

BASIC DESIGN STUDY REPORT
ON
THE ESTABLISHMENT PROJECT
OF
THE IRRIGATION TECHNOLOGY CENTER
IN
THE SOCIALIST REPUBLIC OF THE UNION OF BURMA

JUNE, 1986

JAPAN INTERNATIONAL COOPERATION AGENCY

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PREFACE

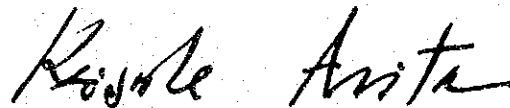
In response to the request of the Government of the Socialist Republic of the Union of Burma, the Government of Japan decided to conduct a basic design study on the Establishment Project of the Irrigation Technology Center and entrusted the study to the Japan International Cooperation Agency (JICA). JICA sent to Burma a study team headed by Mr. Yasuo SASAKI, Chief Engineer, Japanese Institute of Irrigation and Drainage, from 31st January to 24th February, 1986.

The team had discussions on the Project with the officials concerned of the Government of Burma and conducted a field survey in Pegu area. After the team returned to Japan, further studies were made, a draft report was prepared and, for explanation and discussion of it, a mission headed by Mr. Noriaki NIWA, First Basic Design Study Division, Grant Aid Planning and Survey Department, JICA, was sent to Burma from 14th to 23rd May, 1986. As a result, the present report has been prepared.

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

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

June, 1986.



Keisuke ARITA

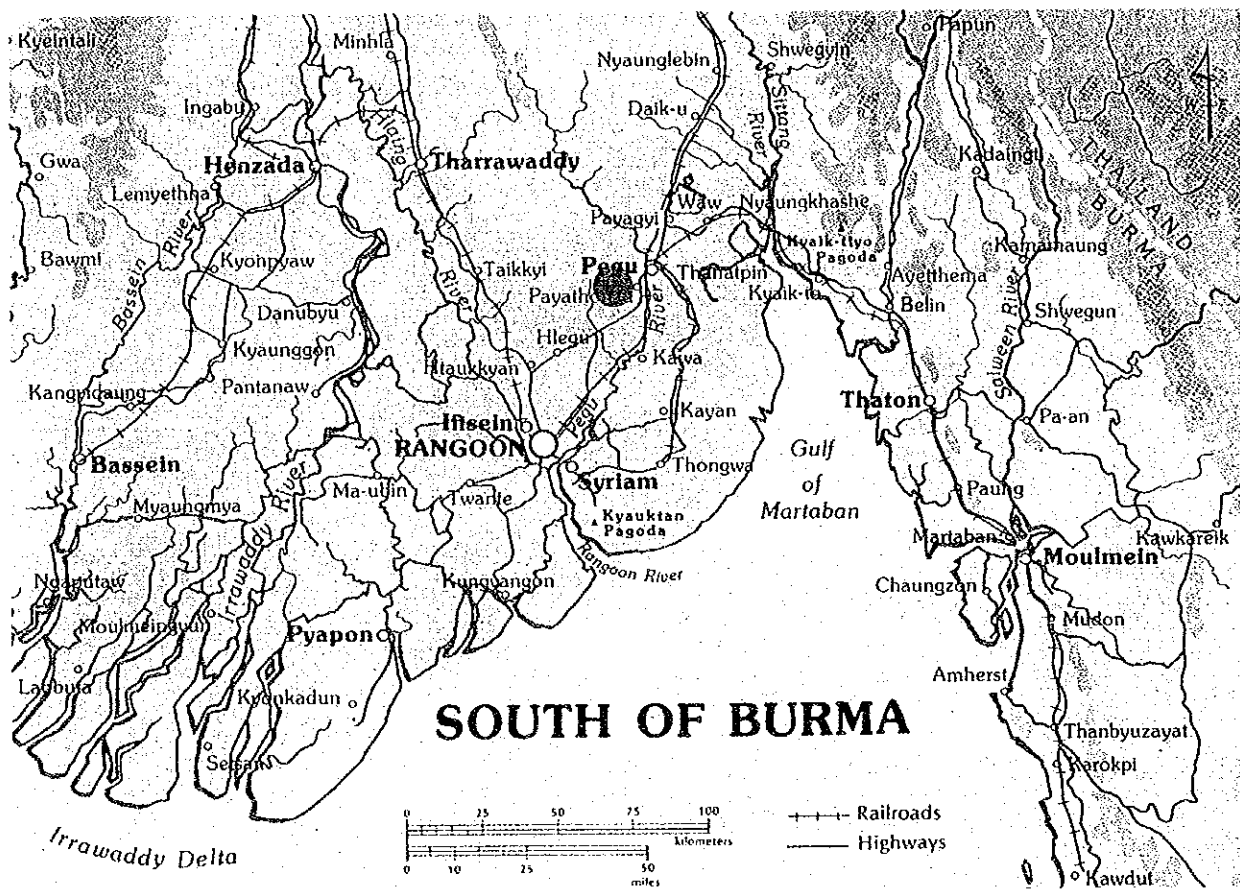
President

Japan International Cooperation Agency

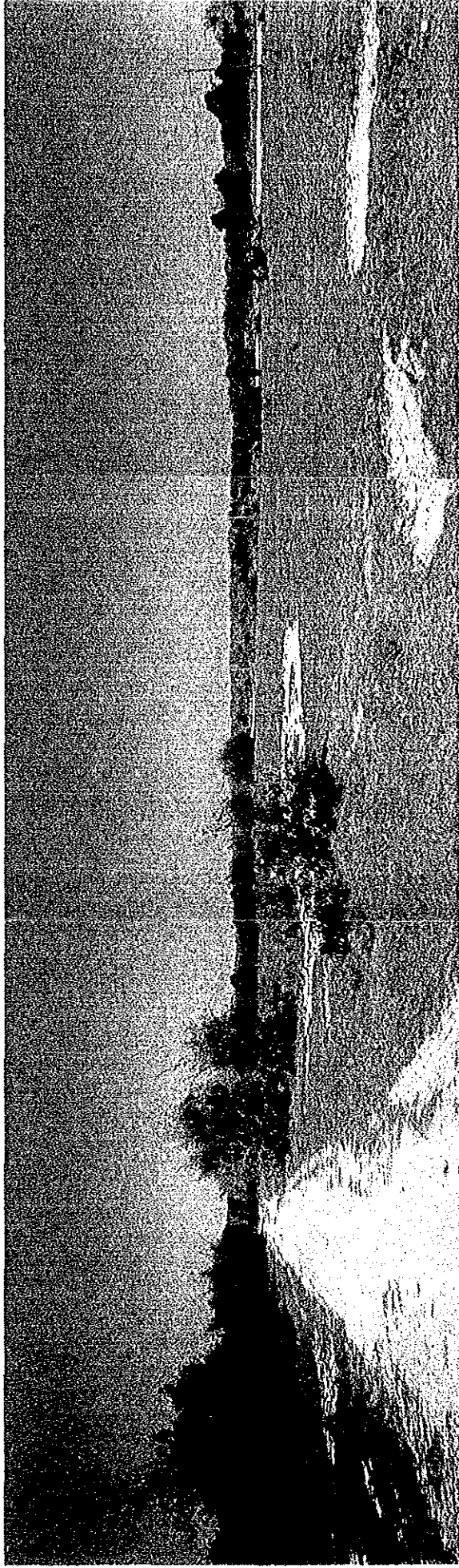


THE IRRIGATION TECHNOLOGY CENTER IN THE SOCIALIST REPUBLIC OF BURMA

PERSPECTIVE



MAP OF SOUTH OF BURMA



PROPOSED CONSTRUCTION SITE

SUMMARY

SUMMARY

Agriculture is the most important industry in Burma which supports the country's national economy. The paramount importance of agriculture is evident from the fact that population engaged in agriculture occupies 66% of the total work force and that the agricultural sector contributes over 45% of the Gross National Product. The importance of the agricultural industry is also apparently stated in the Government of Burma's Twenty-Year Long-term Development Plan which began in 1971. In recent years High Yield Variety (HYV) has been introduced into Burma for the purpose of obtaining increases in agricultural production. Though this has been a qualified success, the rate of yield per unit, when compared to international levels, is extremely small and there seemed little possibility of obtaining much greater yields.

In order to increase agricultural production, plans have to be made to upgrade land productivity by means of expanding the cultivated area and providing it with irrigation. In view of the fact that such plans would require considerable investments, the agricultural policy for the Fourth Four-Year Plan (1982/83 - 1985/86) places importance on increasing the unit yield of planted area by means of intensive cultivation through the utilization of irrigation and increasing of double and triple cropping. Therefore, the irrigation project has made notable progress since the implementation of the Fourth Plan, but it has become apparent that there is a shortage of personnel concerned with the project in the Irrigation Department (ID), Ministry of Agriculture and Forests, as well as limitation in access to new technology.

Furthermore, because of the introduction of technical cooperation from various foreign countries to implement large scale projects, a number of different standards and codes co-exist simultaneously. In view of this situation, the Government of Burma has decided to establish the Irrigation Technology Center (ITC) and requested grant aid for the project as well as Technical Cooperation to the Government of Japan because the technology in this field there is well established.

In response to the request of the Government of Burma, the Government of Japan decided to conduct the Basic Design Study for the project, and the

Japan International Cooperation Agency (JICA) dispatched the Basic Design Study Team, headed by Mr. Yasuo SASAKI, Chief Researcher of Japanese Institute of Irrigation and Drainage, to Burma from 31st January to 24th February, 1986 to confirm the contents of the request and study the background of the project, the appropriateness of the grant aid, the proposed construction site, the project implementation system, the administration and maintenance organization, and construction situation. After the Team returned to Japan, further analyses were made, accordingly the draft final report was prepared. The explanation on the report to Burmese side was made from 14th to 23rd May, 1986 in Burma. As a result, present report has been prepared.

ID will take charge of implementing the project. The Planning Branch of ID will supervise management and administration of ITC after it is opened. In respect to organizational structure, ITC will be ranked equal to Hydrology Section, Soil Section, Surveying Section 1 and 2, and two Project Offices under the jurisdiction of the Planning Branch of ID.

Functions of ITC are collection and processing of irrigation technology data/information, development of irrigation technology, determining design standards, conducting soil and construction materials tests, hydraulic model tests and training of irrigation engineers.

Subjects of training and test have been provisionally agreed upon by the Preliminary Survey Team and Burmese side. These subjects are scheduled to be implemented in ITC.

The proposed construction site is located in the Kyauk Taing Gan Quarter in the suburbs of Pegu City (77km northeast of Rangoon), and the ownership has already been transferred to ID from Pegu City.

The local natural conditions, the proposed construction site, the existing relevant facilities, and the construction situation were surveyed, considering the subjects of training and test, as mentioned above, and requests from the Burmese side. The results were analyzed, and subsequently the composition of the facilities and equipment coincided with the objectives of the Project have been planned as enumerated below.

Composition of the Facilities

. Administration & Training Building (3,600m²):

Classrooms necessary to accommodate a maximum of 80 persons (4 classes), library, computer room, offices (for 203 staff), multi-purpose hall, and others

. Laboratory Building (2,685m²):

Various types of soil and construction materials testing rooms and hydraulic laboratory and others.

. Dormitory (1,395m²):

Bedrooms for men and women (total 80 persons), guest rooms, cafeteria and others.

. Others (855m²):

Garage, covered walkways and others

The main equipment of the Project will be testing equipment for soil and construction materials tests and for training.

Local construction methods and materials will be adopted as much as possible to extend local portion. And equipment as well as buildings have been planned taking easiness and cost efficiency in maintenance into account.

It is estimated that the construction period will be 15 months. ID will allocate maintenance and administration budget to ITC. The estimated maintenance and administration cost of ITC for the coming 4 years of 8,910,000Ks is within the proper range, compared to the figure 9,110,000Ks, which ID has already appropriated.

Once ITC is established and managed smoothly, the level of irrigation technology in Burma will be enhanced and technological level of engineers will be raised. This will contribute to the development of agriculture, which is the chief industry steering the country economy. Furthermore, it can be expected to contribute to the stabilization of economic development. For these reasons the establishment project of ITC is to be

evaluated as extremely significant, and there is full justification regarding the appropriateness of Japanese grant aid to the Project.

Close communication between ITC and the ID head office, training of full-time teaching staff, establishment of information diffusion systems, and an effort for realization of the Technical Cooperation of the Japanese Government will be necessary to increase the further effect of the Project.

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CHAPTER 1
INTRODUCTION

CHAPTER 1 INTRODUCTION

In response to the request of the Socialist Republic of the Union of Burma to the Government of Japan, the Japan International Cooperation Agency (JICA) dispatched a Preliminary Survey Team to Burma in October, 1985 in connection with the establishment of the Irrigation Technology Center (ITC).

The Team carried out a field survey of the proposed construction site and had discussion concerning the contents of Japanese Grant Aid and Technical Cooperation for the Project. The Burmese side desired an early realization of the grant aid and requested that the Basic Design Study Team be dispatched with all due haste.

In consideration of the fact that earth work and structure construction work is limited only in the dry season, JICA dispatched the Basic Design Study Team in January, 1986 to survey and discuss the following items in connection with the possibility of the grant aid for the Project.

1. Analysis of the background of the Project and its appropriateness.
2. Clarification of the situation of irrigation in Burma, and the role of the Project in the Fifth Four Year Plan.
3. Discussion on the contents of the Project and its scale.
4. Confirmation of implementation organization of the Project, management and administration system of ITC and budget allocation for works undertaken by the Burmese side.
5. Survey of the proposed construction site.
6. Survey of existing facilities similar to ITC
7. Data collection of the construction situation.

This report is based on the above survey in Burma, subsequent analysis held in Japan and discussion on the draft final report held in Burma on May, 1986.

The member list of the Study Team and the Burmese Counterparts, the survey schedule, the Minutes of Discussions and other relevant materials are attached in the ANNEX.

CHAPTER 2
BACKGROUND OF THE PROJECT

CHAPTER 2 BACKGROUND OF THE PROJECT

2-1 Agriculture in Burma

Agriculture in Burma is the mainstay contributing the national economy for more than 45% of GNP and employing 9.1 million people which is 66% of the total work force of 13.8 million.

Of the total land area of 67.7 million hectares, the arable land accounts for merely 12% or 8.3 million hectares and the paddy dominates more than half of the arable land. The major crops are paddy, sesame, groundnut, beans, cotton, maize, etc. and the paddy area in the past five years has remained almost constant. The rapid increase in the production of maize and wheat can be attributed to the expansion of the planted area as well as the increase in unit yield.

The unit yield of paddy has also increased as a result of the Whole Township Program that encourages the use of High Yield Variety (HYV), the systematic application of fertilizer, the efficient water management, the control of plant disease and insects, etc. This Program has made a great contribution to Burma where the paddy remains the major export item and provides the means of livelihood for majority of the population.

The Government of Burma promotes the agricultural policy which aims the increase in farm income and self-sufficiency in food, reduction of the import of cotton, oil and fat, wheat, etc. and strengthening of the competitiveness in the world rice market.

While the productivity increase requires the urgent introduction of HYV for the major crops, the expansion of irrigation systems still lags behind, with the irrigated area remaining a low of 13% of the total arable land as of 1984/85. Lack of irrigation system also constrains the expansion of double cropping area which, at present, accounts for mere 2.1 million hectares or 25% of the total arable land. Consequently the water resource development and its efficient use as well as the expansion and improvement of the irrigation systems are prerequisite for achievement of the crop diversification and the productivity increase.

To cope with this condition, Irrigation Department (ID) has been planning and implementing various irrigation projects while, at the same time, realizing the necessity of advancing irrigation technology and training the irrigation engineers.

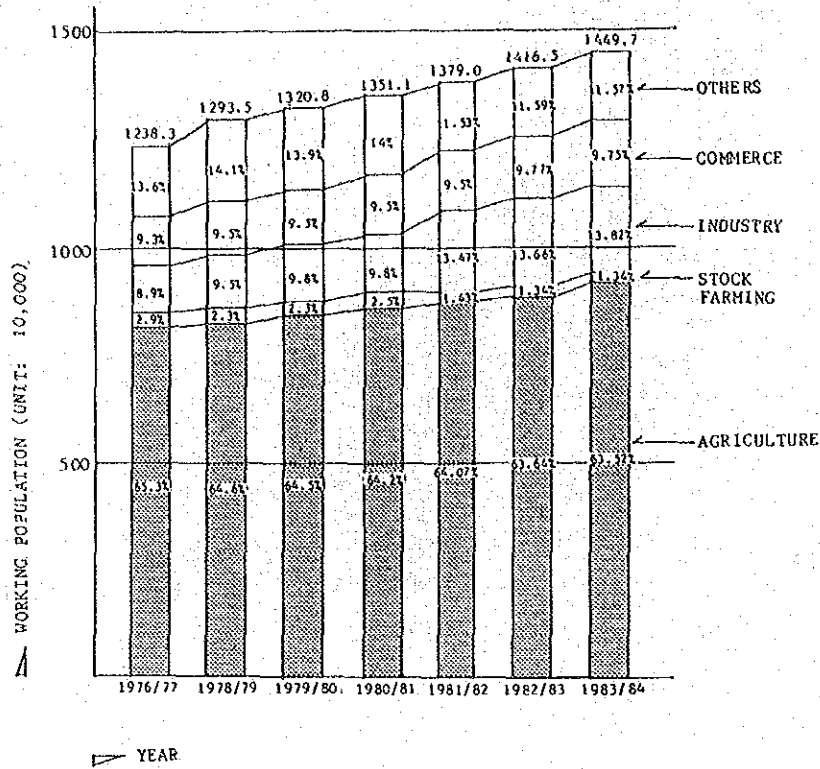


Fig. 2-1 Transition of Work Force

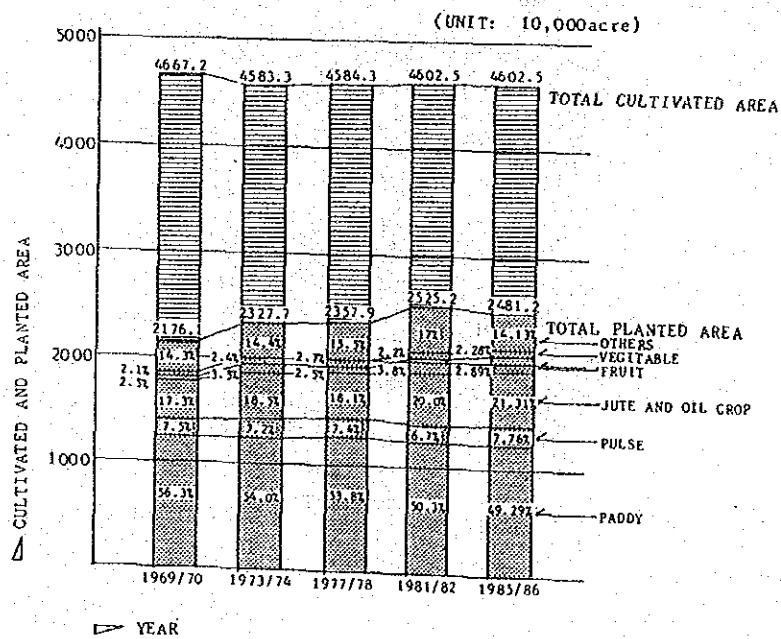
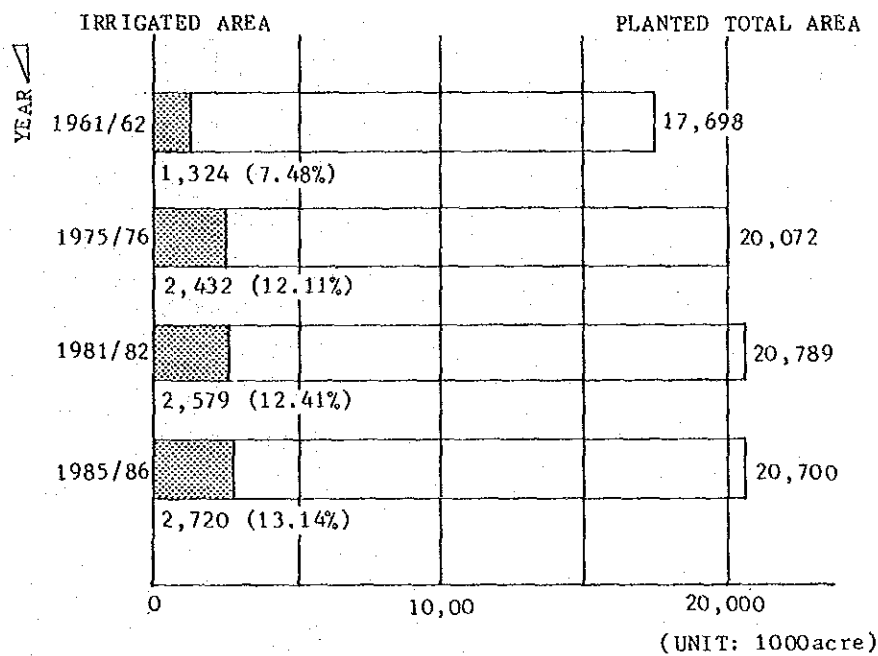


Fig. 2-2 Transition of Utilization of Land

Table 2-1 Comparison of Unit Yield by Countries

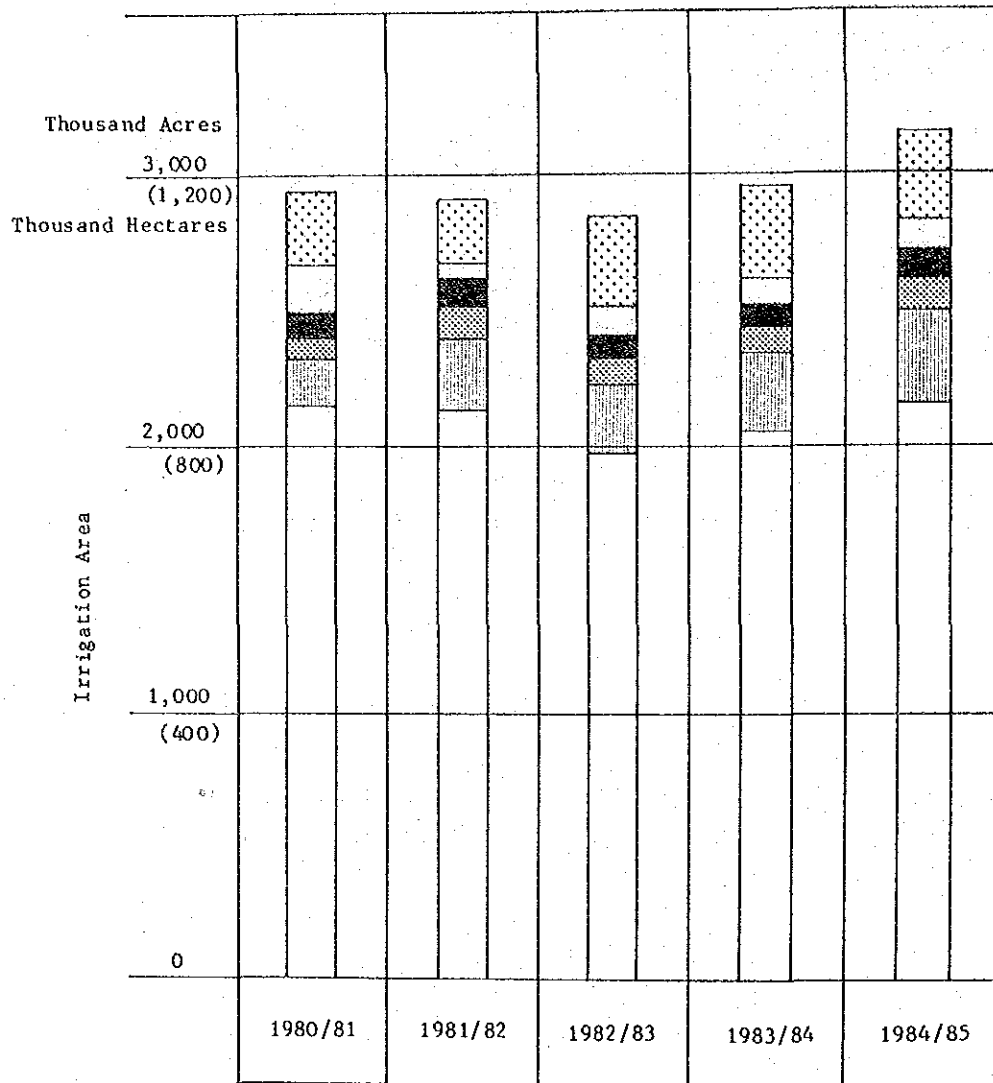
(Source: FAO)

COUNTRY	UNIT YIELD (100kg/ha)		N-P-K MANURE PER AREA (kg/ha)	IRRIGATED AREA (%)	CULTIVATED AREA PER PERSON (ha)
	PADDY	WHEAT			
INDIA	16.2	13.8	16.4	17	0.28
PAKISTAN	23.3	11.9	13.7	65	0.29
BURMA	15.6	5.5	1.8	5	0.64
CHINA	30.9	12.0	39.6	40	0.15
TAIWAN	34.2	—	292.6	58	0.06
JAPAN	58.5	23.1	439.8	55	0.05
U.S.A.	52.5	22.0	82.0	8	0.91



Source: Notes on Agriculture in Burma
Source: ID

Fig. 2-3 Transition of Total Planted Area and Irrigated Area



Source: Report to the Ryithu Hluttaw 1985/86

Fig. 2-4 Irrigated Area by Crops

2-2 Development Plan

2-2-1 New Twenty-Year Plan

The central committee of the Burma Socialist Program Party drew up the basic outline of economic development in 1972 and adopted the guideline of Twenty-Year Long-term Development Plan to start the First Four-Year Plan.

After that, the guideline of superintendence was transferred to the Local Government that revised it to New Twenty-Year Plan (1974/75 - 93/94).

As a part of the New Plan, the Second (1974/75 - 77/78), the Third (1978/79 - 81/82) and the Fourth (1982/83 - 85/86) Four-Year Plan have been implemented in the respective years.

The establishment of ITC has been placed as the most important project for the Fifth Four-Year Plan.

Agriculture has always been accorded the top priority in the New Twenty-Year Plan with the following targets;

1. To attain self-sufficiency in food in response to the growing population
2. To stabilize the supply of agricultural raw materials for the local agro-industries
3. To expand the primary export for improvement of balance of payment

The two primary measures set forth for attainment of the above targets are; i) to encourage the rearrangement of farm area based on the principle of appropriate crop on the appropriate land and increase the unit yield, and ii) to expand the planted area through promotion of double and triple cropping.

The Fourth Four-Year Plan basically followed the targets set out in the Third Plan and places special emphasis on the following seven items:

1. To maintain the sustained economic growth
2. To attain the balanced growth among the different sectors and regions

3. To increase the efficiency and expand the production of the existing agricultural and industrial sectors
4. To expand the transportation sector
5. To promote development and efficient use of the domestic resources
6. To promote the export
7. To restrain the domestic borrowing of the government and introduce the international loan on soft terms

The Government of Burma had set, for the Fourth Plan period, the average target growth rate of 5.4% for the agricultural sector and placed special emphasis on the development of its key industry, i.e., agriculture.

2-2-2 Development Targets in the Agriculture Sector

Following are the measures delineated in the Fourth Four-Year Plan for attainment of targets in the agriculture sector;

1. Adjustment between the cropping pattern and the land use
2. Achievement of the productivity increase in agriculture
3. Improvement in the dissemination of information to the farmers
4. Expansion of extension of agriculture and training programs to the farmers

Among the above measures, emphasis was placed on extension of HYV, intensified use of fertilizer, and expansion of planted area for productivity increase. The Fourth Plan envisaged the expansion of planted area amounting to 0.4 million hectare by reclamation of new farm area, rehabilitation of desolate land, and double and triple cropping. It appeared that the reduction of paddy area as much as 0.2 million hectare could be attributed to promotion of other crops.

In order to increase paddy production by 20% through increase in unit yield, the measures taken were; extension of irrigation systems, application of chemical fertilizer, introduction of HYV, and improvement in such techniques as puddling, transplanting of seedling, weeding, and water control.

2-2-3 Irrigation Project

Agricultural productivity increase was promoted by means of introduction of HYV and expansion of planted area in the Four-Year Plan. The expansion of planted area premises the promotion of multiple cropping based on the improved irrigation system. According to the Five-Year Plan (1986/87-90/91) prepared for external resources and published in December 1985, there are 24 listings of the high priority projects in agriculture, of which six projects are related to irrigation.

ID is planning to embark on 13 projects in the Fifth Four-Year Plan period (1986/87-89/90). The establishment of ITC is included among these projects and the annual budget allocation during the said Plan period has already been made respectively for ID as a whole and for ITC Project. The establishment of ITC has been given the top priority, which confirms the commitment to this project of ID.

Table 2-2 Budget Allocation for Irrigation Department (ID)
- Fifth Four-Year Plan Period -

(unit: Million Kyat)

Year	Total Budget	Foreign Currency Portion of total Budget
1	553.47(13.0)	279.29(10.4)
2	452.31(14.0)	246.07(11.1)
3	464.21(25.1)	209.89(20.1)
4	490.17(35.0)	169.68(30.0)
Total	1,959.86(87.2)	904.95(71.5)

(Source: Irrigation Department)

Note: Figures in parenthesis refer to the allocation to the Irrigation Technology Center (ITC) Project

Table 2-3 Irrigation Projects in the Fifth Four-Year Plan

Sr NO	Name of Project	Size	Cost (US \$ Million)		Benefitted area (acres)	Type of Project	Period of Construction (years)
			Local	Foreign			
1	Rehabilitation of Existing Irrigation System (YE U Canal)	Large	14.7	12.7	121,000	Diversion	6
2	Tank Irrigation Project II	- do -	28.4	13.2	48,000	Irrigation	5
3	Small Scale Irrigation Project	Small	15.0	5.0	15,000	Small Dams	4
4	Yenwe Dam Project	Large	85.2	209.9	118,000	Irrigation, Hydropower	1
5	Ngamoyeik Dam Project	- do -	25.7	22.7	80,000	Irrigation	7
6	Lower Burma Paddy Land Development Project III	- do -	19.6	14.3	222,000	Flood Protection Land Reclamation	6
7	Salin Dam Project	- do -	17.6	15.6	40,000	Irrigation	5
8	Momeik Valley Irrigation Project	Small	2.5	0.2	7,660	Diversion	4
9	Taungmyo Dam Project	Large	30.6	21.0	50,000	Irrigation	5
10	Mon Chaung Dam Project	Medium	5.8	5.9	9,000	Irrigation	4
11	Mindon Irrigation Project	- do -	7.5	5.6	10,000	Diversion	4
12	Rekhine Water Resources Development Project	- do -	11.6	8.8	25,000	Irrigation	5
13	Irrigation Technology Centre	- do -	2.0	8.9	-	Institutional Strengthening	2

Source: Irrigation Department

2-3 Present Conditions of Irrigation Department

2-3-1 Function, Organization of Irrigation Department (ID)

(1) Function

ID is a sole organization which employs irrigation engineers in Burma and the scope of its activities includes investigation, planning, surveying, design and construction in respect to irrigation and drainage, flood protection, river improvement, security of navigation by river or channel and operation and maintenance for respective facilities. Furthermore, ID is collecting meteorological and hydrological data by providing observation stations of its own.

Therefore, ID is the biggest organization on water resources development in Burma, which independently carries out all services in respect to implementation of irrigation projects.

(2) Organization

The ID consists of the head office, 5 branch offices, 17 regional offices and 3 workshops. The organization of ID is shown in Fig. 2-4. The total number of the staff amounts to 25,150, out of which regular staff are 14,148 and temporary staffs are 11,002.

2-3-2 Present Activities of Irrigation Department (ID)

Major current activities and subjects to be solved in the ID are listed as follows:

(1) Present Status of Computer Application (Existing computer facilities)

The ID's existing computer facilities as of February 1986 are shown in Table 2-5.

Table 2-5 Existing Computer Facilities

Computer	Nos	Equipped in	Major Dimension	Remark
PRESTO	1	'85 Aug.	CPU 360KB 16MB Hard-Disk FDD 8"x2+5"x1 CRX-1100x2	Head Office
CROMEMCO	2	'81 June	CPU 64KB 10MB Hard-Disk	Paddy Project
TRS-80II	1	'82 Sep.	CPU 64KB	Pump Irri. Project

The PRESTO system installed at the Head Office has been operated for 12 to 16 hours a day mainly for scientific data processing of the Planning & Design Circle, and not used for administrative works mainly due to the lack of memory capacity.

On the other hand, the PDP 11/70 system of the Rangoon University Computer Center (UCC) has been open free of charge to the governmental users. Represented by the Hydrology Division, ID has a right to utilize the UCC computer within the limit of eight hours a month. However, the actual achievement of computer utilization is reported as about 15 minutes per week and it has been completely discontinued after 1982, since the UCC computer has always been occupied by other users.

The Hydrology Division, which manages a numerous volume of hydro-meteorological data collected, processed and retrieved, has accumulated about 26,624 station-year of data by the end of 1985, inclusive of those collected from the Meteorological and Hydrological Department. These data up to 1982 have already been recorded and stored on 120 magnetic tapes through the UCC computer. However the remaining data after 1982 have been left in the form of cording sheets, because the utilization of the UCC computer is quite limited or, as a matter of fact, almost impossible. The volume of data kept by the Hydrology Division at present is, according to the existing data format, estimated at about 65MB.

The items for the present computer application are reported as follows,

- . Earthwork computation
- . Slope stability analysis
- . Discharge computation by flow formula
- . Pipeline network analysis
- . Streamflow computation by rating curve
- . Sediment flow analysis
- . Compilation and maintenance of rainfall record
- . Compilation and maintenance of meteorological data
- . Compilation and maintenance of hydrological data
- . Run off analysis
- . Complement of missing data
- . Regression analysis
- . Reservoir operation study
- . Water balance study
- . Frequency or probability analysis
- . Backwater profile (non-uniform flow)
- . Flood analysis and flood routing
- . Simulation study (Polder-dyke drainage simulation)
- . Benefit-cost analysis

Computer programs developed by the ID staff cover the above mentioned subjects, and one to five programs are prepared in compliance with the method of analysis. These programs are, however, written in various levels of computer language such as BASIC and FORTRAN in response to the available computer systems in the past, and so they are to be converted in conformity with the proposed computer systems.

UCC has been comprehending the utilization of computer systems in the entire Burma, and has been executing supporting services inclusive of installation, adjustment, maintenance and system design at the request of the users. Regarding maintenance works of the computer systems, the UCC has accumulated many experiences especially for mini-computer as well as for personal computer systems, and no serious problem has been reported. In connection with this, the PRESTO system in the Head Office of ID was installed, adjusted and has been maintained by UCC.

(2) Soil and Construction Materials Test

In order to construct irrigation facilities efficiently, it is necessary to utilize the results of respective tests such as physical and dynamic tests on soil, sand, gravel, concrete and water in design and construction method. In Burma, soil tests play a vitally important role in the fill-type dams in designing of an irrigation facility.

ID provides only the soil test equipment installed in 1978 in a space included in the ID Hydraulic Model Test Building which was constructed in 1967. The laboratory is composed of soil, concrete, water quality testing rooms and the total floor area is about 720 sq.m.

The quantity of the testing equipment provided by ID at present is quite insufficient to meet increasing requirements in future.

The sampling method of soil material is based on excavation of the test pit, however, undisturbed sampling is impossible at the high ground water level.

In respect to concrete testing, only the compression testing machine is available and other equipment are deteriorated or out of use due to lack of spare parts or operation manuals.

As for water quality tests, any tests have not been performed due to lack of equipment and reagents. At present, ID, therefore, has been dependent for all of the tests upon an organization of the Agricultural Corporation.

The said organization, however, has been working at the maximum of its capacity, causing considerable inconvenience in taking three to six months for finishing one test.

(3) Hydraulic Model Test

In designing hydraulic structures, simulation by hydraulic model tests is inevitably required to research hydraulic phenomena from a view point of overall planning or systems.

The ID's hydraulic laboratory exists in Rangoon, where only two hydraulic model tests for shoot and spillway structures were executed in the past during the years 1982 and 1983. Although the necessity of the model test is actually realized, no experiment has been carried out afterwards due to the lack of materials, capable engineers and budget, and facilities as well as the shed have become superannuated.

(4) Staff Training

In the ID, there exists no periodical or permanent training program for engineering staff, and technical knowledge is being transferred only through individual channels at the respective office or section from the senior engineer to the junior or assistant engineer. With this circumstance, in spite that engineers are highly educated, their specialities are quite specified and limited to the area in which they are engaged for a relatively long period.

2-4 Background of the Request

Development of agriculture has been accorded the highest priority by the Government of Burma where the agriculture is the mainstay of its economy employing about 66% of the total work force. However, since the production increase in agriculture by way of expansion of planted area requires a massive investment, emphasis in the Fourth Four-Year Plan (1982/83-85/86) has been shifted from the areal expansion to the intensified production through HYV and to the increase in land productivity through multiple cropping. Further important issues to be tackled during the Fifth Four-Year Plan period are promotion of irrigated agriculture and training of qualified engineers.

Under these circumstances, the Government of Burma has planned to establish the ITC. Then, the Government of Burma made a request for grant aid and project type Technical Cooperation to the Japanese government.

The original request is summarized as follows;

1. Objectives

The establishment of the ITC for the purpose of upgrading irrigation technology through such activities are as follows.

- . To collect and compile information and data
- . To prepare design criteria/standards
- . To provide reliable data and test result
- . To test construction materials and to make recommendations
- . To simulate hydraulic reaction
- . To conduct training for irrigation engineers
- . To upgrade operation and maintenance activities for heavy construction machinery

2. Executing Agency

The Irrigation Department(ID) of the Ministry of Agriculture and Forests

3. Proposed Construction Site

Kyauk Taing Gan Quarter of Pegu Division

4. Facilities

- . Administration Building Complex
- . Training Center
- . Hydraulic Model Testing Unit
- . Soil Mechanics Testing Unit
- . Construction Material Testing Unit
- . Dormitory
- . Workshop for Heavy Construction Machinery

5. Equipment

- . Hydraulic Model Testing Equipment
- . Soil and Construction Material Testing Equipment
- . Computer
- . Heavy Construction Machinery Workshop Equipment
- . Training and Other Workshop Equipment