit storage area is 3.5 tons/m² using 0.7 in specific gravity of fertilizers and 5.0 m in stacking height. Taking into account an alley area ratio as same as the storage of grains, thirty percent, the storage capacity of fertilizers per unit floor area will be 2.45 tons/m² (3.5 tons/m²

x 0.7). Based on the above storage capacities, the required floor area of each godown is calculated as listed below.

Site Name	Storage Capacity (ton)			Required Floor Area (m ²)		
	Grains	Fertilizers	Total	Storage for Grains	Storage for Fertilizers	Total
Kilolo	2,400	300	2,700	1,160	122	1,282
Ifwagi	1,500	200	1,700	725	82	807
Matembwe	1,900	300	2,200	918	122	1,040
Itundu	1,900	300	2,200	918	122	1,040

(2) Scale of Supporting Facilities

The proposed supporting facilities will consist of office buildings and guardhouses as stated in Sub-Clause 4.3.3 of Chapter 4. The floor area of each building is computed to find the required room's floor area in consideration of the number of staff concerned as shown on the table below:

Office Building

Room classification	Formula and Basic Data			Floor Area
Store Keeper Room	Store keeper	1 person	8.5 m ²	15.75 m ²
	Reception space		7.0 m ²	
	Sub-total			15.5 m ²
Store Keeper Assistant Room	Assistant	2 persons	7.0 m ²	15.75 m ²
			x 2 = 14.0 m ²	
	Sub-total			14.0 m ²
Accountant Room	Accountant	1 person	7.0 m ²	15.75 m ²
	Typist	1 person	7.0 m ²	
	Sub-total			14.0 m ²
Labour Room	Labours	44 persons/L	1.0 m ² x 44 = 44.0 m ²	45.50 m ²
Store Room				22.75 m ²
Corridor				21.0 m ²
Total				136.50 m²

Note: L : 65% of the number of labours at the peak working period.