MINISTRY OF AGRICULTURE,
ANIMAL INDUSTRY AND FISHERIES
THE REPUBLIC OF UGANDA

# BASIC DESIGN STUDY REPORT
# ON
# THE PROJECT FOR IMPROVEMENT OF AGRICULTURAL EXTENSION AND TRAINING INSTITUTES
# IN
# THE REPUBLIC OF UGANDA

DECEMBER 1997



JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
NIPPON KOEI CO., LTD.

MINISTRY OF AGRICULTURE,
ANIMAL INDUSTRY AND FISHERIES
THE REPUBLIC OF UGANDA

# BASIC DESIGN STUDY REPORT
# ON
# THE PROJECT FOR IMPROVEMENT OF AGRICULTURAL EXTENSION AND TRAINING INSTITUTES
# IN
# THE REPUBLIC OF UGANDA

DECEMBER 1997

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
NIPPON KOEI CO., LTD.

# PREFACE

In response to a request from the Government of the Republic of Uganda the Government of Japan decided to conduct a basic design study on the Project for Improvement of Agricultural Extension and Training Institutes in the Republic of Uganda and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Uganda a study team from July 14 to August 17, 1997.

The team held discussions with the officials concerned of the Government of Uganda, and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Uganda in order to discuss a draft basic design , and as this result, the present report was finalized.

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

I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Uganda for their close cooperation extended to the teams.

December, 1997

Kimio Fujita
President
Japan International Cooperation Agency

December, 1997

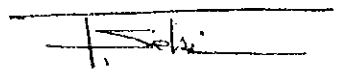
Letter of Transmittal

We are pleased to submit to you the basic design study report on the Project for Improvement of Agricultural Extension and Training Institutes in the Republic of Uganda.

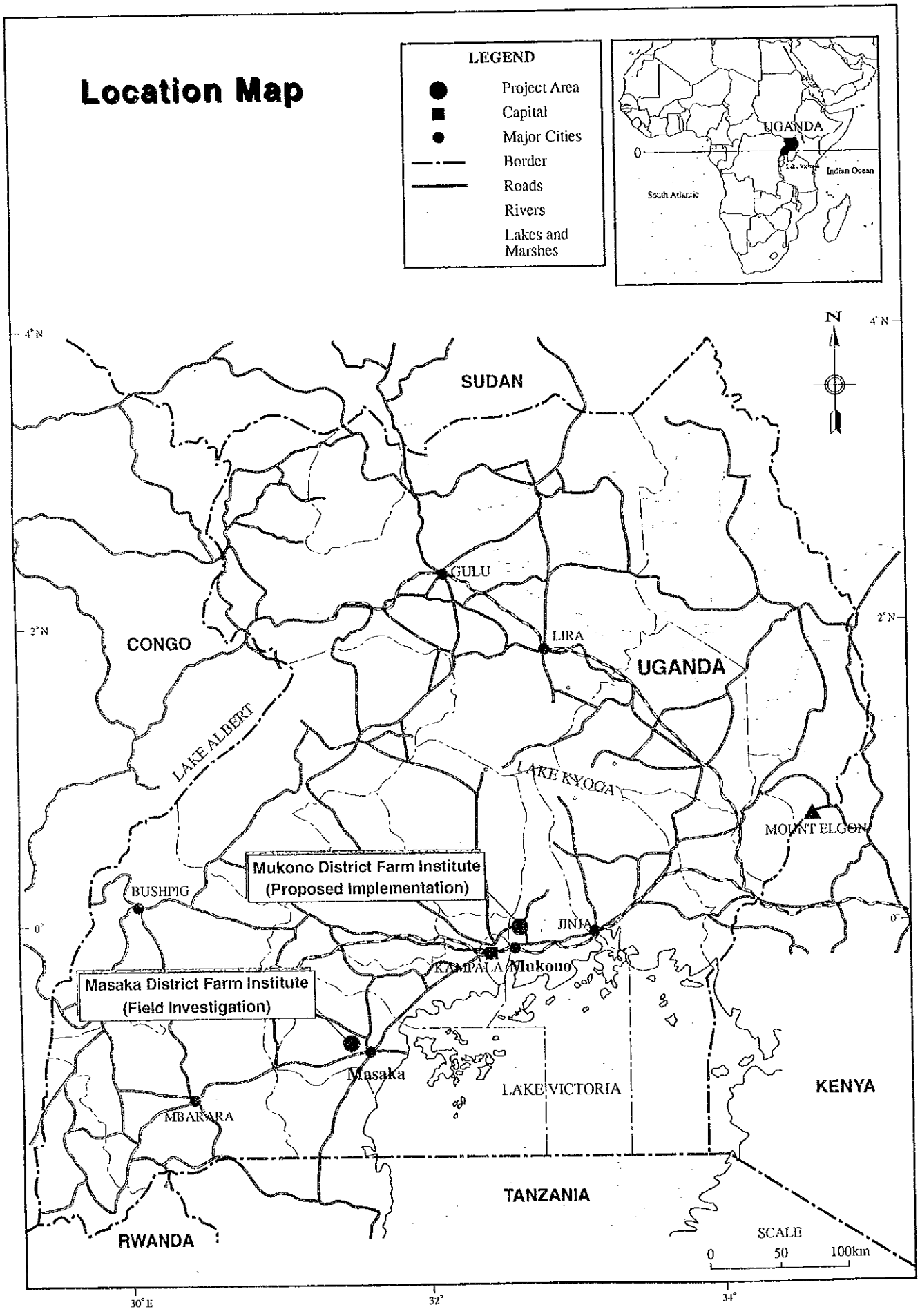
This study was conducted by Nippon Koei Co. Ltd., under a contract to JICA, during the period from July, 1997 to December, 1997. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Uganda and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

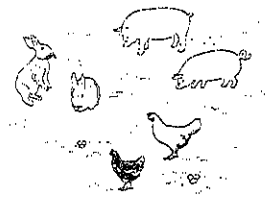
Finally, we hope that this report will contribute to further promotion of the project.

Very truly yours,



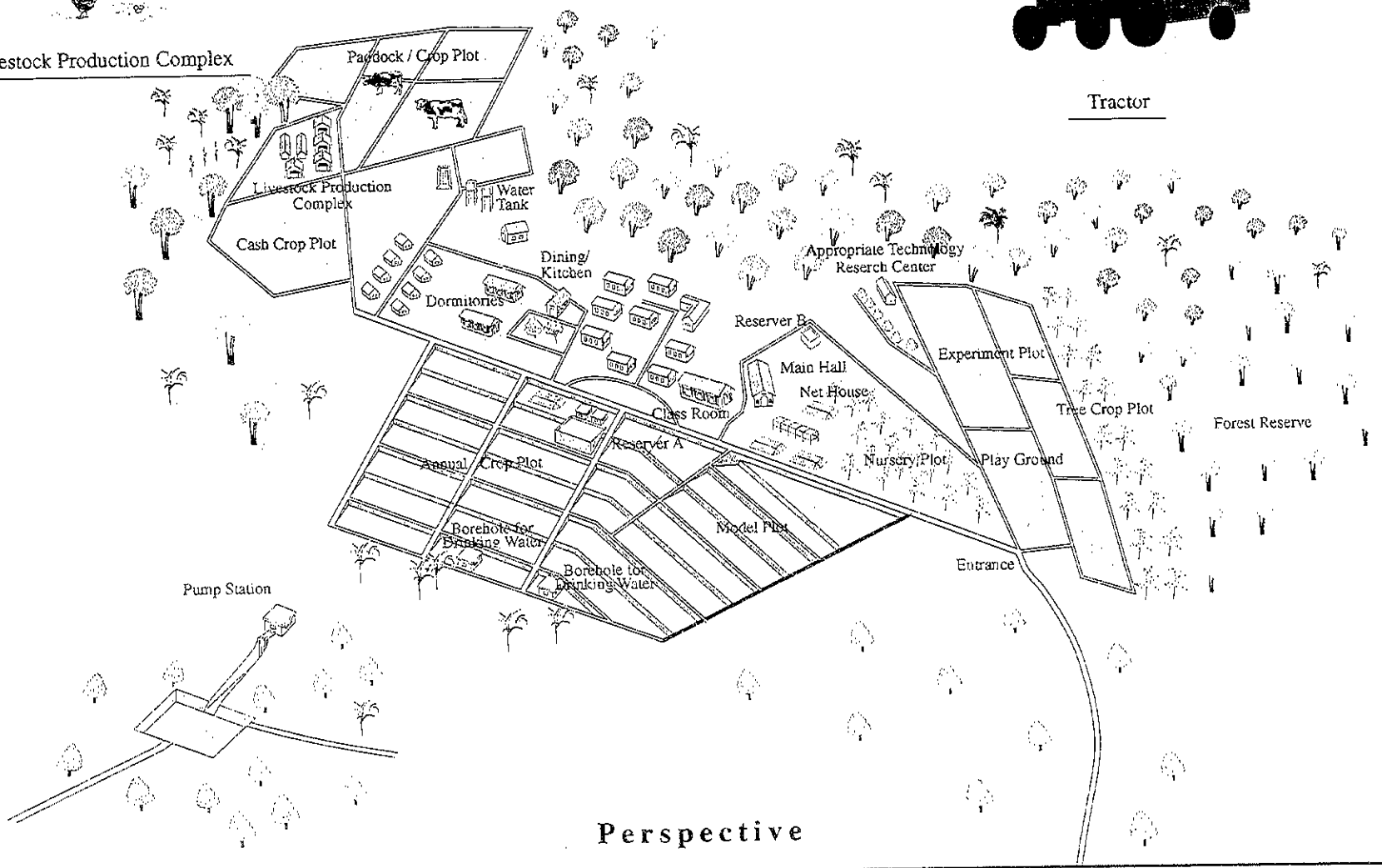
Takashi Seki
Project manager,
Basic design study team on
the Project for Improvement of
Agricultural Extension and
Training Institutes in the Republic
of Uganda
Nippon Koei Co., Ltd.


Location Map
LEGEND
Project Area
Capital
Major Cities
Border
Roads
Rivers
Lakes and Marshes
UGANDA
Indian Ocean
South Atlantic
N
4°N
SUDAN
GULU
2°N
CONGO
LIRA
UGANDA
LAKE ALBERT
LAKE KYOGA
MOUNT ELGON
Mukono District Farm Institute
(Proposed Implementation)
BUSHPIG
0°
JINJA
KAMPALA
Mukono
Masaka District Farm Institute
(Field Investigation)
Masaka
LAKE VICTORIA
KENYA
MBARARA
TANZANIA
RWANDA
SCALE
0 50 100km
30°E
32°
34°



Livestock Production Complex

Tractor




**Perspective**

# BASIC DESIGN STUDY
# ON
# THE PROJECT FOR IMPROVEMENT OF
# AGRICULTURAL EXTENSION AND TRAINING INSTITUTES
# IN
# THE REPUBLIC OF UGANDA

## TABLE OF CONTENTS


Preface
Letter of Transmittal
Location Map / Perspective
Abbreviations

Page

**CHAPTER 1 .BACKGROUND OF THE PROJECT** ..... 1- 1

**CHAPTER 2 .CONTENTS OF THE PROJECT** ..... 2- 1
2.1 Objectives of the Project ..... 2- 1
2.2 Basic Concept of the Project ..... 2- 1
2.2.1 Scope of the Project ..... 2- 1
2.2.2 Basic Concept for Agricultural Extension and Training Program ..... 2- 2
2.2.3 Basic Concept for Improvement of DFI's Facilities ..... 2-14
2.2.4 Basic Concept for Operation and Maintenance Plan ..... 2-21
2.2.5 Basic Concept for Technical Advice ..... 2-22
2.2.6 Basic Plan for the Project ..... 2-22
2.3 Basic Design ..... 2-24
2.3.1 Design Concept ..... 2-24
2.3.2 Basic Design ..... 2-26

**CHAPTER 3 .IMPLEMENTATION PLAN** ..... 3- 1
3.1 Implementation Plan ..... 3- 1
3.1.1 Implementation Conditions ..... 3- 1
3.1.2 Notes for the Construction ..... 3- 2
3.1.3 Scope of Works ..... 3- 3
3.1.4 Consultant Supervision ..... 3- 4

3.1.5 Procurement Plan ..... 3- 6
3.1.6 Implementation Plan for Technical Advice ..... 3- 6
3.1.7 Implementation Schedule ..... 3- 9
3.1.8 Obligation of Recipient Country ..... 3-11
3.2 Operation and Maintenance Plan ..... 3-12

**CHAPTER 4. PROJECT EVALUATION AND RECOMMENDATION** ..... 4- 1
4.1 Project Effect ..... 4- 1
4.2 Recommendation ..... 4- 2

## APPENDICES

Page

**1. MEMBER LIST OF SURVEY TEAM** ..... C- 1

**2. SURVEY ITINERARY** ..... C- 2

**3. LIST OF PARTY CONCERNED IN UGANDA** ..... C- 4

**4. MINUTES OF DISCUSSION** ..... C- 5

**5. ESTIMATED COST TO BE BORNE BY RECIPIENT COUNTRY** ..... C-24

**6. OTHER RELEVANT DATA** ..... C-25
6.1 Confirmed Project Implementation Organization ..... C-25
6.2 Confirmed Future Organization Plan for Mukono DFI ..... C-26
6.3 Our Application to Lease Part of Church Land for Water Provision ..... C-27
6.4 Application to Lease Part of Church Land for Water Provision to the District Farm Institute ..... C-28
6.5 Preliminary Plan for Improvement of Masaka DFI ..... C-29
6.6 Data Sheet for Corn Penetration Test ..... C-39
6.7 Result of Water Quality Analysis ..... C-41

**7. REFERENCES** ..... C-45

**8. BASIC DESIGN DRAWINGS** ..... C-46

# ABBREVIATIONS

| | |
|---|---|
| AEP | Agricultural Extension Project |
| D & MU | Drinking and Miscellaneous Use |
| DAE | Directorate of Agricultural Extension |
| DFI | District Farm Instisute |
| E/N | Exchange of Note |
| ERP | Economic Reconstruction Program |
| FAO | Food and Agricultural Organization of the United Nations |
| FEO | Field Extension Officer |
| GOJ | Government of Japan |
| GOU | Government of Uganda |
| IDA | International Development Association |
| JICA | Japan International Cooperation Agency |
| MAAIF | Ministry of Agriculture, Animal Industry and Fisheries |
| NAEP | National Agricultural Extension Plan |
| O & M | Operation and Maintenace |
| PBME | Project Benefit Monitoring and Evaluation |
| SMS | Subject Matter Specialist |
| T & V | Training and Visiting System |
| UEB | Uganda Electricity Board |
| UNDP | United Nations Development Program |
| UNFA | Uganda National Farmers Association |
| UPT | Uganda Posts and Telecommunications |
| WDD | Water Development Department |

# STANDARD ABBREVIATIONS

| | |
|---|---|
| $m^3$ | Cubic metre |
| $m^3$/sec | Cubic metre per second |
| d | Day |
| hr | Hour |
| °C | Degrees Celsius |
| El. | Elevation above mean sea-level |
| ha | Hectare |
| kg | Kilogram |
| km | Kilometre |
| lit | Litre |
| lit/min | Liter per minute |
| lit/sec | Litre per second |
| km | Kilometer |
| m | Metre |
| cm | Centimeter |
| mm | Millimetre |
| $km^2$ | Square kilometre |
| $m^2$ | Square metre |
| ton | Tonne |
| V | Volt |
| Hz | Hertz |
| v/Hz | Volt per hertz |
| $t/m^2$ | Tonne per square metre |
| kW | Kilowatt |
| kVA | Kilovolt-ampere |
| $m^3/h$ | Cubic metre per hour |
| GL | Ground level |
| $m^3/sec/km^2$ | Cubic metre per second per square kilometre |
| HWL | Hight water level |
| LWL | Low water level |

# *CHAPTER 1*
# *BACKGROUND OF THE PROJECT*

# CHAPTER 1 BACKGROUND OF THE PROJECT

Uganda is a landlocked country located between longitudes 4°38'N and 1°28'S, and latitudes 29°34'E and 35°02'E with a total territory of about 241,000 km². The national population is about 20.4 million in the year 1997, and its annual growth rate is 3.45% in the period from the year 1991 to date. People occupying about ninety percent of the national population live in the rural area, where about 3.41 million households are engaged in the agricultural activities. The total agricultural lands is about 8.46 million ha, and an average land held by a household is about 2.5 ha.

The agricultural sector achieved high performance during the 10 year period after the independence in the year 1962 owing to the increased production of food crops and cash crops such as coffee and cotton. The Uganda's economy grew with an annual rate of 4% in the period from 1965 to 1971 with a principal contribution of agricultural sector occupying about 50% of GDP, and partly with a support of industrial sector dependent on the food processing and cotton manufacturing. However, the national economy in the 1980's declined sharply due to the political turmoil continued over the 10 year period. Such social conditions resulted in deteriorating most social and economic infrastructure. Even under such situation, however, the agricultural sector could survive mainly by maintaining the good production of coffee, which occupied the 95% part of the total exports.

The Government of Uganda (GOU) set up the Economic Reconstruction Program (ERP) in the year 1981 with a support of IMF. Since the launching of the ERP, the national economy has been steadily improved, and the growth rate of GDP during the seven-year period from 1989 to 1996 gained 6.5% per annum on an average. While, the growth rate of the agricultural sector was kept as relatively low as 4.1%, ranging from 7.5% in cash crop production and to 3.9% in food crop production. Although the share of agricultural sector in GDP fell slightly from 55% in 1987 - 89 to 47% in 1994 - 96, agriculture still grips the mainstay of the Uganda's economy.

The GOU's goals in the agricultural sector are to diversify agricultural production for promoting the exports, while achieving food self-sufficiency. These are specifically: (1) increased production of food crops for ensuring national food security and sufficient level of nation's nutrition; (2) diversification of food and cash crops; (3) production of materials for promotion of domestic agro-industry; and (4) creation of increased employment opportunity.

Under such background mentioned above, the GOU requested the Government of Japan (GOJ) to undertake a master plan study on the integrated agricultural and rural development project in central Uganda, which has high potential for agricultural development and its demonstration. In response to this request, the GOJ conducted the master plan study, through Japan International Cooperation Agency (JICA), for the four Districts in the central region, namely Luwero, Masaka, Mpigi and Mukono Districts during the period from February 1993 to

August 1994. With the results of master plan study, the GOU requested the GOJ to extend a grant aid assistance for rehabilitation of existing two (2) District Farm Institutes (DFI) and construction of new two (2) DFIs together with supply of necessary equipment for these institutes.

The major items of the GOU's request are given below :

(1) Rehabilitation of Existing DFI

(a) DFI in Masaka

| | | | |
|---|---|---|---|
| i) | Buildings | : | buildings including fencing, water supply, telecommunication, power supply |
| ii) | Farm Improvement | : | facilities for animal husbandry and fishery, stores for agro-chemicals, others |
| iii) | Demonstration Farm for Paddy | : | approx. 3.0 ha |
| iv) | Access Road | : | approx. 10 km |
| v) | Equipment | : | equipment for transportation, office, training and extension, agrometeorological station, soil, others |

(b) DFI in Mukono

| | | | |
|---|---|---|---|
| i) | Buildings | : | all the buildings including water supply |
| ii) | Farm Improvement | : | Facilities for animal husbandry and fishery, stores for agro-chemicals, others |
| iii) | Demonstration Farm for Paddy | : | approx. 3.0 ha |
| iv) | Access Road | : | approx. 2 km |
| v) | Equipment | : | Equipment for transportation, office, training and extension, agrometeorological station, soil, others |

(2) Construction of New DFI in Mpigi and Luwero Districts

| | | | |
|---|---|---|---|
| i) | Buildings | : | required buildings including electrical installation, water supply, sewage system, soil water & surface water drainage, road, car park, others |
| ii) | Farm Improvement | : | Facilities for crop section and livestock unit |
| iii) | Demonstration Farm for Paddy | : | approx. 6.0 ha in total |
| iv) | Access Road | : | approx. 10 km in total |
| v) | Equipment | : | equipment for transportation, office, training and extension, agrometeorological station, soil, other |

In response to this request, the GOJ decided to conduct a basic design study during the period from July 1997 to December 1997. JICA sent a basic design study team (the Study Team) from 14th July to 17th August 1997. During the field investigation, the Study Team and the Ministry of Agriculture , Animal Industry and Fisheries (MAAIF) made a series of discussion on the confirmation of contents of the GOU's request and the scope of the works. As the result of the discussion the Mukono and Masaka DFI, excepting new DFIs in Mpigi and Luwero Districts, were selected for the field investigation in the Study. In the discussion MAAIF requested the Study Team to provide a technical advice team for effective operation and maintenance of the completed facilities.

After the field investigation in Uganda the Study Team analyzed the collected data and information in Japan. The scope of the project was judged to be the Mukono DFI and not to include the Masaka DFI from the analysis results, and the basic design for improvement of the Mukono DFI was prepared. Based on the study results and the design, the draft basic design report was prepared in Japan.

JICA dispatched a mission to explain the draft basic design report to the GOU during the period between October 15 and October 26, 1997. A basic agreement was signed and exchanged after the contents of the draft basic report were verified and agreed upon by both parties.

The major features of the project components decided through the basic design study are as follows:

## Features of the Project

| Description | Quantity |
|---|---|
| **1. Building facilities** | |
| 1.1 New construction (main hall, class room, dormitory and kitchen and dining) | 5 units |
| 1.2 Renovation (administration building and dormitory) | 2 units |
| **2. Farm facilities** | |
| 2.1 Net shade units and cattle sheds | 9 units |
| 2.2 Others (storage house and drying yard) | 2 units |
| **3. Water supply facilities** | |
| 3.1 Potable water supply facilities | 1 unit |
| 3.2 Water supply facilities for miscellaneous use | 1 unit |
| **4. Farm development** | |
| 4.1 Land preparation | 4.7 ha |
| 4.2 Terracing works | 5.1 ha |
| 4.3 Farm roads (main and feeder roads) | 7.2 km |
| 4.4 Regulating ponds | 2 units |
| 4.5 Irrigation facilities | 1 unit |
| **5. Supply of equipment and goods** | |
| 5.1 Goods for main hall and class rooms | L.S. |
| 5.2 Training equipment | L.S. |
| 5.3 Laboratory instruments | L.S |
| 5.4 Agricultural machinery, etc. | L.S. |
| **6. Technical advice** | L.S. |
| (Period) | (15.5 months) |

# *CHAPTER 2*
# *CONTENTS OF THE PROJECT*

# CHAPTER 2 CONTENTS OF THE PROJECT

## 2.1 Objectives of the Project

In the year 1996, the Government of Uganda (GOU) set up a national program titled "Medium - Term Plan for Modernization of Agriculture (1996/97 - 2000/01)" (the Modernization Plan), in which five specific targets were raised: (i) improvement of mutual linkage among research, extension and farmers; (ii) development of marketing infrastructure; (iii) promotion of zone-based agricultural production; (iv) improvement of access to credit services in rural areas; and (v) promotion of agro-based rural enterprises. The Modernization Plan was designed with a total investment cost of Ush 321.7 billion, of which the largest amount at a rate of 38% was allocated to the agricultural research and extension program, focusing mainly on application of research outputs to the on-farm activities. Under the Modernization Plan, the Agricultural Extension and Training Institutes were anticipated to play an important role in extending the adaptable technique over the farmers. In fact, the district agricultural extension and training institutes, so-called District Farm Institutes (DFIs), have been undertaking the demonstration of agricultural research performance and the training program on farming techniques and practices.

The Project for Improvement of Agricultural Extension and Training Institutes (the Project) is to improve the facilities and extension and training systems of the Mukono DFI, which is located in the central Uganda having high potential for agricultural development. The Project aims at restructuring the agricultural extension and training systems, promoting diversification of crop production and improving agricultural productivity, and ultimately enhancing the economic situation of farmers in the Mukono District by means of the improvement of facilities of Mukono DFI together with the provision of necessary equipment and machinery.

## 2.2 Basic Concept of the Project

### 2.2.1 Scope of the Project

The GOU's initial request for grant aid scheme to the Government of Japan (GOJ) was to provide the improvement of two existing DFIs and the establishment of new DFIs in two Districts. Through a series of discussions between the GOU and the GOJ, however, both the parties agreed to omit the schemes for establishment of two DFIs in Mpigi and Luwero Districts from the request in due consideration of the GOU's budgetary constraints and insufficient managerial capacity enough to operate and maintain new DFIs at present. Hence, the JICA Study was focused on the improvement of two existing DFIs in Mukono and Masaka Districts. As a result of the basic design study, the improvement project of the Masaka DFI was excluded from the scope of the Project to be implemented under the GOJ's grant aid scheme for a reason of difficulty in expecting drastic activation of the DFI.

A process is envisaged for improvement of Agricultural Extension and Training Institutes in Uganda in such a manner that the Mukono DFI, having fairly favorable conditions in activities and financial management, will be improved first as a model project, and secondly its result will be extended over the improvements of the rest DFIs. Therefore, the scope of the Project is to be concentrated on the implementation of the Mukono DFI's improvement.

### 2.2.2 Basic Concept for Agricultural Extension and Training Program

Training and Visiting (T&V) System as an agricultural extension method applied in Uganda at present has limited effect as there is insufficient number of field extension officers and difficulty in recruiting new ones due to the GOU's restructuring policy. The extension effect through the T&V system has not been quantitatively assessed in such terms as the increase in agricultural productivity and farmers' income. Institutionalisation of farmers' training system for improvement of farming practices at farm level and direct contribution to the farmers' livelihood as well as establishment of proper monitoring system on training and extension services are keen issues at present.

The Mukono DFI produces and sells seedlings of coffee and fruit trees to manage a part of expenditures for operation and maintenance of the facilities, while training and agricultural production activities are restricted due to deterioration of the facilities and underdeveloped production field.

Under the above conditions, the following concept is applied for improvement of the Mukono DFI :

1) Due to the difficulty in increasing extension officers, framers' training will be institutionalized in the Mukono DFI and key farmers will be trained. By the tie-up between the extension officers and the trained key farmers, new agricultural techniques will be extended to farmers in the vicinity of the key farmers. Through this flow, crop diversification and crop productivity increase will be promoted in the Mukono District. Monitoring and evaluation of the DFI activities will be carried out to assess the effect of extension at farm level.

2) In addition to the training related activities, the agricultural production and sales, which have been carried out on a small-scale, will be expanded. The benefit obtained through these training and production activities will be allotted to a part of the operation and maintenance cost of the Mukono DFI.

3) Since the training buildings and farm facilities constructed in early 1960s have been superannuated and the existing farm is not well equipped for training and farming in the Mukono DFI, the present training environment will be modernized by improvement of buildings, the farm and their facilities and procurement of necessary equipment for training.

Based on the above concept, the following steps have been planned for re-activation of the DFI and establishment of farmers' training programs :

a) Increase in agricultural and non-agricultural training demand and its revenue through improvement and upgrading of training facilities;

b) Increase in agricultural production and its revenue through farm development and improvement of managerial capacity on commercial production and marketing;

c) Allocation of additional revenue from utilisation of training facilities and commercial production to expenditure of farmers' training programs and formulation of appropriate farmers' training programs;

d) Transfer from ordinary public budgeting to partial self-accounting system in Mukono DFI and establishment of highly transparent financial management system;

e) Training in Mukono DFI;

- Training for Extension Staff: Restrict to the regular extension training in proposed financial plan to secure the financial viability in the event of training budget reduction in the future;

- Farmers' Training: Gradual expansion of the numbers of trainees up to targets in five years after the completion of the project;

- Non-agricultural training: Accept the request of other organisations only when agricultural training is not affected; and

f) Establishment of appropriate accounting procedures on self-accounting system, and improvement of management and production technologies.

The existing training and extension activities in Mukono DFI will continue along the existing line of programs. They include: training for extension staff with over thirty (30) years of history; extension activities for surrounding areas of the DFI; and non-agricultural training expected by the district (sanitation, literacy, family planning, accounting, AIDS prevention, teacher training, etc.) In addition to the aforementioned concept (1), practical farmers' training will be introduced. Therefore, the new Mukono DFI training and extension activities comprise: (a) Farmers' training; (b) Training for extension staff; (c) Non-agricultural training; and (d) Other extension activities.

As for farmers' training, according to interviews with extension staffs and farmers, two kinds of preferences have been revealed. Heads of farm households and their wives prefer short-term or one-day visiting training as they cannot leave the house vacant for a long period of time. On the other hand, the rural youth hope to acquire new skills through long and medium-term training. Based on the above needs, the following farmers' training programs are formulated: (i) Long and medium-term training for the rural youth, aiming at nurturing the future leaders; (ii) Short-term training for rural farmers including women to improve the existing farming practices, and (iii) One-day visiting training. (Ref. Table 2.2.1)

As mentioned in the above steps f) through h), the number of trainees are envisaged as follows. Non-agricultural training is carried out only when there is excess capacity since the priority is given to agricultural training including MAAIF and District Agriculture Office (DAO) related training.

Trainees in DFI

| Item | Agriculture | | | Non-agriculture | Total |
|---|---|---|---|---|---|
| | Extension Staff | Farmers | sub-total | | |
| 1994-96 Average | 7,030 | no | 7,030 | 8,060 | 15,090 |
| 1 year after Works | 2,610 | 3,440 | 6,050 | 5,400 | 11,450 |
| 2 years after Works | 2,610 | 4,210 | 6,820 | 5,400 | 12,220 |
| 3 years after Works | 2,610 | 4,980 | 7,590 | 5,400 | 12,990 |
| 4 years after Works | 2,610 | 5,750 | 8,360 | 5,400 | 13,760 |
| 5 years after Works | 2,610 | 6,520 | 9,130 | 5,400 | 14,530 |

c.f. Farmer trainees, including both i) long and medium-term, and ii) short-term, will be doubled in 5 years.

(1) Farmers' Training

DAO identifies agricultural products with high potential based on the conditions in each county and determines required technical items for the extension activities(see Table 2.2.2). According to these technical items, training subjects will be prepared by the DFI. The identified major products are divided into crops and livestock; they include vegetables, fruits (passion fruits, pineapples, etc.), and dairy, piggery and poultry in addition to traditional coffee and banana. As for the traditional cash crop - coffee, dissemination of new varieties is emphasized. Farmer trainees shall have both aptitude and willingness to promote: (a) extension of improved farming technologies; (b) formation of farmer group; and (c) marketing activities in his group. Taking the land holding distortion into account where small farmers holding less than two (2) ha occupy around 75% of the total farm households, large and economically advanced farmers are not considered as trainees of the project.

The number of trainees for each training program will be decided as below:

One-day visiting training program mainly comprises lectures and field observation. For effective lectures, the maximum number of participants is said to be forty (40) in general. As the age variance is expected among trainees, one batch will be limited to around 30 farmers. Frequency will be once a month and annually some 360 farmers will receive the training.

Long and medium-term training program, aiming at improving the knowledge and skills of the young farmers, comprises group training and field practices. Since closer attention may be necessary for each trainee, the number is limited to twenty (20) per course. As the joint follow-up training is planned, trainees for crop and livestock courses will be forty (40) per annum respectively.

Short-term training program is designed for motivated heads of farm households and rural women who are willing to improve farm management. The short-term training program will focus on common subjects and trainees will be limited to around ten (10) per course. The joint follow-up is also expected for this program and annual trainees for crop and livestock courses will be 40 persons each.

The contents of farmers' training programs are summarised as follows:

a. Long and medium-term training for rural youth

Long and medium-term training program, aiming at the rural youth who will be heads of farm households, comprises two kinds of courses, i.e., a crop course and a livestock course. The crop courses, mainly for vegetables, cereals and fruits, will run for three months in total in a given year while the livestock courses covering dairy, piggery and poultry run for two months. The crop course will not be scheduled during peak cultivation and planting periods in the rainy seasons. The longest training session in a course will be two weeks. After the first two-week training session, the farmer trainees will return to their villages for two weeks and come back to the second session of the program for another two weeks. This training pattern has the merit of reflecting results of trial practices at farmers' own fields to the next training session for technology verification and solution of local constraints.

The training program emphasizes the field application and practices, covering the items listed below:

| | |
|---|---|
| i) Briefing: | Introduction of the DFI's facilities and activities; identification of farming constraints at respective trainees' villages; grouping according to the identified constraints; group-wise preparation of training subjects; |
| ii) Lecture: | Agricultural production in general; training subjects identified above; evaluation of training, etc.; |
| iii) Field training: | On-the-job training using the DFI's facilities; and |
| iv) Field practices: | Under the group-wise theme including commercial production and marketing activities. |

Annually Mukono DFI will run two (2) long and medium-term courses for each crop and livestock training. In the first year, the number of trainees will be limited to 10 per course and 40 in total. The final target number of the above four courses will be 20 per course and 80 persons in total which will be achieved in the following four years by an increase of 10 persons per year (see Table 2.2.1).

According to interviews with the extension staff and an interview survey of farmers, the two week absence from home will pose no problem for the rural youth. It was also concurred that trainee recruitment will face little difficulty if new skills can be acquired by implementing the above.

b. Short-term training for rural farmers including women

Many heads of farm households and rural women hope to increase their farm income through introduction of new crops, diversification with poultry, etc., and are eager to receive training on these subjects. As they cannot stay away from home too long, a short-term training program is designed. DFI will also run two kinds of short courses: one for crop and the other for livestock. Two six-day sessions will be organised in a course except peak cultivation and planting periods in the rainy seasons. The training period will be 12 days for each course. The training covers identification of farming constraints and preparation of training subjects on the first day, and practices using the DFI's facilities on rest of the days.

Annually Mukono DFI will run eight short courses in total, four each for crop and livestock. In the first year, the number of trainees will be limited to 5 per course and 40 in total. The final target number will be 10 per course and 80 persons in total which will be achieved in the following four years (see Table 2.2.1). The extension staff also reassures that little problem is envisaged in implementing these short courses.

c. One-day visiting training

Although there is much demand by farmers for training as mentioned above, the number of trainees for long and medium term as well as short courses is limited. The farmers' training program itself is a new activity for DFI. In respond to the amounting requests for training and observation, one-day visiting training program is organized. This also provides an opportunity for farmers to obtain highly demanded improved seed and seedlings grown in the DFI.

One-day visiting training is implemented under the specific aim such as: (i) observation of specific farming technologies; (ii) introductory course for potential trainees for the above long and medium-term and short-term training programs; and (iii) procurement of improved seed and seedlings grown in the DFI. One-day visiting training program will be monthly organised and trainees are recruited by the county extension co-ordinator and field extension officers at county and village levels through information dissemination. One batch of trainees will be around 30 farmers.

(2) Training for Extension Staff

Mukono DFI has been long regarded as the training site for the staff related to agricultural extension in the district. Since the DFI's establishment, the training programs for the district extension staff have lasted for over 30 years . Therefore their continuation based on the existing programs is planned.

The training will comprise residential training for two and six days, and one-day workshop training. Based on the classification of past training programs, the following programs are to be implemented :

- Training for Subject Matter Specialists (SMSs) and County Extension Co-ordinator (6 days, 20 persons per course), 4 sessions per year;
- Training for Field Extension Officers (FEOs) (2 days, 70 persons per course), 2 sessions per year;
- Training for Livestock SMSs (six days, 20 persons per session), 2 sessions per year;
- Seminar or Workshop organized by Research Institute and others (six days, 30 persons per session), two sessions per year; and
- One-day Workshop Meeting (70 persons per session), 11 sessions for Mukono DFI (one session substituted by two days training for FEOs).

The training program for extension staff covers not only technical subjects but also management improvement at farmers' level in order to uplift farmers' livelihood.

(3) Non-Agricultural Training

Mukono DFI has been utilised as the training site for both agricultural and non-agricultural (sanitation, literacy, family planning, accounting, AIDS prevention, etc.) purposes for its proximity to the capital. In view of such background, the DFI will continue to be used for non-agricultural training purposes.

Non-agricultural training has been implemented using the DFI's facilities by the request of other organisations. As such, advanced planning is virtually impossible. Therefore, the estimate is made based on the past performance of the non-agricultural training programs, residential training and one-day training programs covering around 40 persons each will be allocated. This program will not interfere with agricultural training as mentioned in the above.

The aforementioned three training programs can be summarised as below:

Outline of Training at Mukono DFI

| Training | Trainee | Execution | Content |
|---|---|---|---|
| (1) Farmers' Training: | | | |
| Long and medium-term | rural youth | DFI and DAO | crop or livestock (2 weeks per session) |
| Short-term | heads of farm households, rural women | DFI and DAO | crop or livestock (2 weeks per session) |
| One-day visiting | farmers | DFI and DAO | one day training with particular topic |
| (2) Extension Staff Training | national and district extension staff | GOU, DAO, DFI | staff training and meetings |
| (3) Non-Agricultural Training | district residence and others | other organizations | training on topics other than agriculture |

(4) Other Extension Activities

The farmer respondents for the interview survey carried out by the Study Team answered that expected services of the DFI aside from farmers' training were soil test, distribution of improved seeds and seedlings, etc. Consultation on crop damage due to insects and diseases was also mentioned. No government organisation, however, has carried out these services to farmers. Accordingly, the Mukono DFI will introduce testing services to farmers by using introduced simple soil test equipment and microscopes in order to improve support services to farmers. An information room will be established for the purposes of: (a) preparing public information paper and training materials; (b) storage for books and documents; and (c) exhibition of DFI's training and extension activities.

(5) Plan for Training Facilities

Based on the final target of training program as shown in Table 2.2.1, the following training facilities and their capacities will be required :

a) Dormitory — Number of weeks having more than 60 residential trainees will be 20 or more in a year, around 40% of the total number of weeks in a year (50) except the new year's and year-end weeks. By the facilitation of dormitory with the capacity of 60 persons, the annual utilisation ratio will be more than 60% in the first year after the completion of the project and exceed 70% after 5 years. Thus the required capacity of dormitory will be 60 persons.

b) Classrooms — The execution of agricultural and non-agricultural programs would often overlap, hence at least two classrooms are

required. The capacity of classroom required for farmers' training, training for extension staff and non-agricultural training will be around 10 - 30 persons, 20 - 70 persons and 40 persons, respectively. For the execution of these training programs, two classrooms with a capacity of 40 person each (80 persons in total) will be planned. The annual utilisation ratio of the two classrooms will be 77% in the first year and around 80% after 5 years.

c) Main Hall — In addition to one-day workshop training for district extension staff and training for field extension officers (around 80 persons covering 70 district extension staff and 10 others such as lecturers and the DFI staff ), one-day farmers' visiting training (30 persons) and one-day non-agricultural training program (20 - 60 persons), the overlapped program execution with other farmers' training, training for extension staff and non-agricultural training will be anticipated. The main hall will be used as a classroom as well as for a large scale meeting. The capacity of the main hall will be 80 persons, same as the capacity of the existing main hall based on the required capacity of training for extension staff (80 persons) and farmer trainees' joint meeting (80 persons).

d) Dining and Kitchen — The capacity will be 60 persons, same as dormitory's residential capacity.

(6) Plan for Training Farm Utilisation

In Mukono district, diversification program in agricultural product aiming at the increase in farmers' income has been promoted. To this end, crop diversification through expansion of vegetables, cereals, fruits, etc. in addition to traditional coffee, livestock diversification and extension of improved technologies are urgent issues. For the promotion of crop diversification, distribution of improved seed and seedling is needed. For the introduction of animal husbandry, chicks, piglets and calves are indispensable. In addition, strengthening of agricultural support services including extension of proper farming practices and other marketing development such as joint-sales to be done by extension farmers' group will be vital.

Training farm in Mukono DFI will be improved to meet the above needs to promote the diversification. In addition to the on-going function such as demonstration, the farm will have twofold functions for practical training for farmers as well as for revenue

generation to supplement operation and maintenance cost of DFI facilities and farmers' training expenditure. Farm production comprises: (1) crop sector of cash crops, cereals, vegetables, fruits, and seed and seedlings; (2) livestock sector of poultry (broiler and layer), pigs, dairy cows, oxen and rabbits; and (3) multiple production between crop and livestock sectors through maize and pasture production. Improvement and production plans of the training farm are as follows :

i) Improvement of Training Farm

Present land use of the training farm comprises: forest and fallow land; existing farm land; and area for DFI facilities. Existing dense forest (5.9 ha), although small in size, can be regarded as resources to be protected and should be excluded from the improvement plan. As for remaining areas, the maximum use based on the topography and present land use will be exploited for agricultural production, demonstration, experiment and DFI facilities and farm productivity will be increased. Farm land development will be made in the area of 16.5 ha consisting of the existing farm land (11.8 ha) and the expandable fallow land (4.7 ha, presently covered with bush etc.). Other areas are: training and residential buildings (3.5 ha); animal sheds and seed/seedlings facilities (2.7 ha); forest, roads and others (12.7 ha).

Planned annual crop land (5.1 ha) is located at low-lying area and suitable for supply of irrigation water. The annual crop land will be irrigated for vegetable production in lean season and maize production for feed. The existing animal sheds are located on the slopes above the swamp which is in the southwest of the training and residential building. The valley wind along the swamp brings odor to classrooms etc. and the DFI staffs requested the relocation of these facilities to minimize their influence. Therefore, the fallow land in the north will be developed as paddock, pasture and fodder crop area (3.8 ha) and livestock center for livestock farm facilities (0.7 ha) through land reclamation works by bush-opening and land smoothening. The other fallow land in the south (0.9 ha) will be developed as fruit farm. Model farm (0.8 ha, two blocks) will be prepared for exhibition of appropriate land use, crop diversification and farming practices at farm level.

Demonstration activities at the existing farm faces difficulties due to virtually non-existent farm road network. Transport of farm inputs and harvest done by man-power is one of the constraints hampering the increase in crop productivity . Farm road development at the training farm will be a precondition for effective demonstration and productivity increase.

Land use plan in Mukono DFI is summarised as follows :

Proposed Land Use

| Land Item | Net Area (ha) | Proposed Use | Present Land Use |
|---|---|---|---|
| (1) Office, Classroom, Residential | 3.5 | buildings for training and residence | Existing facility area |
| (2) Farm Land | 16.5 | | |
| Annual crop | 5.1 | vegetable, fodder, etc. | Existing plot in front of the office, pasture |
| Experiment | 2.3 | experimental crop | Existing experimental plot (south) etc. |
| Fodder, paddock | 3.8 | paddock, fodder | Fallow land (north) |
| Cash crop (coffee, cocoa) | 3.6 | coffee, cocoa, etc. | Existing farm |
| Fruit | 0.9 | fruit | Fallow land (south) |
| Model farm | 0.8 | farm level exhibition | Existing plot in front of the office |
| (3) Farm Facility | 2.7 | | |
| Livestock | 0.7 | sheds, warehouse | Fallow land (north) |
| Nursery | 2.0 | fruits, vegetables, coffee, etc. | Existing plot |
| (4) Preserved Forest | 5.9 | forest | Forest, Fallow land(north) |
| (5) Others | 6.8 | appropriate technology center, road, etc. | Forest land, others |
| Total | 35.4 | - | - |

ii) Agricultural Production

Farm production comprises: (1) crop sector of cash crops, cereals, vegetables, fruits, and seed/seedlings; (2) livestock sector of poultry (broiler and layer), pigs, dairy cows, and rabbits; and (3) multiple production between crop and livestock sectors through fodder production. Following the aforementioned recommendation of DAO and taking Mukono DFI's records and requests into account, initial production crops will be as follows. In the future, new varieties and other crops will be explored based on the market trend, results of tests on experimental plots, among others.

Production Crops

| Items for Production and Sales | Name of Crop |
|---|---|
| cash crop | coffee etc. |
| vegetables | tomato, cabbage, onion, other local crops, etc. |
| fruits | passion fruit |
| cereal and others | maize, peas, etc. |
| seed/seedling: fruits | mango, citrus, avocado, passion fruit, etc. |
| -do- cash crops (new variety) | coffee, cocoa, etc. |
| -do- vegetables | tomato, cabbage, onion, etc. (for internal use initially) |

Cash crops, i.e. coffee and cocoa, will be converted from traditional to new varieties at cash crop plots (3.6 ha). Of 5.1 ha of annual crop area, vegetable using two (2) ha will be produced twice a year in lean seasons through production of forcing seedling under net shade, transplanting and growing under irrigation. Fruits such as passion fruits will be produced in the new fruit farm. Model farm (0.8 ha) will have a wide variety of crops such as vegetables, peas and maize for exhibition. To meet maize feed requirement (around 43 tons), maize will be produced twice a year at 5.7 ha covering annual crop area (3.1 ha), fodder area (1.9 ha) and experiment area (0.7 ha).

One unit of standard net shade (net area of 300 $m^2$) will be introduced for production of vegetable seedling. In order to promote crop diversification and meet farmers' demand, fruit seedling production will be enlarged by adding two (2) units of net shade to one existing unit. For diversification of coffee and cocoa from prevailing varieties to high yielding ones, one unit of net shade will be newly added to the existing facilities (around 800 $m^2$). The net shade of respective crops is summarised as follows :

Net Shade Area for Nursery

(Unit : net area $m^2$)

| Seedling | Existing | | New | | Total | | Purpose |
|---|---|---|---|---|---|---|---|
| Coffee/Cocoa | 800 | (4) | 300 | (1) | 1,100 | (5) | production 100,000/year |
| Fruit | 300 | (1) | 600 | (2) | 900 | (3) | 30,000/year |
| Vegetable | - | | 300 | (1) | 300 | (1) | for vegetable plots (2 ha) |
| Total | 1,100 | (5) | 1,200 | (4) | 2,300 | (9) | - |

No. of units in brackets ( ).

Following the aforementioned recommendation of the DAO and taking Mukono DFI's records and requests into account, the livestock sector of Mukono DFI will comprise: cows for milk production; GOU-recommended oxen for farming; piggery; poultry for layer and broiler; and rabbits for sales and nutrition supplements. Strengthening the livestock sector will contribute to promote diversification of farm production, thereby improving small farmers' income and livelihood.

The present number of four (4) sows and two (2) cows will be increased to eight (8) and six (6), respectively. Annually six cows will produce six calves, each of which could be distribute to one farmer trainee for each livestock course (two long and medium-term courses and four short-term courses). Eight (8) sows will produce annually around 160 piglets which could be distributed to 80 farmer trainees in the livestock course with one pair per farmer. Two oxen will be introduced for demonstration and extension of cultivation using draft animal power. Facilities for poultry and rabbit will be newly established to contribute in improving the farm livelihood, especially for rural women. Breeding stocks of broiler and layer (100 each), and two units of hatcheries (each with 500 holding capacity) will be

introduced for production of 500 broilers and 500 layers. The surplus chicks will be distributed to farmer trainees. Rabbit production will be scaled at around 210 in number (annual number of farmer trainees 520 persons x 2 chicks / 5 cycles = 208 chicks).

To meet the above mentioned production targets, farm facility improvement requires: four units of net shade for seedling (two for fruits, one each for vegetables and coffee/cocoa); cow shed; ox shed; piggery; poultry houses (one each for broiler and layer), storage houses for cereals and farm inputs, and drying yard.

In Mukono DFI, the production targets for crop and livestock in the first year after the completion of construction works and those of final targets which will be achieved in the following four years are summarised as follows :

Outline of Agricultural Production Plan in Mukono DFI

| Item | First Year | | | Final Target / Fifth Year onward | | |
|---|---|---|---|---|---|---|
| | Planted Area/ Initial Stock | Production | | Planted Area/ Initial Stock | Production | |
| Crop Sector | | | | | | |
| 1. Nursery | ($m^2$) | (piece) | | ($m^2$) | (piece) | |
| Fruit Tree | 900 | 18,000 | | 900 | 30,000 | |
| Coffee | 1,100 | 70,000 | | 1,100 | 100,000 | |
| 2. Crop | (ha) | (ton) | | (ha) | (ton) | |
| Maize | 11.4 | 30 | | 11.4 | 43 | |
| Soybean | 0.5 | 0.6 | | 0.5 | 0.9 | |
| Vegetables | 4.0 | 25 | | 4.0 | 42 | |
| Coffee | 0.8 | 0.7 | | 0.8 | 2.0 | |
| Passion Fruit | 0.3 | 1.8 | | 0.3 | 4.5 | |
| Livestock Sector | | | | | | |
| Layer | 500 | 75,000 | eggs | 500 | 126,000 | eggs |
| Broiler | 500 | 1,400 | birds | 500 | 2,300 | birds |
| Dairy | 6 cows | 12,800 | lit. | 6 cows | 21,400 | lit. |
| | | 4 | calves | | 6 | calves |
| Piggery | 8 sows /1 boar | 90 | piglets | 8 sows /1 boar | 140 | piglets |
| Rabbit | 5 does/1 buck | 100 | rabbits | 5 does/1 buck | 160 | rabbits |

(Ref. Table 2.2.3)

Prior to the completion of construction of farm facilities, Mukono DFI will have formulated the operation plan for farm management. At completion, it will start procurement of breeder stock and farm inputs. Then, maize production at the annual crop area under irrigation condition (3.1 ha) and seedling production of vegetables, fruits and coffee using the net shade will start. From the rainy season, maize (1.9 ha) and Napier (1.0 ha) production at the fodder area, maize production (0.7 ha) at the experiment area, and transplanting of vegetable seedling at the annual crop area will be begun. Before harvesting of maize for major feed ingredients, animal feed will be purchased. Maize harvested will be utilised for self-production of animal feed. In the next rainy season, the second cropping will be begun at the respective area for annual crop, fodder and experiment.

### 2.2.3 Basic Concept for Improvement of DFIs' Facilities

In accordance with the above mentioned agricultural extension program and agricultural production plan, a plan on the improvement of the Mukono DFI's facilities is formulated. The GOU's request for grant aid scheme with regard to the facilities improvement is divided into the five categories: (i) building facilities; (ii) farm facilities; (iii) water and electric supply facilities; (iv) farm development; (v) provision of training equipment and agricultural machinery. The respective items of improvement works for the Mukono DFI are screened for the project implementation on the basis of results of field investigation by the Study Team and discussions with the GOU as well, and also taking into account the anticipated DFI's managerial capacity after the improvement project be made. The details of these improvement works for the Mukono DFI are mentioned below.

(1) Building Facilities

According to the proposed extension and training program mentioned in Sub-section 2.2.2, the required DFI's buildings with the respective capacities are as follows:

| | | | |
|---|---|---|---|
| Main hall | : | 80 persons | |
| Class room | : | 80 persons | (40 persons x 2 classrooms) |
| Dormitory | : | 60 persons | |
| Dining and kitchen | : | 60 persons | |

The GOU's request includes the construction and rehabilitation of seven buildings for main hall, class rooms, dining and kitchen and dormitories. Based on the results of inventory survey of the existing building facilities and the above required building capacity, the basic design study of improvement works are made as described below.

(i) Main Hall

The existing Hall building, aged more than 37 years and showing a potentially structural failure, will be demolished due to heavy deterioration and unsafe condition, and a new Main Hall with a capacity of 80 persons will be built for training, lectures, meetings, etc. on the same spot.

(ii) Classrooms

Based on the future plans for training, 2 classrooms will be newly built as existing one aged more than 37 years will not be able to be used long time even after partly renovation. Laboratories for seed inspection and soil test with material stores will be attached to the new classroom building. Existing classrooms will be utilised temporarily as store rooms for seed.

(iii) Dormitory

Based on the planned training period and courses and present conditions of the existing dormitories, 2 dormitory buildings with a capacity of 20 persons each will

be newly built. Guest rooms for lecturers will be attached to the each building. Among the four existing dormitories, one building which is less deteriorated than the others will be renovated. The remaining two superannuated dormitories will be utilised temporarily as store rooms for equipment and materials for training and lodging.

(iv) Dining and Kitchen

A dining room which has a capacity of 60 persons and a kitchen will be newly built next to the new dormitories as existing aged one is deteriorated heavily. Existing dining room will be utilised temporarily for rest of DFI workers.

(v) Administration Building

The existing administration building will be renovated and existing classroom will be modified for the information room having functions of library and a printing room.

As the results of the above study, the following improvement works are planned, consisting of construction of five new buildings and rehabilitation of two existing ones.

Improvement of Building Facilities

| Improvement Category | Building | Capacity | Nos. |
|---|---|---|---|
| New construction | Main hall | 80 persons | 1 |
| | Class room (2 rooms with laboratory) | 80 persons | 1 |
| | Dormitory | 40 persons | 2 |
| | Dining and kitchen | 60 persons | 1 |
| Renovation | Administration building | - | 1 |
| | Dormitory | 20 persons | 1 |

After the completion of the Project, the existing buildings will be utilised as temporarily facilities as follows: (Ref. Fig.2.3.1)

Utilization of Existing Building Facilities

| Existing Buildings | Future Use after the Project |
|---|---|
| Dormitory (a) | Partly used as a temporary store house |
| Dormitory (b) | - do - |
| Dormitory (c)* | All rehabilitated and used as a dormitory, "New Dormitory (3)" |
| Dormitory (d) | Partly used as a temporary store house |
| Dining room | Partly used as a resting room for workers |
| Administration Build.* | All rehabilitated and used as office/information room |
| Classroom | Used as a store house |
| Hall | Destroyed and a new hall will be constructed at the same place. |
| Kitchen | Destroyed |

c.f. * to be improved by the Project.

(2) Farm Facilities

According to the proposed basic concept for Agricultural Extension and Training Program mentioned in Sub-section 2.2.2, the required nursery area and basic capacity of livestock facilities are as follows:

| | | |
|---|---|---|
| Nursery production (fruits, coffee, vegetables) | : | 2,300 $m^2$ in net |
| Milk cow and draft ox | : | 8 heads |
| Pig | : | 9 heads |
| Poultry (egg production) | : | 500 persons |
| Broiler | : | 500 heads |
| Poultry (breeder) | : | 200 persons |
| Rabbit | : | 210 heads |

The GOU's request is composed of net shade units for nursery, livestock sheds for cows, pigs, poultry and rabbits, stores for fertilizers and pesticides, agricultural production store and dry yard. Based on the agricultural production plans, the basic design study of improvement works are made as described below.

(i) Net shade unit

There are five units of the existing net shade house, having a total area of 1,100 $m^2$, and these units will be utilized as the part of farm facilities. Therefore, new net shade units with a total area of 1,200 $m^2$ will be additionally constructed. Adopting a ordinary type of net shade unit of 300 $m^2$ prevailed in Uganda, four units of net shade house will be constructed newly.

(ii) Livestock sheds

The existing livestock sheds for cows, pigs and poultry are deteriorated and these sheds will be shifted to the western portion of the DFI's premises from the present places which will be converted to the annual crop farm according to the agricultural production plans. Therefore, the sheds for the respective livestock are newly constructed.

(iii) Storage

No storage house is available in the Mukono DFI. As the storage is indispensable for the purposes of storing agricultural products, fertilizers and pesticides, and also for grading and packaging of crops (vegetables), a storage house is newly constructed. The storing requirements are based on the quantities of agricultural products in the respective crop seasons as tabulated below.

Agricultural Production for Storage

(unit; ton)

| Crop | First crop | Second crop |
|---|---|---|
| Maize | 21.7 | 21.7 |
| Soy bean | 0.9 | 0.0 |
| Total | 22.6 | 21.7 |

Keeping a space for corridor and working plot at a rate of 40%, the required storage area is designed at 60 $m^2$ in total as shown below.

Agricultural Production and Storage Area

| Description | Quantity |
|---|---|
| Maximum storing volume (ton) | |
| Grain | 11.8 |
| Ear | 10.9 |
| Total | 22.7 |
| Required storing area ($m^2$) | |
| Grain | 15 |
| Ear | 45 |
| Total | 60 |

Adding the areas of storing spaces for fertilizers, pesticides, grading and packaging of crops (vegetables), feed mixing, the required area of storage house is designed at 160 $m^2$ in total as shown below.

Storing Spaces

| Description | Area ($m^2$) |
|---|---|
| Grain store | 60 |
| Fertilizer and pesticide store | 25 |
| Vegetable selection and shipping | 35 |
| Administration | 20 |
| Feed mixing | 20 |
| Total | 160 |

(iv) Drying yard

The existing drying yard is utilized for drying farm outputs, and its area is as small as 64 $m^2$. An additional drying yard will be newly constructed for drying maize. Its required area is designed at 130 $m^2$ enough to process all the annual products of maize in the Mukono DFI.

As the results of the above study, the construction of the following farm facilities are planned.

Improvement of Farm Facilities

| Improvement Category | Building | Capacity | Nos. |
|---|---|---|---|
| New construction | Net shade unit | 1,200 $m^2$ | 4 |
| | Cow-shed | 8 heads | 1 |
| | Pig-shed | 9 heads | 1 |
| | Poultry-shed (egg production) | 500 heads | 1 |
| | Poultry-shed (broiler/breeder) | 500/210 heads | 1 |
| | Rabbit-shed | 210 heads | 1 |
| | Storage | 160 $m^2$ | 1 |
| | Dry yard | 130 $m^2$ | 1 |

(3) Water and Electricity Supply Facilities

(i) Drinking water

The drinking water is taken from the natural swamp near the site by a co-using pump station, and delivered to the DFI's premises including agricultural farms for irrigation purpose through an overhead water tank. Its quantity is estimated at 27.2 $m^3$ a day (Ref. Table 2.2.4). However, quality of the swamp water is contaminated, and in fact the laboratory test conducted during the field investigation has revealed its inadequacy for drinking. In addition, pumps related to the water supply are aged and require heavy repair and maintenance.

In view of health control of DFI's staff and trainees, therefore, the water source will be changed from the said swamp to the groundwater which is prevailed in the vicinity area. A new overhead water tank will be provided because the existing one, being deteriorated with heavy leakage, will last no longer. Based on the expected number of increased DFI's staff and trainees in the future, the required quantity of drinking water supply is calculated at 6.9 $m^3$ per day (Ref. Table 2.2.4).

(ii) Water for livestock, etc.

A part of irrigation water taken from the neighboring swamp as a new water source will be shared to the water for the livestock and miscellaneous use in the DFI's premises. The water is taken from a regulating pond for irrigation purpose, and supplied to the DFI's facilities and livestock sheds through an overhead tank to be constructed newly. Based on the agricultural production plans, the required quantity of water supply for livestock, etc. is estimated at 20.3 $m^3$ per day (Ref. Table 2.2.4).

(iii) Electric supply

The present power supply is provided by Uganda Electricity Board (UEB), using 11 kV overhead wire lines. Power is received in the existing dining building after reducing tension with pole mounted transformers. Three phase power reaches up to the site boundary only and all power after entering the site is single phase.

The Project will require three phase power for the water pumps. An additional line will be provided to upgrade to three phase power receiving. The transformer will be also exchanged due to increased power requirements. The receiving will at the site of the present transformer on the pole. The power will be distributed by overhead and underground cables to the various training facilities and to the pumps. The electric systems are three phase with 380V/50Hz and single phase with 220V/50Hz.

The GOU will improve existing power line from single to three phase between the existing transmission line outside of DFI and the site of present transformer by the GOU's own cost.

(4) Farm Development

The farms in the Mukono DFI, extended on the gently sloped hills, is poorly developed for functioning as the demonstration and training farm. There are also many potentially farming areas which are uncultivated and left as bush lands at present. These farming blocks including those unused will be consolidated and developed for the purpose of training and demonstration farms and the agricultural production as well, together with construction of farm roads. Two types of farm development works are proposed: one is terracing works for the exiting farming blocks in which irrigation system will be facilitated; and the other is land reclamation works for the unused field blocks by bush-opening and land smoothening. The farming blocks to be developed by both the works are proposed to be 5.1 ha and 4.7 ha in net, respectively.

The existing farm roads will also be rehabilitated and extended in conjunction with the above farm development works. The farm roads will have two types, i.e. main and feeder roads and the both are paved by mallam (laterite materials) for ensuring farm operation in the rainy season. The roads to be improved are four main roads with a total length of 1,518 m and 28 feeder roads of 5,675 m in total length. The width of main and feeder roads are 5.0 m and 3.0 m, and with effective width (paved) of 3.0 m and 2.0 m, respectively. The drainage ditches are provided along the farm roads.

No irrigation is presently practiced in the DFI except for the existing net shade houses for tree nursery. To realize the effective extension and training of irrigated agricultural techniques and profitable agricultural production, the introduction of irrigated farming is indispensable. For this, an irrigation system will be constructed in the farming blocks developed by the terracing works with an area of 5.1 ha, according to the agricultural production plan. The irrigation water will be lifted by pumps from the said existing pond, and distributed to the farms through two regulating ponds newly constructed under the Project. In addition, the rain water will also be utilized for irrigation by trapping through the drainage ditches along farm roads and conveying to a regulating pond, intending to save the operation cost of the irrigation intake pump.

Expecting high irrigation efficiency, the piped irrigation networks will be facilitated in such a manner to supply water by manually handled hose tapped from the buried water pipes.

(5) Provision of training equipment and agricultural machinery

The GOU's request is divided into five categories: (i) tables, chairs, etc. for main hall, (ii) tables, chairs, etc. for classrooms; (iii) training equipment; (iv) laboratory instruments; and (v) agricultural machinery. Based on the results of inventory survey of existing equipment held by the Mukono DFI including the present conditions for maintenance and repair, the items of equipment to be supplied are selected together with those technical specifications. The basic design study of provision of training equipment and agricultural machinery are made as described below.

(i) Goods for main hall

Four types of goods items with 38 number in total will be provided for the newly constructed main hall, including tables, benches, and teaching board, which are required for lectures to trainees, etc.

(ii) Goods for class rooms

Two types of goods items with 84 number in total will be provided for the class rooms, including chairs with desk and teaching board, which are required for lectures to trainees, etc.

(iii) Training equipment

Five types of training equipment items with 5 number in total will be provided, including typewriter, computer with printer, video deck, video monitor and loudspeaker set, which are required for supporting the classroom lectures.

(iv) Laboratory instrument

Five types of training equipment items with 5 number in total will be provided for laboratory, including soil testing instruments, salinity tester, microscope and water distiller, which are required for field soil tests on fertility.

(v) Agricultural machinery, etc.

a) Agricultural machinery

Six types of agricultural machinery with 8 units in total will be provided, including tractor, plough, harrow, trailer, ox-plough and ox-cart.

b) Climatological instruments

Four types of climatological instruments with 6 units in total will be provided, including wet and dry thermometer, maximum and minimum thermometer, rain gauge and instruments shelter, which are required for recording the basic agro-climate data.

c) Others

Four types of transportation and other equipment with 6 units in total will be provided, including pick-up for transporting agricultural inputs and outputs, motorcycle for extension activities, soil mixer for nursery beds and hatchery unit for training and commercial production of poultry.

### 2.2.4 Basic Concept for Operation and Maintenance Plan

The present administration of the Mukono DFI will be responsible for provision of maintained training facilities and equipment to be improved by the Project to existing agricultural extension system. The Directorate of Extension of MAAIF and the District Agricultural Office as well will continue technical advice and financial support to the DFI. To realize efficient operation of farmers training services and increased agricultural production, the present organization of the Mukono DFI will be partly reformed and strengthened. Newly three key staffs will be increased and 15 key staffs in total will manage the DFI activities in the new organization.

The expenditures required for the DFI's management are the costs for salary and allowance of office staff and workers, maintenance of premises facilities and equipment, extension and training services, agricultural production, operation of demonstration farms, etc. Two fund resources will be secured for improved management of DFI; one is the budget allocated by MAAIF, and the other the DFI's own revenue benefited from the training using DFI's premises and DFI's own agricultural production.

The former fund will cover staff salary and operation and maintenance costs of premises. While, the latter will be utilized for farmers training services in principle. This specialized financial management method as a government agency will need to introduce a special accounting system, namely partial "Self-accounting System". In the accounting system to be introduced, the DFI will be allowed to decide to use the income gained from the DFI activities such as farm production and training but will not be allowed to change the items and their amount in the budget allocated by MAAIF.

There are, however, few office staff who are familiar with commercialized farm management in the Mukono DFI, and no accumulation of such technical and managerial know-how. Therefore, technical advice program by experts will be required and therefore formulated in this Project.

### 2.2.5 Basic Concept for Technical Advice

The Mukono DFI is considered to have the following constraints to the successful farm management under the self-accounting system:

(i) Defective accounting system,
(ii) Shortage of experience in financial management, and
(iii) Lack of demonstration, extension and training programs on the farm management.

In the light of the above mentioned constraints and in response to the GOU's request, the Project for Mukono DFI will cover not only the improvement of DFI's facilities but also technical advice on the farm management, financial management and extension and training services to farmers. This technical advice aims ultimately to strengthen the DFI's capability to ensure the adequate maintenance of facilities and operation of extension and training services.

In addition, agriculture and farm economic survey will be carried out for targeting farmers to be trained by the DFI to monitor and evaluate the results of extension and training programs, and the results of survey will be reflected on the Mukono DFI management for further improvement.

The technical advice will cover specifically four scopes of the farm operation with financial management, farmers' training, crop (vegetable) production and livestock (poultry) production. The period of technical advice is set at 15.5 months in total, consisting of preparatory works for management of farm and farmers' training (3.5 months) and subsequent operation advice (12 months) after the completion of farm facilities.

### 2.2.6 Basic Plan for the Project

The basic development plan for the Mukono DFI, which is formulated based on the concepts for the respective plans mentioned above, is to improve and construct the building facilities, farm facilities and farming fields together with provision of training equipment and agricultural machinery. The project features are given below :

Features of the Project

| Description | Total Requirement | Quantity |
|---|---|---|
| **1. Building facilities** | | |
| 1.1 New construction | | |
| Main hall | 80 persons | 1 unit |
| Class room | 80 persons | 1 unit |
| Dormitory | 40 persons (20x2) | 2 units |
| Kitchen and dining | 60 persons | 1 unit |
| 1.2 Renovation | | |
| Admin. house | | 1 unit |
| Dormitory | 20 persons | 1 unit |
| **2. Farm facilities** | | |
| Net shade unit | 1,200 $m^2$ (300x4) | 4 units |
| Cow shed | 8 heads | 1 unit |
| Piggery | 9 heads | 1 unit |
| Poultry shed (egg production) | 500 birds | 1 unit |
| Poultry shed (broiler/breeder) | 500/200 birds | 1 unit |
| rabbit shed | 210 heads | 1 unit |
| Storage house | 160 $m^2$ | 1 unit |
| Drying yard | 130 $m^2$ | 1 unit |
| **3. Water and electric supply facilities** | | |
| Drinking water | 6.9 $m^3$/day | 1 unit |
| Water for livestock, etc. | 20.3 $m^3$/day | 1 unit |
| Electricity | 3 phases/single phase | 1 unit |
| **4. Farm development** | | |
| Land preparation | 4.7 ha | 1 unit |
| Terracing works | 5.1 ha | 1 unit |
| Farm roads | | |
| Main road | 5 m wide | 1,520 m |
| Feeder road | 3 m wide | 5,700 m |
| Regulating pond | - | 2 units |
| Irrigation facilities | 5.1 ha | 1 unit |
| **5. Supply of equipment and goods** | 4 items (bench, table, etc.) | 38 pcs. |
| Goods for main hall | 2 items (desk, board) | 84 pcs. |
| Goods for class rooms | 5 items (typewriter, computer, etc.) | 5 pcs. |
| Training equipment | 5 items (soil tester, etc.) | 5 pcs. |
| Laboratory instruments | 14 items (tractor, motorcycle, etc.) | 20 pcs. |
| Agricultural machinery, etc. | | |
| **6. Technical advice** | | |
| Period | 15.5 months | - |
| Scope of advice | 4 scopes (Farm management and financial operation, farmers training, vegetable production and livestock production) | - |

## 2.3 Basic Design

### 2.3.1 Design Concept

(1) Design Concept for the Natural Conditions

(i) Building and farm facilities

The penetration tests were carried out at the proposed sites for new buildings in the premises of the Mukono DFI to sound the bearing capacity of soil foundation. The results of penetration tests revealed that the N - value at the building foundation level of 1 to 2 m deep below the ground surface ranged from 5 to 10 and the bearing capacity of more than 5 ton/$m^2$ can be expected for the building foundation. It is judged that no special foundation treatment will be needed for proposed one-story buildings, therefore, a normal type of foundation like a direct foundation method will be adopted in the design by reducing load to less than 5 ton/$m^2$.

(ii) Terracing works

Most farms in the Mukono DFI have land slopes ranging from 5% to 7%. Taking into account the higher irrigation efficiency, soil conservation, and efficient and safe use of agricultural machinery, the farm lands reformed by terracing works is designed to have a land slope of 3%.

Despite the top soils in the DFI farm is generally fertile for agriculture, the soil layer available for crop production is relatively shallow as thin as 20 cm to 30 cm, and soil in the lower layer is composed of laterite having poor fertility is low. In executing the terracing works, therefore, a method called "Top Soil Treatment" will be adopted in such a manner that the fertile top soil once excavated is piled in the stockyard and again dressed on the reformed land surface.

(iii) Drainage

The efficiency of surface drainage in the premises of Mukono DFI will be highly improved by the construction and improvement of water harvesting facilities, farm development and farm roads, and this may result in intensive flood flush into the neighboring premises of which land elevation is lower than that of DFI. To prevent such intensive flush by heavy rain, drainage water will be intercepted by drainage ditches along the farm roads and led to the existing natural swamp. On the other hand, many drainage outlets towards the neighboring premises are provided scatteredly in the places where no such intensive flush would take place.

(2) Design Concept for the Social Conditions

The Project will promote the raising of poultry and rabbit productions which can be handled by rural women without difficulty. This activity will result in upgrading the social status of rural women and also improving the nutritive conditions in the rural areas. Chicks and rabbit bred in the DFI will be delivered with charge to women who participate in the training programs. For this purpose, the simple poultry and rabbit sheds will be constructed as the models enough to be maintained by them.

A simple lobby is designed for the newly constructed dormitory, so that trainees coming from outside will be able to enjoy together and exchange views and opinions.

(3) Smooth Procedure for Tax Exemption

The Uganda's tax regulation is to impose taxes and duties at a total rate of about 34.5% on the cost of imported goods and materials and half of transportation cost to be incorporated into any development project even under the grant aid program. The GOJ's grant aid scheme does not include the costs for tax and duties levied by the recipient country, therefore the recipient country has to make a budgetary arrangement for fulfilling the domestic tax regulations. For smooth implementation of the Project, the GOU is expected to take timely actions for tax exemption procedures, and besides the implementation schedule of the Project will be prepared in due consideration of time requirements for clearing such procedures.

(4) Maximum Usage of Local Contractor and Available Materials in Uganda

The facilities shall be designed using the construction materials available in Uganda such as cement, steel bar, aluminum sash gate, etc., and taking into consideration the application of local contractors within technically allowable extent to activate the societies of the local contractors and the construction materials suppliers. As to the procurement of equipment and goods for the agricultural extension and training, the same manner as those for construction materials will be adopted. In addition, Ugandan consultants will be recruited for executing the technical advice to the Mukono DFI, intending to maximize the effects of technical advice and to maintain smooth communication between the DFI's staff and trainees and the foreign experts through them.

(5) Organizational Strengthening of Executing Agencies

The Mukono DFI has three vacancy posts of key staff. In order to implement the Project, the present organization of DFI will be strengthened in such a manner of re-formation of organization and increase of office staff. In this context, the Directorate of Extension of MAAIF confirmed to strengthen the present organization together with

necessary financial arrangement. The MAAIF will also be required to start farmers' training by introduction of partial self-accounting for farm output of the Mukono DFI and to allocate a fund for initial farm operation, so called "seed money" for farm output .

(6) Design Concept for Grade of Facilities and Construction Materials

The materials and equipment for construction and renovation of the DFI facilities and for extension and training equipment will be procured from the domestic dealers in Uganda, which will be able to provide the post-maintenance services, within an allowable quality range. Besides, "maintenance-free" construction materials will be selected as much as possible for saving future maintenance expenditure by the DFI.

(7) Design Concept for Construction Schedule

The implementation of the Project requires 27-month period after the first exchange of note (E/N) between the GOJ and the GOU, taking into account the workable days in a year, the required work volume, time required for tax exemption procedures, technical advice program, and coincidence with the financial system of the GOJ.

Construction Schedule

| | 1st Year | 2nd Year | 3rd Year | 4th Year |
|---|---|---|---|---|
| Construction | | | | |
| Technical Advice | | | | |

## 2.3.2 Basic Design

(1) Improvement Plan of Training Facilities

(i) Design Concept

The design concept given below has been followed during the preparation of the basic design.

a) Special conditions of the proposed site such as climate, life style, architectural style, etc., are fully considered and incorporated into the design.

b) Natural ventilation and natural lighting are utilised in the basic design to reduce maintenance and operation costs.

c) With consideration of the construction capabilities and local conditions, the facilities are designed from view-points of construction ease and cost.

d) Local construction materials will be prioritized to facilitate maintenance work.

e) The facilities are designed to harmonize with existing buildings and surroundings without applying special designs.

On the basis of the above concept, basic design of the proposed building has been prepared and the detail is given in Table 2.3.1.

(ii) Layout Planing

The existing main buildings are located in the comparatively flat area at the center of the site. Training facilities such as classrooms and hall, and accommodation facilities such as dormitories and dining room, are located in the south-eastern part and the north-western part, respectively, of the existing building complex.

The new buildings' locations are arranged to harmonize with the existing block composition and not to cross the movement lines in training facility zone and accommodation facility zone. The location of each facility are as follows; (Ref. Figure 2.3.1)

- The existing hall will be demolished and a new main hall will be built at the same place.
- New Classrooms will be built south-east of the existing classrooms.
- New Dormitories will be built north-west of the existing dormitories.
- New Dining/Kitchen will be built next to the new dormitories.

(iii) Floor Plan

Determination of the required space of the facilities will be as follows, based on training activities, required staff, number of trainees, etc. (Ref. Table 2.3.1)

a) Main Hall

| | | |
|---|---|---|
| - Hall | 80 persons x 1.0 $m^2$/person | = 80.0 $m^2$ |
| - Stage | 8 m x 4.5 m | = 36.0 $m^2$ |
| - Staff Room | 2 persons x 6 $m^2$/person | = 12.0 $m^2$ |

b) Classroom

| | | |
|---|---|---|
| - Classroom | 40 persons x 1.2 $m^2$/person | = 48.0 $m^2$ |
| - Staff Room | 2 persons x 6 $m^2$/person | = 12.0 $m^2$ |
| - Laboratory | | = 28.0 $m^2$ |

c) Dormitory (New construction)

| | | |
|---|---|---|
| - Bedroom | 2 persons x 8.0 $m^2$/person | =16.0 $m^2$ |
| - Meeting Space | 4m x 4m | =16.0 $m^2$ |
| - Guest Room | 6.5m x 3m | =19.5 $m^2$ |

d) Dormitory (Existing building)

| | | |
|---|---|---|
| - Bedroom | 3.5m x 3.95m | =13.8 $m^2$ |

e) Dining/Kitchen

| | | |
|---|---|---|
| - Dining Room | 60 persons x 1.2 $m^2$/person | =72.0 $m^2$ |
| - Kitchen | 9m x 3m | =27.0 $m^2$ |
| | (Dining Room Area x 30% ) | |
| - Servery | 5m x 4m + 2m x 2m | =24.0 $m^2$ |
| - Shop | 2m x 2m | = 4.0 $m^2$ |

f) Office/Administration Build. (Existing building)

| | | |
|---|---|---|
| - Office | 7m x 6.4m | =44.8$m^2$ |
| - Information Room | 8.5m x 6.4m | =54.4$m^2$ |
| (Modification of existing classroom) | | |

(iv) Elevation and Section Design

The facade and section of architectural facilities will be designed on the following guidelines.

a) Columns, girders and floor slab are made of reinforced concrete exterior fill-in walls and interior walls are made of brick masonry.

b) Roofs have structural wood trusses and finished externally with locally available profiled steel sheets.

c) There is no mechanical air conditioning at present. The buildings are designed for natural ventilation. Ventilation louvers, etc. will be provided above openings in walls.

d) Based on the Uganda Building Regulations, ceiling height is more than 2.5m for sitting rooms and more than 3.0 m for classrooms.

e) Openings in walls are designed for adopt by natural light effectively.

(v) Finishing Design

Exterior and interior finishing are based on cost, general use in public buildings in Uganda and ease and economy of maintenance. The common finishing method shown below is the basis for most buildings.

| | | |
|---|---|---|
| Exterior finish: | Roof; | Profiled galvanized steel sheet |
| | Wall; | Paint finish on cement mortal, |
| Interior finish | Floor; | Cement mortar |
| | Wall; | Paint finish on cement mortal |
| | Ceiling; | Paint finish on gypsum board, |

(vi) Structural Design

a) Foundation Design

Based on the soil investigation, the bearing capacity of the soil is sufficient. The foundations of all new construction are continuous reinforced concrete footing. For economy, ground floor slabs are slab on grade, but upper 20-30 cm of topsoil will be removed and replaced with good bearing soil.

Allowable ground bearing capacity is assumed to be 7.0 t/m$^2$ for the layer at GL-1.0 to 1.5m.

b) Earthquake Loading

Based on the Ugandan regulations, the following base seismic coefficient (C) will be used in the structural design for the Project.

- Rigid frame reinforced concrete structure: C = 0.026
- Flexible frame structure and load bearing block wall structure: C = 0.036

c) Wind Loads

Based on the Ugandan regulations, wind velocity of 40m/sec will be adopted for wind load calculations.

(vii) Building Facilities Design

a) Electrical Facilities

The power supply will be taken from a reception panel replacing an existing transformer on a power line. The electric power will be distributed to each facility by underground cables.

- Power characteristics: Single phase 220V, 50 Hz
- Lighting: Taking into consideration of low-voltage, lighting will use incandescent lamps.
- outlets: Outlets will be provided as required.

b) Water Supply System

Water from boreholes which will be provided by the Project will be pumped up to the high reservoir tank in the site. From this point, water will be distributed to required places for drinking water. Water from the intake in the swamp also to be provided by the Project will be pumped up to the high reservoir tank in the site. From this point, water will be distributed to required places for domestic use except drinking.

- Distribution points of drinking water: Wash basins in dormitories, kitchen, outdoor taps
- Distribution points of water for domestic use (except drinking water): Toilets, showers, washing rooms

c) Hot Water Supply System

Electrical hot water supply system will be provided for showers in existing and new dormitories and new kitchen.

d) Waste Water Discharge System

Waste water and soil water discharged from each facility will be received by septic tanks built in the site where it will be treated. The treated water will be discharged into seepage tanks and allowed to seep the ground. The proposed well

sites are located more than 200 m away from the location of the seepage tanks. Accordingly, no environmental impact to health is thought by the seepage tanks.

e) Rain Water Discharge System

Buildings will be provided with splash aprons which will route the rain water discharged into a gutter around each building. The gutters will connect to the existing drainage system.

f) Air Conditioning and Ventilation System

Air conditioning and mechanical ventilation system will not be installed in any building. The Main Hall and classrooms will be provided with ceiling fans.

g) Lightning Protection System

Lightning protection system will be provided for all buildings under the scope of the Project, based on reference drawings of the Ugandan regulations.

h) Fire Protection System

Fire extinguishers will be provided for all buildings under the scope of the Project, based on the Ugandan regulations.

(viii) Rehabilitation Plan of Existing Buildings

Rehabilitation plan of existing buildings will be as follows;

a) Dormitory

- Replacement of roof sheets,
- Replacement of ceiling,
- Repair of steel doors and windows,
- Replacement of wooden doors,
- Repainting,
- Replacement of plumbing system,
- Rewiring and replacement of lighting fixture and outlets,
- Replacement of splash apron
- Replacement of water heater

b) Administration Building

- Replacement of roof sheets,
- Replacement of ceiling,
- Repair of steel doors and windows,
- Replacement of wooden doors,
- Repainting,
- Rewiring and replacement of lighting fixture and outlets,
- Replacement of splash apron

(2) Improvement Plan of Farm Facilities

Based on the farm management plan, the following facilities will be newly built in the improvement plan of farm facilities. Because of deterioration of existing facilities and the modification of farm land use, the area for new livestock facilities in Mukono DFI will be transferred to the western part of the site. The farm facilities will be designed based on general use in farm facilities in Uganda. Minimum facility equipment for operation and maintenance will be provided to each facility. (Ref. Table 2.3.2)

(i) Net Shade

4 units of Net Shades for nursery for fruit, vegetable and coffee will be newly built.

| | |
|---|---|
| Floor area: | 310 m2 each ( Net production area : 300m2, Passage : 10m2) |
| Structure: | Wooden frame |
| Facility: | 2 units for fruit, 1 unit for vegetable, 1 unit for coffee |
| Equipment: | Water supply |

(ii) Dairy Unit

Dairy Unit for 6 cows and 2 oxen will be newly built.

| | |
|---|---|
| Floor area: | 96.6 $m^2$ |
| Structure: | Wooden truss roof, Brick masonry wall |
| Finishing: | Roof; Corrugated cement sheet, Wall; Cement mortar |
| Facility: | Cubicles, Milking place, Calf pen, Ox shed, Office, Toilet, Storage |
| Equipment: | Lighting, Receptacle, Plumbing, Manure pit |

(iii) Piggery Unit

Piggery Unit for 8 sows and 1 boar will be newly built.

| | |
|---|---|
| Floor area: | 104.7 $m^2$ |
| Structure: | Wooden truss roof, Brick masonry wall |
| Finishing: | Roof; Corrugated asbestos-cement sheet, Wall; Cement mortar |
| Facility: | Sow pen, Boar pen, Poker and Baconer pen<br>Farrowing pen, Storage, Passage |
| Equipment: | Plumbing |

(iv) Poultry Unit

Poultry Unit for 500 layers, 500 broilers and 200 breeders will be newly built. Incubator room and generator shed will be attached to the poultry unit.

Layer Unit

| | |
|---|---|
| Floor area: | 125 $m^2$ |
| Structure: | Wooden truss roof, Brick masonry wall |
| Finishing: | Roof; Corrugated asbestos-cement sheet, Wall; Cement mortar |
| Facility: | Layer unit (deep litter, 2 $ft^2$/layer x 500 layers : 90$m^2$,<br>Work area : 10$m^2$), Pullet unit (deep litter), Egg store |
| Equipment: | Lighting, Plumbing |

Broiler and Breeder Unit

| | |
|---|---|
| Floor area: | 143.5 $m^2$ |
| Structure: | Wooden truss roof, Brick masonry wall |
| Finishing: | Roof; Corrugated asbestos-cement sheet,<br>Wall; Cement mortar |
| Facility: | Broiler unit (deep litter, 1 $ft^2$/layer x 500 layers : 90$m^2$,<br>Work area : 5$m^2$), Breeder unit (deep litter),<br>Incubator room, Storage |
| Equipment: | Lighting, Plumbing |

Generator Shade

| | |
|---|---|
| Floor area: | 3 $m^2$ |
| Structure: | Wooden truss roof, Brick masonry wall |
| Finishing: | Roof; Corrugated asbestos-cement sheet,<br>Wall; Cement mortar |
| Equipment: | Lighting, Receptacle |

(v) Rabbit House

Rabbit House for production of 210 rabbits per year will be newly built.

| | |
|---|---|
| Floor area: | 30 $m^2$ |
| Structure: | Wooden truss roof, Brick masonry wall |
| Finishing: | Roof; Corrugated asbestos-cement sheet,<br>Wall; Cement mortar |

(vi) Store

Store rooms for maize for feed and other purchased formula feed, grading and packing space for crops (vegetable), fertilizer and insecticide storage will be newly built. Administrative office and work space for preparation of animal feed will also be provided.

| | |
|---|---|
| Floor area: | 175 $m^2$ |
| Structure: | Wooden truss roof, Brick masonry wall |
| Finishing: | Roof; Corrugated asbestos-cement sheet,<br>Wall; Cement mortar |
| Facility: | Vegetable storage, Fertilizer/insecticide, storage, Office,<br>Selection space, Work space |
| Equipment: | Lighting, Receptacle |

(vii) Sun-Drying Floor

In order to dry fodder crops such as maize, etc. a sun-drying floor will be constructed newly.

| | |
|---|---|
| Floor area: | 130 $m^2$ |
| Structure: | Concrete floor |

(3) Improvement Plan for Water Supply Facility

(i) Water Supply Plan for Drinking and Miscellaneous Use (D&MU)

a) Design Conditions

Planned supply volume of D&MU water

Demand estimation for D&MU water and the planned supply volume after project implementation for Mukono DFI are calculated in Table 2.2.3.

The results are summarized below;

Planned Water Supply Volume

unit : liter/day

| Present D & MU water supply volume | Planned D & MU water supply volume | | |
|---|---|---|---|
| | Drinking water | MU water | Total |
| 22,780 | 6,850 | 20,330 | 27,180 |

Extractable Volume of Ground Water

The source for drinking water supply at Mukono DFI will be converted from the present swamp water to water from borehole. The supply volume capacity of the ground water at Mukono DFI are expected to be 0.59 $m^3/h$ (0.16 lit./sec.) on average from available measurement data. Exploratory drilling results of "the Master Plan Study on the Integrated Agricultural and Rural Development Project in Central Uganda" by JICA noted that welling depth occurs at 24 to 36m below ground level and pumped volume is 1.3 to 1.5 $m^3/h$. From these two data, the extractable water volume at Mukono area is concluded to be 0.59$m^3/h$ ( = 0.16 lit./sec.)

b) Basic Design

Borehole

Boreholes will be provided for drinking water use at Mukono DFI. From the planned water supply volume, extractable water volume described above and assuming pump operation time to be 6 hours per day, 2 boreholes will be provided. {6,850 lit./(0.16 lit. x 6 hours x 3,600 sec.) = 1.98 nos.}. From boring experience in the surrounding area and considering the terrain of Mukono DFI including swamp, the design dimension of the boreholes at Mukono area set out as summarized below;

- Depth : 50 m
- Diameter of Borehole : 250 mm
- Diameter of Casing & Screen : 150 m
- Length of Casing : 30 m
- Length of Screen : 20 m

Submersible Pump and Water Main

From the pumping volume, ground water level and overhead tank level, the capacity of the dimensions of the water mains are designed as summarized below;

Submersible Pump for Drinking Water

| Pump Volume | Head (m) | | | Pump motor | Discharge pipe | |
|---|---|---|---|---|---|---|
| (lit/min) | Borehole LWL | Tank HWL | Head | output (kW) | Diameter (mm) | Length (m) |
| 10 | 1,130 | 1,193 | 63 | 1.5 | 32 | 650 |

Overhead Tank

One unit of each overhead tank for drinking water and miscellaneous water will be provided at Mukono DFI. The capacity of the tanks will be sufficient for single day use. The overhead tanks will be fiber reinforced plastic tanks for ease of maintenance. The tanks will be placed on steel towers. The specifications for the water tanks at Mukono DFI are summarized below;

Size of Overhead Water Tank

| Use | Usable store volume($m^3$) | Tank dimension W x L x H (m) | Height of steel tower (m) |
|---|---|---|---|
| Drinking water | 8.0 | 2.0 x 2.5 x 2.0 | 6.0 |
| MU water | 21.6 | 2.0 x 2.5 x 2.0 | 6.0 |

(4) Power Supply

The power provided by Uganda Electricity Board (UEB), will be received at the site of the present transformer on the pole and distributed to training facilities, farm facilities and pumps. Power characteristics for the pumps will be three phase, and for other facilities will be single phase. The transformer will be replaced due to increased power requirements. The specifications for the power supply at Mukono DFI are summarized below;

- Power characteristics: Three phase 380V, Single phase 220 V, 50 Hz
- Capacity of transformer: 100 kVA
- Cable: 600 V PVC Cable
  Overhead and underground cable
- Distribution line: 2.3 km

Among these works GOU will improve existing power line from single to three phase between the existing transmission line outside of DFI and the site of present transformer by GOU's own cost in order to provide the above power characteristics.

(5) Farm Development

(i) Terracing works

The land slope of 12 farm plots for annual crops with a total area of 5.1 ha in net will be mildened by terracing works. The present land slope ranging from 5% to 7% will be reformed to the 3% slope without exceeding one meter in height between adjacently aligned two terrace plots, taking into account the soil conservation and efficient irrigation by hose spraying. As mentioned in Sub-section 2.3.1, the surface soil treatment is adopted to reserve soil fertility with about 20 cm thick. To attain a proposed agricultural productivity immediately after the terracing works, in addition, the top soil will be improved by removal of gravel, deep tillage in sub-soil layer and mixture of organic fertilizer in the surface soil.

(ii) Land reclamation

Aiming at strengthening the extension and training services and increasing the agricultural productivity, the lands being presently uncultivated and wasted will be converted to training/demonstration and production farms and pasturage by land reclamation. The land to be reclaimed consists of ten plots with a total area of 4.7 ha in net. The land reclamation works include shrub opening, uprooting, surface smoothening, removal of gravel, deep tillage and mixture of organic fertilizer, and are outlined below.

Land Reclamation Area

| Name of plot | Nos. of plot | Area (ha) | Land use |
|---|---|---|---|
| Paddock and crop plot | 6 | 3.8 | Paddock and fodder crop |
| Tree crop plot | 3 | 0.9 | Horticulture |
| Total | 9 | 4.7 | |

(iii) Farm roads and drainage ditches

The farm roads will be facilitated to ensure the proper access to the training / demonstration and production farms and pasturages. The farm roads are composed of main and feeder, and drainage ditches are provided along both the roads. The design conditions of farm roads are as follows:

1) The width of main and feeder roads are 5.0 m and 3.0 m, and with effective width (paved) of 3.0 m and 2.0 m, respectively :

2) The pavement is made by pit-run laterite materials (murrum) with a 20 cm thick;

3) The cross sectional slope of road surface is 4 %;

4) The drainage ditches provided along the farm roads have two types; one is unlined canal in case of gentle longitudinal road slope (parallel with contour) and the other concrete flume canal for steep slope portion (crossing with contour), having the flume sizes of 40 cm and 30 cm (bottom width) x 30 cm (height).

The farm roads are outlined below.

Road Length

| Description | Nos. of road | Length (m) |
|---|---|---|
| Main roads | 4 | 1,518 |
| Feeder roads | 28 | 5,675 |
| Total | 32 | 7,193 |

(iv) Irrigation Facilities

a) Design concepts

The following concepts are adopted to the design of irrigation facilities:

1) Save operation cost of water pumps through irrigation-use of rain water collected by a newly introduced "water harvesting system", and piped delivery of irrigation water for minimizing water conveyance loss;

2) Adopt simple irrigation techniques which are familiar with local farmers such as manually hose-spraying irrigation method;

3) Introduce the irrigation system and related facilities simply operated and maintained;

4) Plan irrigation facilities with 80% dependability; and

5) Use the materials and goods to be procured in Uganda.

b) Design conditions

Available water resources

The Mukono DFI will use a swamp adjacently located to the DFI's premises as the irrigation water sources. As no runoff data are available in this swamp, a capacity of water resources available for irrigation is estimated from the daily runoff data of the neighboring Sezibwa river recorded by the Water Development Department (WDD). The outline of runoff data is as follows:

Existing Runoff Record

| Area | Name of river | Station | Catchment area ($km^2$) | Recording period |
|---|---|---|---|---|
| Mukono | Sezibwa | Sezibwa fall | 427 | 1960-62/66-75 (13 years) |

The monthly discharge of the swamp with a 80% probability are computed based on the Sezibwa daily runoff records and the catchment area of the swamp, as shown below.

80% Probable Inflow

| | C. Area | 80% probable discharge (lit/sec) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Area | ($km^2$) | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. |
| Mukono | 6.48 | 14 | 10 | 11 | 23 | 28 | 22 | 16 | 12 | 14 | 18 | 21 | 12 |

According to the report titled "the Master Plan Study on the Integrated Agricultural and Rural Development Project in Central Uganda" prepared by JICA in 1994, the 80% probable specific runoff in the Mukono District was assessed at 0.0018 $m^3/sec/km^2$ by a rainfall - runoff analysis. This specific runoff makes the 80% probable runoff of DFI's swamp at 11.7 lit/sec, and consequently is considered to justify the above runoff assessment using the Sezibwa river data.

Taking the above runoff assessment and conservation of natural environment in and around the swamp into consideration, the irrigation facilities should be designed with an allowable intake discharge from the swamp not exceeding 10 lit/sec.

Cropping pattern

The irrigation system will be facilitated for the farm of 5.1 ha for annual crops. According to the proposed agricultural development program of DFI's training and production farms mentioned in Section 1.2, irrigated crops are tomato, cabbage, onion, other miscellaneous vegetables and maize. The respective cropping areas are tabulated below and those preliminary cropping calendar are shown in Figure 2.3.2.

Assumed Cropping Area

| Crops | Cropping area (ha) |
|---|---|
| Tomato | 0.5 |
| Cabbage | 0.5 |
| Onion | 0.5 |
| Mis. vegetables | 0.5 |
| Maize | 3.1 |
| Total | 5.1 |

Irrigation water requirement and required pump capacity

The water requirement for the above composite cropping pattern is estimated, making a reference to a [1]FAO/UNDP report, giving potential evapotranspiration and effective rainfall in Kampala. An overall efficiency of 80% is adopted the irrigation system for a reason of employing piped distribution system and hose-spraying method. The following table gives the monthly diversion water requirements at the intake.

Diversion Water Requirements

Unit : lit/sec

| Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.64 | 0.45 | 0.19 | 0.26 | 1.42 | 1.64 | 0.29 | 0.33 | 1.00 | 1.54 | 1.30 | 0.29 |

[1] Development of Horticulture Industry, Report on Consultancy on Water Requirements and Irrigation Methods for Vegetables and Fruits, November 1990, FAO/UNDP

Daily pump operation is limited to six hour time in normal condition taking into account the DFI's daily working hours and possible maintenance troubles due to longer operation. Thus, the required pump capacity is calculated at 6.56 lit/sec as shown below.

1.64 lit/sec x 24 hours / 6 hours = 6.56 lit/sec < 10 lit/sec : OK

Field irrigation system

Taking into account such conditions as land slope, high irrigation efficiency and adaptable irrigation techniques, a piped irrigation system is employed and the water is sprayed by manually handled hose. The irrigation water is supplied at a three-day interval, and with four-hour operation a day for a field plot of averaging 0.125 ha (50 m x 25 m). The capacity of water tap for hose is given 2 lit/sec by the following calculation:

| | |
|---|---|
| - Daily irrigation area (Pond - A): | 3.1 ha / 3 days = 1.03 ha / day |
| - Nos of field plot irrigated for half day (4 hours): | 1.03 ha x 0.5 / 0.125 ha = 4 field plots |
| - Capacity of a water tap: | 6.56 lit/sec / 4 field plots = 1.64, say 2 lit/sec |

Storage capacity of Regulating Pond - A for water harvesting

The storage capacity of Regulating Pond - A is designed by a water balance simulation based on the daily rainfall records at the Mukono DFI for two year period from 1995 to 1996, seeking to maximize the use of rain water harvested through the drainage ditches along the farm roads in the DFI and to minimize the operation of intake pump. The simulation optimizes the water harvesting capacity of 1,680 $m^3$.

c) Basic design

Regulating pond

Two regulating ponds, named A and B are constructed, one covers farms located in a lower part in elevation and the other for the irrigation of net shades for tree nursery and farms in a higher part. The reserving capacity of regulating pond is designed to have three days requirement at the peak irrigation period, and additionally water harvesting volume for the regulating pond-A. The respective ponds' capacities are tabulated below.

Capacities of Regulating Pond

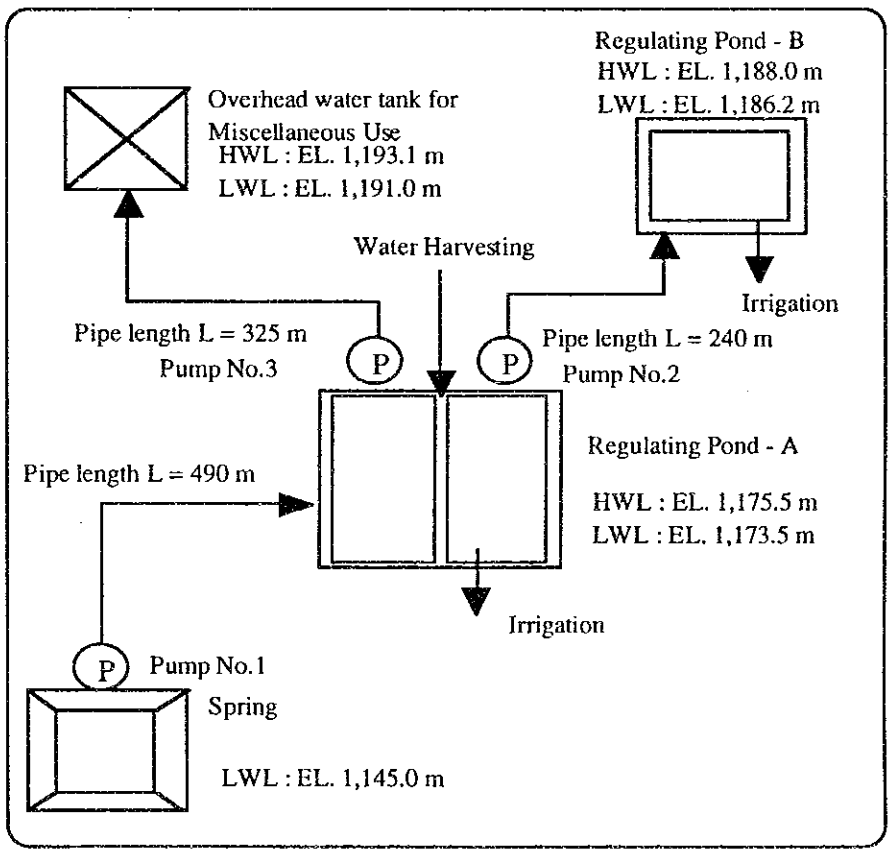
| Regulating pond | Command area (ha) | Regulating capacity ($m^3$) | | | Water level | |
|---|---|---|---|---|---|---|
| | | Peak daily requirement | Water harvesting | Total | HWL | LWL |
| A | 3.1 | 260 | 1,680 | 1,940 | 1,175.5 | 1,173.5 |
| B | 2.0 | 160 | - | 160 | 1,188.0 | 1,186.2 |

To minimize the water leakage, both the regulating ponds are made of reinforced concrete with vertical walls. A desilting cistern is provided at the Pond-A to prevent silt intrusion with harvested rain water. The dimensions of both the regulating ponds are as follows:

| | | |
|---|---|---|
| Regulating Pond - A | : | 35 m x 34.5 m x 2.5 m (high) |
| Regulating Pond - B | : | 9.5 m x 9.5 m x 2.25 m (high) |

Pump facilities

The water conveyance system from the intake at swamp to regulating ponds and an overhead tank is shown below. To simplify pump operation and save its operation cost, the respective pump systems are independently facilitated, and consequently three units of pump are needed.




Water Conveyance System

The design requirements of these pump facilities, on the basis of six hours operation a day, are tabulated below.

Pump Requirement

| Pump No. | Pumping discharge ($m^3$/min) Irrigation water | Livestock water, etc. | Total | Net lift | Pipe length |
|---|---|---|---|---|---|
| No.1 | 0.39 | 0.06 | 0.45 | 30.5 | 490 |
| No.2 | 0.25 | - | 0.25 | 14.5 | 240 |
| No.3 | - | 0.06 | 0.06 | 19.6 | 325 |

From the above design requirements, the types and capacity of pump facilities are designed as follows.

Pump Facility

| Pump No. | Pump Type | Pump Diameter (mm) | Motor output (kw) | Diameter (mm) of delivery pipe |
|---|---|---|---|---|
| No.1 | Volute | 65 | 7.5 | 100 |
| No.2 | Volute | 50 | 3.7 | 65 |
| No.3 | Volute | 50 | 3.7 | 32 |

Piped irrigation network

The piped irrigation networks, conveying water from the regulating ponds to the respective commanding farm, are designed as follows:

Irrigation Network

| Reg. Pond | Main delivery pipe (*) Dia. (mm) | Nos. | Length (m) | Branch delivery pipe (*) Dia. (mm) | Nos. | Length (m) | Valves and taps Check | Air | Desilt | Tap |
|---|---|---|---|---|---|---|---|---|---|---|
| A | 50 | 1 | 162 | 50 | 4 | 627 | 5 | 4 | 4 | 24 |
| B | 50 | 1 | 230 | 50 | 4 | 795 | 5 | 4 | 4 | 23 |
| Total | - | 2 | 392 | - | 8 | 1,422 | 10 | 8 | 8 | 47 |

(*) Type of pipe : PVC, Dia.: Diameter

(6) Basic Design Drawings

For the purposes of estimation of work quantities, preparation of construction plan and estimation of construction cost, the basic design drawings are prepared according the drawing list as shown in Table 2.3.3.

(7) Training Equipment and Agricultural Machinery

The training equipment and agricultural machinery provided for the Mukono DFI are designed and selected on the basis that these equipment and machinery should be:

(i) familiar for DFIs' staff and farmers in handling and operation; and
(ii) procured in Uganda in principle in view of post-sale servicing.

The following table shows the names of equipment and machinery, and specifications, required units and expected source countries of procurement, respectively.

Supply of Equipment and Goods

| Equipment and Machinery | Specification | Unit | Source countries |
|---|---|---|---|
| 1. **For Mainhall** | | | |
| Bench | 5 persons (2.1 x 0.35 x 0.45 m) | 16 | Uganda |
| Trainees' desk | 5 persons (2.1 x 0.5 x 0.76 m) | 16 | Uganda |
| Table for teacher | 1.6 x 0.8 x 1.1 m | 4 | Uganda |
| Teaching board | 3.0 x 4.0 x 1.8 m | 2 | Uganda |
| 2. **For Classroom** | | | |
| Chair with desk | 0.3 x 0.35/0.54 x 0.54 x 0.43 m | 80 | Uganda |
| Teaching board | 3.0~4.0 x 1.8 m | 4 | Uganda |
| 3. **Training Equipment** | | | |
| Typewriter | Standard manual type | 1 | Uganda |
| Computer and printer | Desk top, monitor 15", Laser jet printer | 1 | Uganda |
| Video deck | VHS, NTSC/PAL/SECAM | 1 | Uganda |
| Video monitor | Screen 28", NTSC/PAL/SECAM | 1 | Uganda |
| Loudspeaker set | Amplifiers 250W, Speaker 150W x 2 | 1 | Uganda |
| 4. **Laboratory instrument** | | | |
| Soil nutrient tester | Hand carrying type | 1 | Japan |
| Soil acid tester | Hand carrying type, pH3.5 - 8.0 | 1 | Japan |
| Salinity tester | Hand carrying type | 1 | Japan |
| Microscope | Handy type, Range 20X - 1,500X | 1 | Japan |
| Water distiller | 5 lit/hr, 3 kW | 1 | Japan |
| 5. **Agricultural machinery,etc** | | | |
| Wheel tractor | 2WD, 65 HP | 1 | Uganda |
| Plough implement | Disk type 26" x 3 | 1 | Uganda |
| Harrow implement | Disk type, Offset type, 20" x 18 | 1 | Uganda |
| Trailer | Stationary type, loading capacity 3.5 tons | 1 | Uganda |
| Ox-plough | Furrow width 20 cm | 2 | Uganda |
| Ox-cart | 2 wheel loading capacity 1 m3 | 2 | Uganda |
| Wet & dry thermometer | - 30 to +50 centigrade | 2 | Japan |
| Max/Min thermometer | - 20 to +50 centigrade | 2 | Japan |
| Rain gauge | 200 mm dia. and 600 mm high | 1 | Japan |
| Wooden shelter | 510 x 510 x 350 mm inside dimension | 1 | Japan |
| Pickup | 4x4, Single cab | 1 | Kenya or Uganda |
| Motorcycle | 125 cc, off-the-road type | 2 | Kenya or Uganda |
| Soil mixer | 1.0 HP, Output 150 lit. | 1 | Japan |
| Hatchery unit | Approx. 500 eggs with D. engine generator | 2 | Uganda |

Operation and maintenance method of the provided equipment and machinery will be explained and trained under the guidance of manufacturer's agencies.

Specifications, unit and purpose of equipment and machinery are shown in Table 2.2.4 in detail, and description on source countries for procurement is shown in Table 2.3.4.

# *CHAPTER 3*
# *IMPLEMENTATION PLAN*

# CHAPTER 3 IMPLEMENTATION PLAN

## 3.1 Implementation Plan

### 3.1.1 Implementation Conditions

The Project for Improvement of Agricultural Extension and Training Institutes will be implemented at Mukono District Farm Institute with the following method and construction formation on the condition that the Project will be executed under the Japan's Grant Aid Scheme.

(1) Implementation Method

The Project will be implemented at Mukono DFI with the following steps;

(i) Directorate of Agricultural Extension (DAE), Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) will be the executing agency.

(ii) When the Exchange of Note (E/N) between the Government of Japan (GOJ ) and the Government of Uganda (GOU) is signed, DAE will establish the Project Office, which will take care of overall procedures necessary for the implementation of the Project. (Ref. Fig 3.1.1)

(iii) A Japanese consultant, recommended by JICA and entrusted by MAAIF after signing the contract, will carry out the detailed design and prepare the tender documents for the Project.

(iv) After the completion of the tender documents, the E/N regarding the Project implementation will be signed between GOJ and GOU. The Japanese consultant, after signing the contract for the construction supervision and the technical advice, will start the procedure of the tender.

(v) A Japanese contractor, after contract signing, will undertake the construction works and the consultant will carry out the construction supervision.

(vi) Prior to the commencement of construction, the Project Office will hand over the Project area to the contractor. Therefore, the land acquisition shall be completed by this time.

(vii) Upon completion of the construction work, the responsibility of Operation and Maintenance (O & M) works will be transferred to Mukono DFI.

(viii) Upon completion of the works for farm facilities, the consultant will start the technical advice. By this time, therefore, Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) shall obtain the budget for initial activities of extension, training and agricultural production in Mukono District Farm Institute and be ready for the disbursement. (Ref. Fig 3.1.2)

(2) Formation of the Construction

A Japanese contractor has been engaged in the construction work of a certain project in Uganda under the Japan's Grant Aid. The contractor as a main contractor has trained the local contractors and employed them as subcontractors in the project. Judging from the scale and estimated number of labor of the Project, the main contractor can not execute the work with a sole subcontractor, and has to use several subcontractors. Therefore, the Project will be implemented by formation of a Japanese main contractor and several local subcontractors. The works are partially to be sublet to the subcontractors, and the subcontractors will execute the works mainly by use of construction equipment and materials (cement, brick, steel frame, reinforcement bar, aggregate, pump, etc.) provided by the main contractor.

(3) Necessity of Japanese Experts for the Contractor

A Japanese expert for the contractor will be required for borehole construction.

### 3.1.2 Notes for the Construction

(1) Procedure of Tax Exemption

Under the Japan's Grant Aid Scheme, Japanese nationals regarding to the project implementation shall be exempted from customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the supply of the products and services. In Uganda, however, the amount imposed for the duties, the taxes and the levies on the Japanese nationals shall be paid by the executing agency.
The procedure required for the exemption to the Japanese nationals will be complex and will be taken by not only Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) but also other relevant ministry and offices. MAAIF shall take the initiative in the process of the procedure to clear promptly and the procedure shall be well understood by MAAIF and the contractor.

(2) Measure for Environment Impact during the Construction

The possible environment impact will be (a) damage to Mukono DFI's facilities and inhabitant houses, (b) restoration of borrow areas of filling and pavement materials, (c) accident of construction machine particularly dump truck, and (d) eroded soil by rainfall.

In order to avoid the occurrence of physical and environmental damages to the DFI's facilities and inhabitant houses, the specification shall be provided concerning the limit of the driving speed, spreading water to access road to prevent dust and so on.

To avoid the accident by construction equipment, such measures will be taken as (i) limit of driving speed, (ii) prohibition of private use, (iii) regular safety assembly, and (iv) deployment of traffic control officer.

Terracing works requires movement of considerable amount of soil within a limited area. In top soil treatment of the terracing works, stripped top soil will be collected temporarily. As it rains every month in Uganda, the collected top soil must be stocked in the manner so as to decrease the impact in and around the DFI caused by soil erosion.

### 3.1.3 Scope of Works

(1) Scope of Works to be Executed by the Japanese Side

- To carry out the detailed design and preparation of tender documents,
- To undertake the construction works in Mukono DFI as described in "Chapter 2.3 Basic Design"

(2) Undertaking by GOU

- Provision of the necessary land for the construction of the new pump station and its relevant facilities,
- Installation of three (3) phase electric distribution line up to the site of existing transformer in Mukono DFI as a new motive power source,
- Construction of fence of new paddock,
- Budgetary arrangement and the prompt disbursement for tax exemption to the Japanese nationals regarding to the project implementation, especially on imported construction materials and equipment,
- Application for construction of the buildings and payment of its application fee.

### 3.1.4 Consultant Supervision

(1) Detailed design and Tender Works

Prior to the implementation of the Project, the detailed design and tender works will have to be carried out. Immediately after the signing of the E/N, the consultant will be made contract with Ministry of Agriculture, Animal Industry and Fisheries (MAAIF), and the consultant will start the detailed design. The consultant should discuss the design and implementation schedule of the works with Directorate of Agricultural Extension (DAE) at the detailed design stage.

The works involved in the detailed design are as follows;

i) Additional investigation / survey
- Topographic survey (sites for road, overhead water tank, regulating pond),
- Test drilling, pumping test and water quality analysis for ground water,
- Electric sounding for ground water resources,
- Soil mechanical test,
- Investigation/confirmation on equipment procured in Uganda,
- Discussion/confirmation on the contents and schedule of technical advice and investigation of training materials.

ii) Detailed design
- Detailed design for new construction and rehabilitation of buildings and their relevant facilities,
- Detailed design for farm facilities,
- Detailed design for roads, field plot formation and irrigation facilities
- Detailed design for water supply facilities,
- Preparation of program for technical advice, and
- Confirmation of project cost on the basis of the detailed design

iii) Preparation of the tender documents
- Preparation of tender drawings, and
- Preparation of the tender documents for the construction works

The tender for selection of a contractor for the construction works will be conducted after getting approval from Directorate of Agricultural Extension (DAE) for the tendering process. The first step is the pre-qualification tender, and notice of this will be published in the major daily newspapers on construction and economy in Japan on behalf of DAE.

The pre-qualification documents will be distributed by the consultant to the applicants and the tender documents will be distributed by the consultant to the pre-qualified applicants.

The quoted tenders will be received by the consultant and opened in the presence of the representative of DAE. After the opening, the tender evaluation will be carried out by the consultant in collaboration with the representative of DAE, and the draft contract will be prepared by the consultant based on the tender evaluation result.

(2) Construction Supervision

Once the contract has been concluded for the construction works, the consultant will clarify the construction method and time schedule from the contractor. The resident engineer of the consultant will be assigned to supervise the construction works with the commencement of the construction, and will regularly report the work progress to both JICA Kenya office and DAE. The resident engineer of the consultant will also coordinate the agencies concerned with the Project, including the contractor, for smooth implementation of the Project.

Since the Project work is broadly divided into civil works and building works , a civil engineer will stay in Uganda as the resident engineer and a building engineer will be sent to the site periodically in order to supervise building works.

Through these arrangement, the Project works will be completed on schedule with good standard.

The scope of the construction supervision is outlined below;

i) Evaluation and approval of the construction drawings
- Evaluation and approval of the construction drawings, application for commencement of the works, sample of materials, specification of the equipment, etc. submitted by the contractor

ii) Construction progress and quality control
- Checking and guidance on the construction plans and time schedule ; progress and quality control of the construction works and necessary inspection of the construction methods

iii) Approval on the payment to the contractor
- Checking and evaluation of the performance of the works necessary for issuing payment certificates and completion certificate to the contractor.
- Attendance at the handing-over of the completed facilities to DAE after confirming the completion of the works and fulfillment of the contract.

iv) Final Checking at the end of maintenance period

- Checking of the completed works at the end of the maintenance period with the contractor and representative of MAAIF

### 3.1.5 Procurement Plan

Of the equipment and materials to be used for the construction works, those available in Uganda will, in principle, be procured from the local markets. Based on this basic concept, discussion was made concerning the availability of equipment and materials with the major local contractors, the Japanese contractor who is being in-charge of the Japan's Grand Aid Project in Nakawa (The Project for Improvement of Nakawa Vocational Training Institute), and DAE. It was clarified that the equipment and materials for the general civil and building works, which are Ugandan or imported from Kenya, will be available in Uganda, some of which were imported from Europe or Japan. Particular materials such as pump, electrical equipment, building apparatus, material for water supply facility may not be available in Uganda, which would be imported by the contractor.

On the other hand, the construction equipment being used in Uganda are generally made in Europe and/or Japan. The required number and variety of equipment in the Project are limited and can be leased in Uganda. Therefore, the construction equipment of the Project will be planed to be procured in Uganda on the basis of lease.

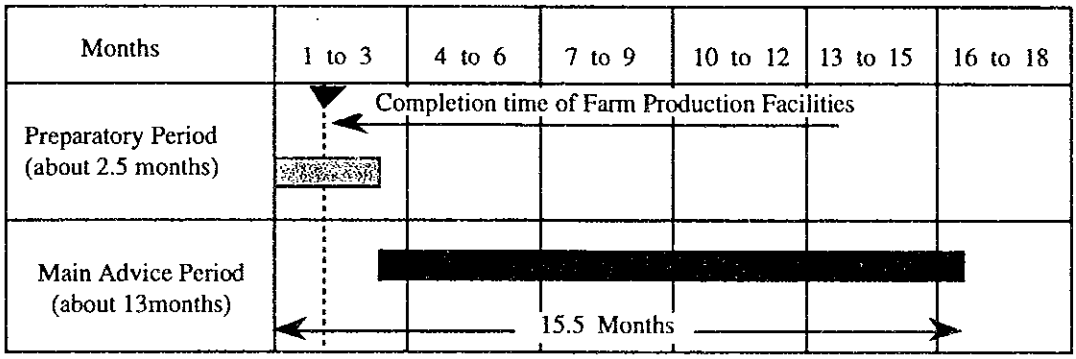
### 3.1.6 Implementation Plan for Technical Advice

Mukono DFI had been operated and maintained under fully budgetary support of MAAIF since its establishment. Due to recent budgetary shortage of Mukono DFI caused by GOU's recent financial difficulties, however, the DFI is managed by supplementary input of agricultural production earnings in the training farm in addition to the disbursed budget in these days. In this project, it is planned that newly institutionalized farmers' training and DFI management will be supported financially by strengthening this DFI's earning activity. Activation of Mukono DFI will contribute to agricultural extension in Mukono District. Most of the present DFI staffs, however, are not acquainted with financial farm management, self-accounting system, farmers' training and so on which will be introduced newly in Mukono DFI. Accordingly technical advice will be provided to Mukono DFI under the Grant Aid Scheme in order to support the DFI staffs for more effective DFI operation and management.

Technical advice will be provided to "Farm & Financial Management" part for DFI staffs to understand farm management deeper and for farmer trainees to manage their farms rationally, "Farmers' Training" part to be introduced newly, "Crop (Vegetable) Production" part for crop diversification, mainly for vegetable production and "Livestock (Poultry) Production" part to be strengthened, mainly poultry.

Technical advice will start about one month before the completion period of farm production facilities under the Grant Aid Scheme and consists of two periods, preparatory period (about 2.5 months) and main advice period (about 13 months). Total period will be about 15.5 months as shown below:

Technical Advice Period




In the preparatory period, the following activities will be carried out ;

- Preparation of detailed operation plan for the training programs including farmers' training, farm and facilities, field trial and experimentation, and commercial crop production, and
- Training of the DFI's staff for the above operation.

After the above preparatory works, the DFI will start farm production by using new facilities and the technical advice will be provided for the DFI's partial self-accounting management. The main advice period was judged to be necessary for at least a year or two crop seasons in order to strengthen the DFI's organization and functions carrying out sound financial management, efficient commercial production and effective training programs.

The items in the preparatory period and main advice period are demarcated below and the schedule is shown in Fig. 3.1.3.

Demarcation of Technical Advice

| Period | Items to be Advised |
|---|---|
| Preparatory Period | DFI staffs' introduction training, detailed operation plan for farm management, farmers' training, financial management, agriculture and agro-economy survey |
| Main Advice Period | farm & financial management, farmers' training, crop (vegetable) & Livestock (poultry) production, monitoring & evaluation and modified DFI management plan if required |

Technical advice will be provided by Japanese and Ugandan consultants in principal. The Ugandan consultants will assist the Japanese consultants. The Japanese consultants must have experience of farm advisory services in developing countries and the Ugandan consultants

must have not only knowledge for their specialty fields but also capability for smooth project implementation standing between Ugandan counterpart personnel in the DFI and the Japanese consultants.

Major parts of technical advice will be implemented by two Japanese consultant specialists covering farm and financial management, and farmers' training who will be assisted by three local consultants on farmers' training, crop (vegetable) production and livestock (poultry) production. The consultant will transfer their knowledge to the counterparts who are the project manager in DAE, principal and other key staffs of the DFI and will assist agricultural extension officers technically in the district. The scope of works of the above technical advisory staffs are as follows:

| | |
|---|---|
| 1. Farm & Financial Management Specialist (Japanese) | Representative of all of technical advisory team, formulation of farm and financial management plan, technical advice on farm and financial management, and project benefit monitoring and evaluation (PBME). |
| 2. Farmers' Training Specialist (Japanese) | Formulation of farmers' training program, technical advice on farmers' training and PBME. |
| 3. Farmers' Training Specialist (Ugandan) | Assistance to 2. Farmers' Training Specialist, technical advice on farmers' training, and PBME. |
| 4. Crop (Vegetable) Production Specialist (Ugandan) | Formulation of crop production plan, especially for vegetable, technical advice on production and marketing of vegetable seed, seedling and products, soil and seed test, and O & M of farm machinery. |
| 5. Livestock (Poultry) Production Specialist (Ugandan) | Formulation of livestock (poultry) production plan, and technical advice on livestock & feed production and marketing. |

The implementation and assignment schedule for the above Technical Advice is shown in Fig. 3.1.3. The following expenditure for activities' promotion will be necessary for sound implementation of the technical advice :

| | |
|---|---|
| a) Evaluation Survey Cost | Benchmark, monitoring and evaluation survey on agriculture and agro-economy covering farmer trainees and their village area |
| b) Maintenance Cost of Equipment Introduced | Part of maintenance cost for irrigation pump, tractor, pick-up truck, motor-cycle, hatchery and generator. |
| c) Cost for Enlightenment and Demonstration | Part of enlightenment & demonstration Cost for preparation of farmers' training materials, extension activities of DFI staff and field extension officers, and payment to outside trainers on livelihood improvement. |

| | | |
|---|---|---|
| d) | Introduction Cost for Appropriate Technology | Introduction of new vegetable and maize seed, and farm input for trial production of new varieties. |
| e) | Workshop Cost | Workshop and seminar for field extension officer and representatives of farmer groups in Mukono District, and staff of other DFIs. |

### 3.1.7 Implementation Schedule

(1) Implementation Schedule of the Project

As stated in Chapter 2.3 "Basic Design", the Project will be implemented together with the technical advice. The respective works will be done in the following period ;

- Detailed design : 5 months
- Construction works : 15 months
- Technical Advice : 15.5 months

In the project implementation, the project works will be carried out in the following two phases;

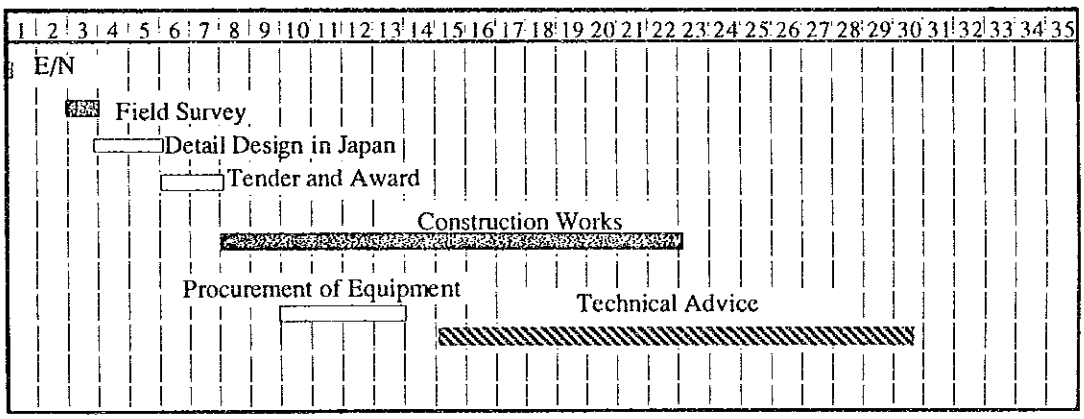
Phase-1: Detailed Design, Improvement of Farm Facilities, Farm Development except one reservoir,

Phase-2: Training Buildings, Water Supply Facilities, A reservoir, Technical Advice

The implementation schedule is shown below;

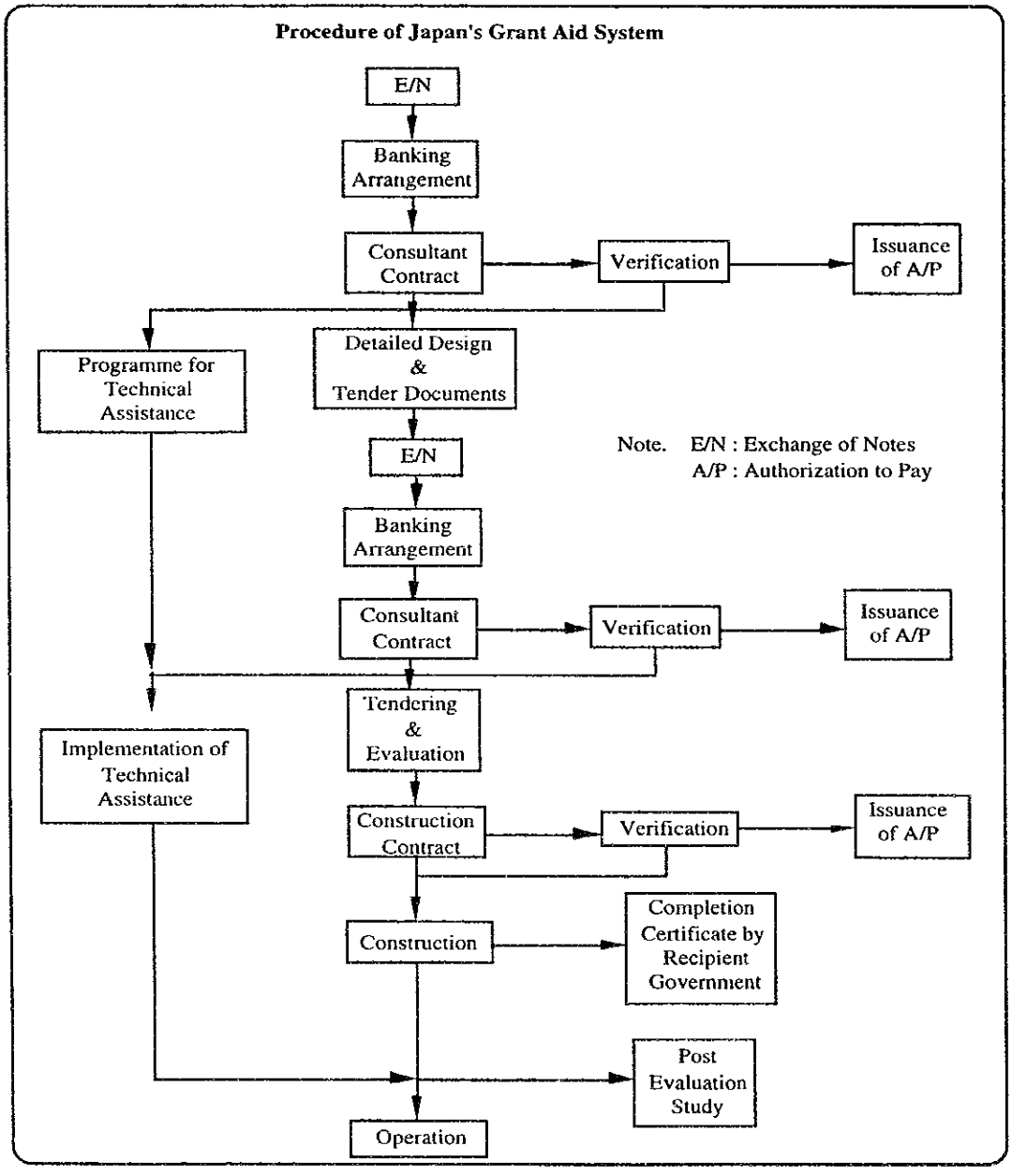
Implementation Schedule

(Unit: month)



(2) Implementation Procedure under Japan's Grant Aid System

The project shall be implemented as shown below, taking into consideration the procedure of the Japan's Grant Aid system.



### 3.1.8 Obligation of Recipient Country

For the detailed design, implementation and technical advice of the Project, the Government of Uganda will undertake the followings in addition to ;

(i) To provide data necessary for the Project,
(ii) To secure and clear the site required for the Project prior to the Project implementation,
(iii) To bear commissions to the Japanese foreign exchange bank for its banking services based upon the Banking Arrangement for payment, namely the advising commission of the "Authorization to Pay" and payment commission,
(iv) To ensure prompt unloading, tax exemption, customs clearance at the port of disembarkation in Uganda and prompt internal transportation therein of the materials and equipment for the Project purchased under the Grant Aid,
(v) To exempt Japanese nationals engaged in the Project from custom duties, internal taxes and other fiscal levies which may be imposed in the Republic of Uganda with respect to the supply of the products and services under the verified contracts,
(vi) To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contract such facilities as may be necessary for their entry into Uganda and stay therein for the performance of their work,
(vii) To provide necessary permission, licenses and other authorizations for implementing the Project, if necessary,
(viii) To assign appropriate budget and staff members for proper and effective operation and maintenance of the facilities constructed under the Project,
(ix) To maintain and use properly and effectively the facilities constructed under the Project,
(x) To bear all the expenses, other than those to be borne by the Japanese Grant Aid with the scope of the Project,
(xi) To coordinate and solve any issues related to the Project which may be raised from third parties or inhabitants of the Project area during implementation of the Project,
(xii) To carry out the followings regarding the scope of works undertaken by GOU as stipulated in section 3.1.3 "Scope of Works" ;
- Provision of the necessary land for the construction of the new pump station and its relevant facilities,
- Installation of three (3) phase electric distribution line up to the site of existing transformer in Mukono DFI as a new motive power source,
- Construction of fence of new paddock,
- Budgetary arrangement and the prompt disbursement for tax exemption to the Japanese nationals regarding to the project implementation, especially on imported construction materials and equipment,
- Application for construction of the buildings and payment of its application fee.

(xiii) To carry out the followings regarding the technical advice ;

- To introduce partial self-accounting system to the Mukono DFI in the management of farm production and training,
- To bear all the expenses regarding the technical advice, other than those to be borne by the Japanese Grant Aid with the scope of the Project,
- To strengthen existing organization of the Mukono DFI by sending qualified staff to the vacant posts,
- To bear all the operation and maintenance cost not only during the technical advice period but also after the period,
- To disburse the purchasing cost for the initial farm inputs which are not borne by the Japanese Grant Aid.

## 3.2 Operation and Maintenance Plan

(1) Operation and Maintenance Plan of Project Facilities

Mukono DFI has been maintaining existing buildings and farm facilities since its establishment in early 1960s. In O & M of the buildings and facilities constructed or rehabilitated by the Project, special attention is not always required to be paid to their O & M. However, periodical checking and quick repair works is essential. In the plan, the strengthened new DFI organization headed by the principal will have full responsibility of the O & M and the clerical officer will keep the check and repair records.

General life time of building is about 45 years for reinforced concrete structure, about 35 years for steel-frame structure and about 20 years for wooded structure. For building facilities, general life time is 20 - 25 years for electric apparatus and 15 - 20 years for water supply and drainage. Periodical checking and maintenance works including grass cutting are required not only for buildings but also for all other related apparatus and facilities such as toilet, water supply and so on.

For farm facilities, periodical checking and prompt repair works are indispensable, especially for pump and water supply, irrigation facilities, farm roads, side-ditch and so on.

O&M works are generally divided into the following types ;

(i) Regular maintenance works

The regular maintenance works refer to the day to day maintenance of pump, water supply, irrigation facilities and DFI yard, comprising routine repair of grass cutting,

clearance of debris at the pump intake, filling of holes on the roads, oiling of pump and so on.

(ii) Periodic maintenance works

The periodic maintenance works is defined as the repair of minor damages which do not cause immediate danger or malfunction to the facilities. Minor improvements if any are also included in the periodic maintenance.

(iii) Emergency repair

Repair of damaged facilities which would hamper the normal irrigation practices, shall be quickly and effectively carried out under the category of the emergency repair.

(iv) Annual maintenance works

The annual maintenance work shall be executed at the fallow period, and in case of large work quantities, the work might be carried out by the contractor.

(2) Operation and Maintenance Plan of Project Equipment

Mukono DFI has general training equipment and apparatus, however, it has not agricultural machinery at present. In this plan the officer in charge of agriculture mechanization of the enhanced DFI organization will have responsibility of O&M of the equipment. The O&M works are generally divided into the following types ;

(i) Checking before operation and periodic maintenance works

Before operation of equipment checking will be carried out by the operator in accordance with a check list prepared by the officer in charge of agriculture mechanization. Operation hours, supply amount of fuel, engine cooling water, oil will be recorded in the check list. Any unfavorable condition and the check records will be reported to the officer in charge.

Periodic maintenance will be ordered by the officer in charge, judging from the check record. The periodic maintenance will be made by a workshop nearby DFI.

(ii) Repair and custody

Repair of equipment will be made by the manufacturer's agency within guarantee period of the equipment. As life time of equipment fully depends upon the custody condition of equipment during fallow period of farming, the officer in charge of agriculture mechanization will establish the system.

(iii) Custody of Spareparts

prepared by the officer in charge of agriculture mechanization. Number, name of spareparts, stock number, consumed number must be clearly mentioned in the list.

(3) Operation and Maintenance Cost

O&M for Mukono DFI during the technical advice and at the full development stage will be estimated as follows (Ref. Table 3.2.1) :

Estimated Financial Balance

(Unit: Ush 1,000)

| | Balance Item | Initial Year | Target (5 Years after) |
|---|---|---|---|
| I. Income | Staff Salary from Government | 19,200 | 19,200 |
| | Others from MAAIF | 27,000 | 27,000 |
| | Training Fee | 145,550 | 145,550 |
| | Agricultural Production | 129,050 | 204,410 |
| | Sub-total | 320,800 | 396,160 |
| II. Expenditure | Staff Salary & Allowance | 44,400 | 44,400 |
| | O&M cost | 45,320 | 51,080 |
| | Training Cost | 128,770 | 163,070 |
| | Agricultural Production cost | * 86,220 | 90860 |
| | Demonstration cost | 8,050 | 16,100 |
| | Sub-total | 312,760 | 365,510 |
| III. Balance | | 8,040 | 30,650 |

Note; *: initial investment cost is included.

In the financial balance in 1996/97 the income was Ush 225.4 million, the expenditure Ush 217.6 million and the balance Ush 7.8 million. After the project implementation, however, the financial conditions will be much improved. The GOU's subsidy of total Ush 46.2 million in the above table must be provided every year.

The government subsidy with and without the project can be compared below. The staff salary from government with the project will increase by Ush 2.8 million over that without the project and the other subsidy from MAAIF Ush 8.69 million. This increment of the GOU's subsidy must be provided when the project is implemented.

GOU's Subsidy Increase

Unit: Ush 1 000

| Items | 1996/97 (Without Project) | With Project | Increase |
|---|---|---|---|
| Staff Salary from Government | 16,400 | 19,200 | +2,800 |
| Others Subsidy from MAAIF | 18,310 | 27,000 | +8,690 |
| Total | 34,710 | 46,200 | +11,490 |

On the basis of the assessment of O&M cost estimate, the cost for Mukono DFI activities in a half year required for the first cropping will be at least around Ush 97 million excluding staff salary and labor wage. (See Table 3.2.2) The amount of Ush 97 million will be allotted by the MAAIF in addition to the staff salary and labor wage of newly strengthened DFI organization. This fund will be revolved together with net reserve through the commercial production under the partial self-accounting system.

(4) Financial Operation Plan

Based on the agricultural training and production plans and the fund allotment of the MAAIF, financial balance sheet for the operation of Mukono DFI is prepared by season as given in the following page It is assumed that the final target of the agricultural training and production plans will be achieved in the four year after the technical advice period of around one year. The net reserve of the fifth year will be Ush 205.7 million which account for around double amount of the MAAIF's initial allotment (Ush 97.0 million). The fund requirement for the first cropping season from the sixth year will be around Ush 121 million which will be re-allocated as new revolving fund for Mukono DFI.

Annual Financial Plan in Mukono DFI

(Unit: Ush'000)

| Item | Technical Assistance Period 1st Year | | 2nd Year | | 3rd Year | | 4th Year | | Final Target 5th Year | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1st Crop Season | 2nd Crop Season | 1st Crop Season | 2nd Crop Season | 1st Crop Season | 2nd Crop Season | 1st Crop Season | 2nd Crop Season | 1st Crop Season | 2nd Crop Season |
| A. Revenue | 240,021 | 240,039 | 257,478 | 267,322 | 286,586 | 298,257 | 319,348 | 332,845 | 355,762 | 371,087 |
| 1. MAAIF Allotment (Revolving Fund) | 97,021 | 97,039 | 105,058 | 114,902 | 124,746 | 136,417 | 148,088 | 161,585 | 175,082 | 190,407 |
| 2. MAAIF Budget (Exc. Sarary adn Wage) | 5,700 | 5,700 | 5,700 | 5,700 | 5,700 | 5,700 | 5,700 | 5,700 | 5,700 | 5,700 |
| 3. Training Charge | 72,777 | 72,777 | 72,777 | 72,777 | 72,777 | 72,777 | 72,777 | 72,777 | 72,777 | 72,777 |
| 4. Sales of Farm Products | 64,523 | 64,523 | 73,943 | 73,943 | 83,363 | 83,363 | 92,783 | 92,783 | 102,203 | 102,203 |
| B.Expenditure | 142,982 | 134,981 | 142,576 | 142,576 | 150,169 | 150,169 | 157,763 | 157,763 | 165,355 | 165,354 |
| 5. Training Cost | 64,383 | 64,382 | 68,671 | 68,671 | 72,958 | 72,958 | 77,246 | 77,246 | 81,533 | 81,532 |
| 6. Agri. Productic /1 | 47,112 /1 | 39,112 | 40,692 | 40,692 | 42,271 | 42,271 | 43,851 | 43,851 | 45,430 | 45,430 |
| 7. O & M | 22,662 | 22,662 | 23,382 | 23,382 | 24,102 | 24,102 | 24,822 | 24,822 | 25,542 | 25,542 |
| 8. Allowance | 4,800 | 4,800 | 4,800 | 4,800 | 4,800 | 4,800 | 4,800 | 4,800 | 4,800 | 4,800 |
| 9. Demonstration | 4,025 | 4,025 | 5,031 | 5,031 | 6,038 | 6,038 | 7,044 | 7,044 | 8,050 | 8,050 |
| C.Net Reserve (A-B) | 97,039 | 105,058 | 114,902 | 124,746 | 136,417 | 148,088 | 161,585 | 175,082 | 190,407 | 205,733 |
| Balance of Revenue excluding Revolving Fund and Expenditure | 18 | 8,019 | 9,844 | 9,844 | 11,671 | 11,671 | 13,497 | 13,497 | 15,325 | 15,326 |
| Cumulative | | 8,037 | | 19,688 | | 23,342 | | 26,994 | | 30,651 |
| Net Reserve excluding Revolving Fund (C - Revolving Fund) | 18 | 8,037 | 17,881 | 27,725 | 39,396 | 51,067 | 64,564 | 78,061 | 93,386 | 108,712 |

/1 : Including cost for foundation stock