

No.

**Myanmar**  
**ITC Project Phase II and Follow-up**  
**Ex-Post Evaluation Study Report**



Myanmar ITC Project Phase II and Follow-up Ex-Post Evaluation Study Report

March 2008 JICA

**March 2008**

**Myanmar Office**  
**Japan International Cooperation Agency**

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**Myanmar**

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## Preface

This Ex-post evaluation study was conducted to review the ITC Phase II Project and its Follow-up after 3 years of its termination focusing on impact and sustainability of the project including ex-post performance of the project by its own capacity.

Since 1992, the government of Myanmar has promoted dam and reservoir construction to fulfil water requirement of agriculture use. Due to the lack of proper irrigation plans and water management technologies, however, capacity of the dams and reservoirs could not be utilized as expected.

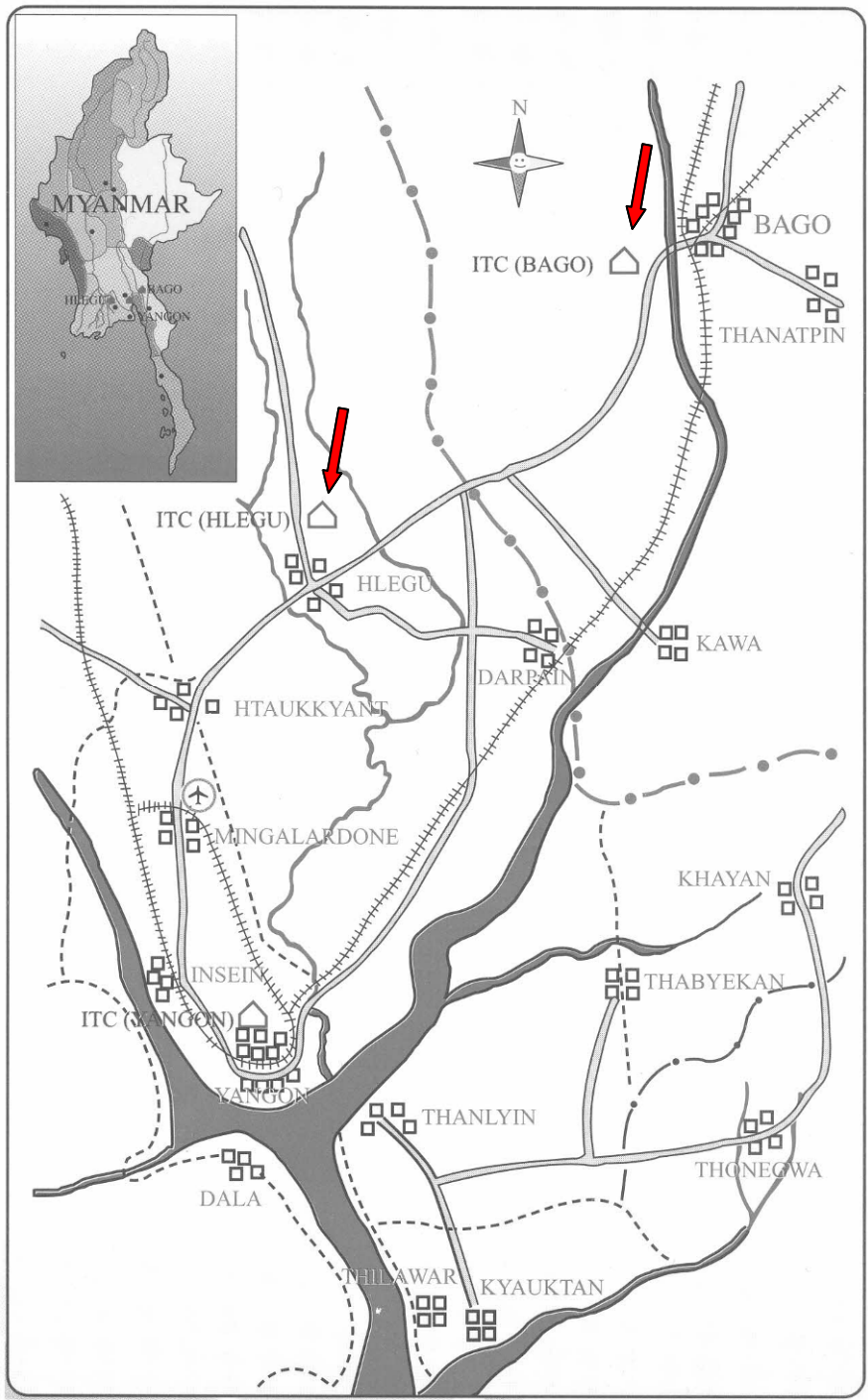
To fill the gap, the Government of Myanmar requested the Government of Japan to support irrigation technology development especially in water management. As per the request, JICA extended its technical cooperation on requested field of expertise with a view to improve agricultural productivity in Myanmar through efficient water use especially in the Ngamoeyeik area as a model for the applying water management technology and its related fields.

The main activity of the project is to nurture Myanmar counterpart personnel to equipment with sound knowledge and experiences on Water Management and its related fields in order to train maintenance offices' staff of ID and farmers of the project areas in order to meet overall of goal and projective.

This evaluation study was conducted by JICA evaluation team in cooperation with officials concerned of Irrigation Department in Yangon and counterpart personnel of Irrigation Technology Centre in Bago and Sub-office in Hlegu, officers of Maintenance offices and farmers

Japan International Cooperation Agency (JICA)  
Myanmar Office

### Location Map of ITC in Bago and Hlegu



Photos (Extensive type test farm site in Zalettaw for the Intermediate Goal Area Project)



1. Photo used for GIS

2. Location of branch channels



3. Irrigation system map for the test farm

4. Right branch channel, photographed Sept. 2007



5. Plots in the test farm

6. Farmers' training in Zalettaw

Source of photos No. 1, 2 and 6: ITC, 2007

## Abbreviations and Key Information

MOAI: Ministry of Agriculture and Irrigation  
 ID: Irrigation Department  
 ITC: Irrigation Technology Center  
 IGA: Intermediate Goal Areas  
 MAS: Myanmar Agriculture Service  
 SLRD: Settlement and Land Records Department  
 MNPED: Ministry of National Planning and Economic Development

Target area in ITC Project Phase II (April 1999 – January 2005): Ngamoyeik  
 Target areas in IGA Project (April 2005 – March 2010): Zalettaw, Tabuhla and Mazin

Intensive type: test farm construction involves rezoning of paddy plots  
 Extensive type: test farm leaves plot-to-plot irrigation and has different watercourse density

### Double cropping system in Zalettaw

Rain-fed paddy (Monsoon Paddy)	June to October
Summer paddy (Paddy sown during dry season with Irrigation water)	November to April
Other crops	Same as summer paddy

### Proportion of Agriculture Sector contribution to GDP

Year	1988/89	2000/01	2001/02	2002/03	2003/04	2004/05
Agriculture	38.5%	33.6%	48.0%	44.3%	42.5%	41.2%

MNPED, Central Statistical Organization, 2006

### Coverage of Irrigated Area in Myanmar (000 ha)

Year	1988/89	2001/02	2003/04	2005/06
Net Area Sown	8,055	10,654	11,043	11,877
Net Irrigated Area	1,018	1,985	1,960	2,235
% of Net Irrigated Area	12.6	18.6	17.7	18.8
Multiple Cropping Irrigated Area	151	539	611	733
% of Gross Irrigated Area	14.8	27.2	31.2	32.8

Agriculture at a Glance 2006 (MoAI)

### Prices of Rice at Harvest Time (Kyats/MT)

Year	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06
Ngasein	15,826	15,826	73,044	54,783	58,435	58,435
Medone	18,261	18,261	99,827	75,966	80,348	85,218
Emata	16,557	16,557	77,914	63,305	73,044	86,679
Ngakywe	19,478	19,478	109,566	80,348	85,218	92,522
Kauknyin	19,478	19,478	163,132	211,828	168,001	187,480

MOAI, 2006 (Kauknyin is sticky rice. All others are ordinary rice.)

Fiscal year: April to March

50 Basket=around 1 metric ton (MT)

2.47 Acre=1 Ha.

One US\$ = 1,300 Kyats (unofficial rate for small banknotes) as of September 2007

## Ex-post Evaluation Summary Sheet

Evaluation conducted by: JICA Myanmar Office

<b>1. Outline of the Project</b>	
<b>Country:</b> Myanmar	<b>Project Title:</b> Irrigation Technology Centre Project Phase II
<b>Issue/sector:</b> Agriculture Sector	<b>Cooperation scheme:</b> Project Type Technical Cooperation
<b>Division in charge:</b> Agricultural Technical Cooperation Division, Agricultural Development and Cooperation Department	<b>Total cost:</b> 630 Millions JPY (Phase II)
<b>Period of cooperation:</b> Phase II: (1999 to 2004) Follow-up: (2004 to 2005)	<b>Partner Country's Implementing Organization:</b> Irrigation Technology Centre
	<b>Supporting organization in Japan:</b> Ministry of Agriculture, Forestry and Fisheries
<b>Related cooperation:</b> Irrigation Technology Centre Project Phase I (1988 to 1998)	
<p><b>1-1 Background of the project:</b></p> <p>Agriculture has been the backbone of Myanmar economy, accounting for 52% of GDP and taking up 63% of workforce. With agricultural development being prioritized in national economic plans, the government had developed irrigation facilities throughout the country since 1992 in order to increase agricultural productivity through expansion of irrigation areas. Irrigation water, however, couldn't always reach every part of irrigable areas due to lack of satisfactory irrigation plans or proper water management technology.</p> <p>Against this background, towards achieving stable and increased agricultural production, Myanmar government requested the Irrigation Technology Centre project "Phase II", aiming at further expansion of irrigation areas and continued development of outputs from ITC project Phase I. After the completion of Phase II, "Follow-up" was carried out to finalize the technical book, one of major Phase II outputs.</p> <p>This ex-post evaluation was conducted on the Phase II and Follow-up with main focus on Impacts and Sustainability among five evaluation criteria.</p>	
<p><b>1-2 Project overview (Phase II)</b></p> <p>The Phase II was based at the Irrigation Technology Centre (ITC) in Bago and implemented in Ngamoeyeik project area in Hlegu by setting up test farms.</p> <p>(1) <u>Overall Goal</u> To raise agriculture productivity through improvement of irrigation technology (the goal to be achieved in about 10 years or more after the end of Phase II)</p> <p>(2) <u>Intermediate Goal</u> To establish appropriate water management technology in the three irrigation areas: Tabuhla, Zalettaw and Mazin ( The Intermediate Goal was introduced during the mid-term evaluation in November 2001 to be achieved in about 5 years after the end of Phase II and to bridge across the wide gap between the Project Purpose and Overall Goal)</p> <p>(3) <u>Project Purpose</u> To upgrade the irrigation technology especially in water management in Ngamoeyeik Project Area as a model, applying the basic irrigation technology which was achieved through the Phase I Project</p> <p>(4) <u>Outputs</u></p> <ol style="list-style-type: none"> <li>1) Irrigation technology of water management and maintenance in main facilities is improved.</li> <li>2) Study method for water management of terminal irrigation system is improved.</li> <li>3) Technical supporting system for water management is improved.</li> <li>4) Irrigation information management technology is improved to monitor irrigation projects.</li> <li>5) Water management technology is disseminated to technical staff of Irrigation Department and farmers in test farm through training</li> </ol> <p>(5) <u>Inputs</u> (Japan) Long-term expert: 13 persons, Short-term expert: 19 persons, Training in Japan: 29 persons, Equipment around 772 thousands US\$, Local cost 500 thousands US\$ (Myanmar) Project counterpart: 35 persons, Project operation costs around 2 millions Kyat</p>	

<b>2. Evaluation Team</b>		
Members of Evaluation Team	(1) Mr. Hiroyuki Okuda, Project Formulation Advisor, JICA Myanmar Office (2) Mr. Kyaw Lwin Oo, Program Officer, JICA Myanmar Office (3) Mr. Toyomitsu Terao, Consultant, Fisheries Engineering Co., Ltd.	
<b>Period of Evaluation</b>	September 24, 2007 to October 8, 2007	<b>Type of evaluation:</b> Ex-Post
<b>3. Ex-post Project Performance</b>		
<b>3-1 Ex-post Performance of Project Purpose</b>		
<p>In Ngamoeyeik area during Phase II, Intensive Type test farms (15 plots, 62 acres) and Extensive Type test farms (36 plots, 310 acres) were constructed and relevant water management technologies were transferred. Activities in test farms are being implemented under the supervision of the Yangon Division Irrigation Maintenance Office to which ITC handed over all related responsibilities after Phase II. The technical book produced by Phase II (Follow-up) are highly appraised as useful for improving water management in training for Irrigation Department staff and farmers.</p>		
<b>3-2 Achievement related to Intermediate Goal</b>		
<p>After the Phase II and Follow-up, ITC started the Intermediate Goal Area (IGA) project in April 2005 by using its own resources to achieve the Intermediate Goal by March 2010. ITC has applied the five outputs of Phase II achieved in Ngamoeyeik, except intensive type test farm study, to improve the water management in three project areas (Tabuhla, Zalettaw, Mazin). IGA project is still halfway to its project term but achievements to date are adequate. Construction work of Zalettaw test farms (130 acres) was completed by March 2007 and test farm study will start in the next summer paddy around November 2007. Tabuhla test farm site (230 acres) was selected and its construction will start around the same time. Information and data collection for comparison study, training materials and preparation of technical books are on going. The intermediate goal will be achieved in Zalettaw and Tabuhla where activities precede as planned.</p>		
<b>3-3. Achievement related to Overall Goal</b>		
<p>Progress of IGA project is nothing but the achievement related to Overall Goal but even today there is still a wide gap between the Intermediate Goal and Overall Goal and it is still difficult for ITC to attain the Overall Goal, whose target are more than 300 irrigation areas in the whole country, within about 10 years. Towards achieving the Overall Goal, however, ITC has been conducting trainings and workshops on water management for ID staff and farmers throughout the country, not limited to the Intermediate Goal Areas.</p>		
<b>3-4 Follow-up of the Recommendations by Terminal Evaluation Study</b>		
<p>At the terminal evaluation in September 2003, three recommendations were made; 1)follow-up of Phase II to complete technical book, 2)training of agronomy for farming and 3)utilization of the equipment delivered. All the three recommendations were carried out.</p>		
<b>4. Results of Evaluation</b>		
<b>4-1. Impact</b>		
<p>The impact of improved irrigation technology on increased total yields (Indicator for Overall Goal) is a consequential, logical expectation but hasn't been observed yet in four project areas (Ngamoeyeik, Zalettaw, Mazin and Tabuhla). In recognition of the fact that rice yield is affected by not only irrigation water but also many other factors, cropping intensity is suggested as an alternative indicator. Data of the four irrigation areas shows higher cropping intensities than the union average and that their cropping intensities are on the increase by year. The data indicates that the improvement of irrigation technology is realizing expected impacts.</p> <p>The Phase II and IGA has also produced other significant, positive impacts. A water user group in Ngamoeyik area is activated, conducting regular meeting, managing conflicts among farmers, and providing voluntary maintenance of irrigation facilities. Workload of ID staff is reduced accordingly. Technical confidence of ITC staff are raised through implementation of IGA project for themselves.</p>		
<b>4-2. Sustainability</b>		
<ul style="list-style-type: none"> <li>• Sustainability from technical perspective is largely high. Transferred irrigation techniques are well sustained and steadily applied to the IGA project where adequate progress is observed.</li> <li>• Sustainability from institutional perspective is high. Among the total 24 staff officers of ITC, 11 are assigned for the implementation of IGA project and they all are former counterparts of Phase II.</li> <li>• Sustainability from financial perspective is high considering the budget allocation to ITC. The lack of foreign currency, however, becomes an increasing hindrance for ITC to maintain and continue to utilize laboratory equipment.</li> </ul>		



#### **4-3. Factors that have promoted the project**

##### (1) Impact

- Introduction of the Intermediate Goal provided a clear goal and timeframe for ITC to carry on the improvement of water management technology after the Phase II
- Rice quota system to the government was eased to a large extent in 1989 and completely abolished in 2003, resulting in the increased prices of rice at harvest time and providing incentive for farmers on rice production.

##### (2) Sustainability

- Three contributing factors to sustainability are noticed: constant budget allocation to ITC, assignment of former project counterparts to IGA project, efforts on maintenance of facilities and equipment against aging degradation

#### **4-4. Factors that have inhibited the project**

##### (1) Impact

A concrete plan doesn't exist on how ITC continuously strengthens its capacity and advance water management technology so that the current ITC activities can be accelerated towards achieving the Overall Goal.

##### (2) Sustainability

Unavailability of spare parts and consumables of laboratory equipment, due to the shortage in ID of foreign currencies to purchase them, has influenced and will further affect the operation of ITC

#### **4-5. Conclusion**

The ex-post project performance of the Phase II is kept high. It is possible for ITC to achieve the Intermediate Goal by its target year of 2010. The production of technical books for each irrigation area is in progress and can be completed as planned in Zalettaw and Mazin areas. It is difficult for ITC to attain the Overall Goal because of its far-reaching scope and set timeframe of about 10 years. There are, however, many positive impacts observed after Phase II toward achieving the Overall Goal in terms of capacity of ITC staff and activity of Water User Association. In line with its main mandate of providing technical supports to irrigation projects and of conducting training for ID staff and farmers, ITC is currently trying to identify a feasible way to extend its technical support to more than 300 irrigation areas throughout the country.

### **5. Recommendations and Lessons Learned**

#### **5-1. Recommendations**

For ITC, it is recommended that;

- ITC balance human resources and allocation of assignments among sections to adjust the difference of workload which has been realized during the course of IGA implementation.
- ITC strengthen its capacity for research and development to further promote irrigation technologies to suit with local conditions at low-cost and in a viable way at field level, as well as to maximize the effectiveness of training on ID staff and farmers.
- ITC continue accurate and constant data collection of crop production including paddy in project areas in collaboration with MAS and SLRD, who compose working groups for IGA implementation along with ITC.

For ID, it is recommended that;

- ID explore a possibility of whether experts of relevant technical fields can be invited to ITC for reviewing its current organizational capacity and for suggesting feasible ways to accelerate current ITC activities.
- ID consider to capacitate the Upper Myanmar ITC with proper mandate and role, financial and human resources so that it can provide water management trainings for ID staff and farmers along with ITC Bago.
- ID help ITC staff improve their technical expertise in each respective field through opportunities such as attending technical training, seminar and workshop in abroad as well as in-country.

For JICA, it is recommended that;

- JICA assist ITC in acquiring spare parts and consumables for and in repairing of test instruments and laboratory equipment, which has been impossible due to the shortage of foreign currencies in ITC especially in recent years.

#### **5-2. Lessons learned**

- Farmer participation to water management is demonstrated important as the mobilization of a water user association through farmers training has realized several, significant impacts.
- Introduction of Intermediate Goal is beneficial, when a wide gap between Project Purpose and Overall Goal is identified, for counterparts and JICA to make the process visible and clear for attaining the Overall Goal.
- Observed difficulty of achieving the Overall Goal is attributed to the way the Overall Goal and its indicators were set, instead of due to current project activities. Revision of the Overall Goal can be considered during evaluation.

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The third party review by an external expert

## 1. OUTLINE OF THE EVALUATION STUDY

### 1.1 Project Background

Agriculture has been the backbone of Myanmar economy and important for national development. The population of Myanmar is 52 Million. 75% of the total population reside in rural areas and 63% of workforce is engaged in agriculture. Agricultural development is important to promote the welfare of rural communities. To increase the productivity of agricultural sector, the government has prioritized the development of infrastructure, in particular that of irrigation systems to enable cropping in the dry season as well as to stabilize rice production. Although the government has developed irrigation facilities throughout the country under the Summer Paddy Production Program since 1992, irrigable plots couldn't be adequately irrigated as initially planned due to the lack of satisfactory irrigation plans and proper water management technology.

To support the government in developing irrigation projects, **Irrigation Technology Centre (ITC)** was constructed in 1988 by the grant aid of Japan. Based at ITC, JICA launched a technical cooperation project that resulted in two-phase and continued for 17 years. The ITC Project **Phase I** (1988 - 1998) aimed at improving irrigation technology through activities such as collection and analysis of technical data, preparation of design criteria for irrigation facilities, test and analysis on soil and construction materials, and training of irrigation engineers. The ITC Project **Phase II** (1999 - 2004) was to upgrade the irrigation technology especially in water management in Ngamoeyeik as a model area to apply the basic irrigation technologies which were achieved through the Phase I. In the Phase II, outputs were set in five technical fields; water management for main facilities, water management for terminal facilities, system development, irrigation information management and training. **The Follow-up** (2004 - 2005) for the Phase II started to finalize some remained activities. This ex-post evaluation was conducted on the Phase II and Follow-up in September through October 2007.

### 1.2 Project Overview

The Phase II started on 1 April 1999 following the signing of the Record of Discussion on 19 December 1998. During its mid-term evaluation, the revision of the original Project Design Matrix (PDM) was proposed and accepted at the Joint Coordinating Committee held on 16 November 2001. The main purpose of PDM revision was as follows;

- 1) To clarify the range of **Project Purpose** of upgrading irrigation technology for rice paddy, the words "in Ngamoeyeik Project Area as a model" was added.
- 2) When the Phase II was formulated, the **Overall Goal** was set to be attained in 10 to 20 years after the end of project. Along with the meaning of Overall Goal refined in JICA during the course of the project, the Overall Goal became defined to be achieved within 5 to 10 years after the end of project. To adjust the time frame of achieving the project goal, the mid-term evaluation study concluded that the **Intermediate Goal** be introduced to PDM as an actual replacement of the original Overall Goal.

It was based on the understanding that the original Overall Goal was meant to be achieved in the whole country and not only in the Phase II model area (Ngamoeyeik). The mid-term evaluation study also respected the description of original Overall Goal and left that in the revised PDM. The Intermediate Goal was expected to bridge across the Project Purpose and Overall Goal. The revised PDM was used for the terminal evaluation in September 2003 as PDMe attached in Annex 1.

Overall Goal	To raise agriculture productivity through improvement of irrigation technology (The goal to be achieved in about 10 years or more after the end of Phase II)
Intermediate Goal	To establish appropriate water management technology in the three irrigation areas; <b>Tabuhla, Zalettaw, and Mazin</b> (The goal to be achieved in about 5 years after the end of Phase II)
Project Purpose	To upgrade the irrigation technology especially in water management in <b>Ngamoeyeik</b> Project Area as a model, applying the basic irrigation technology which was achieved through the Phase I Project

Source: PDMe (22 August 2003), see Annex 1.

Throughout the Phase I, Phase II and Follow-up, ITC was the implementing agency of project activities. ITC is a subordinate institution under the Design Branch of Irrigation Department (ID) of Ministry of Agriculture and Irrigation (MOAI). Its institutional structure is provided in Annex 6 and Annex 7, remaining unchanged since the Phase II and Follow-up.

Upon completion of the Phase II and Follow-up, ITC/ID started the **Intermediate Goal Area (IGA) project** in April 2005 by using its own resources to achieve the Intermediate Goal by March 2010. ITC has applied the five outputs of Phase II achieved in Ngamoeyeik model area, except intensive type test farm study, to improve irrigation technologies in the three project areas (Tabuhla, Zalettaw, Mazin).

#### Summary information of project area

Irrigation Area	Location	Irrigable Area (Acre)	Open Year	Test farm (Acre)	
				Intensive	Extensive
Ngamoeyeik	Hlegu TS, Yangon Div.	40,894	Mar. 1995	62	310
Tabuhla	Taikkyi TS, Yangon Div.	39,214	May 1995	-	230
Zalettaw	Bago TS, Bago Div.	1,790	May 1998	-	130
Mazin	Bago TS, Bago Div.	675	May 1999	-	0

### 1.3 Study Objectives

The objectives of the ex-post evaluation study are twofold: (i) to assess the impact and sustainability of the Phase II and Follow-up, and (ii) to summarize recommendations and lessons learned from the result of evaluation that can be utilized by JICA and counterpart agencies in Myanmar in planning and implementing similar projects in the future.

## 1.4 Scope of Work

In accordance with the Ex-Post Evaluation Guideline for Overseas Offices (JICA, March 2007), the evaluation grids and questionnaire were prepared by the consultant. A series of interview with ITC/ID, group discussions with the former project counterparts in ITC and field study on Ngamoyeik, Zalettaw, and Mazin were conducted from 24 September to 8 October 2007 by the consultant. Outline of the study results was drafted by the consultant and commented by the ITC and JICA Myanmar Office.

The evaluation study focuses on **ex-post project performance, impact and sustainability**. The ex-post project performance was studied in terms of project activities and their continuance after the termination of the cooperation. The two evaluation criteria (impacts and sustainability) were highlighted according to the above-mentioned Guideline. In addition, the probability to achieve the Intermediate Goal was also studied.

## 1.5 Constraints of the Study

Due to a civil unrest occurred in Myanmar including Yangon in late September through early October, site visit to Tabuhla, one of the target areas of the IGA, couldn't be conducted by the consultant as initially planned. The cancellation of Tabuhla site visit didn't have major influence on the assessment study of IGA progress because in Tabuhla only survey work on present water management and facility is underway and activities on water management hasn't started yet.

## 1.6 Evaluation Team

Mr. Toyomitsu Terao, a consultant from Fisheries Engineering Co., Ltd., was hired for the assignment of evaluation study. Mr. Hiroyuki Okuda, Project Formulation Advisor, and Mr. Kyaw Lwin Oo, Program Officer of JICA Myanmar Office formed an evaluation study team along with the consultant.

## 2. METHODOLOGY

### 2.1 Evaluation Questions

Main evaluation questions are listed in the Evaluation Grids with Findings (Annex 2) and the Questionnaire (Annex 3). The summary of questions prepared prior to the field studies are as follows.

#### Impacts

- (1) Probability of achievement of the overall goal in the country - Increase of total yields in irrigated fields through efficient irrigation water use, cropping intensity and alternative information to answer the question
- (2) Probability of achievement of the intermediate goal in three target areas - Development process to draft the technical books for three target areas, training materials and training plans for three target areas, records of the training for personnel involved in three target areas, activities of the Implementing

Committee for IGA

Sustainability

- (1) Policy and administration system - Effects of the abolishment of rice quota system in 2003, economic effects on farmers in lower Myanmar
- (2) Institutional and financial side - Budgetary support to ITC, staff status for project operation in ITC, continued or discontinued achievements of the 5 project outputs
- (3) Technical side - Any technical constraints upon sustaining the operation of ITC and irrigation maintenance authorities

2.2 Methodology

The evaluation was designed mainly based on the following documents.

- The Evaluation Report on the Irrigation Technology Center Project Phase II in the Union of Myanmar, September 2003, JICA
- Project Completion Report of Irrigation Technology Center Project Phase II (Follow-up), January 2005, ITC and JICA
- Project Design Matrix of the above project (PDMe), 22 August 2003
- Ex-post Evaluation Guideline For Overseas Offices (Draft), March 2007, JICA

The **PDM** (as attached in Annex I) is a technical tool used in the Project Cycle Management(PCM) and shows a logical sequence among overall goal, project purpose, outputs and activities, together with inputs of project resources. In mid-term and terminal evaluation, projects are assessed in terms of five criteria; relevance, effectiveness, efficiency, impacts and sustainability. In case of ex-post evaluation, the assessment is conducted with two criteria; impacts and sustainability. The matrix below shows a relationship of key elements of PDM to their relevant evaluation criteria.

Basic idea of five evaluation criteria

	Relevance	Effectiveness	Efficiency	Impacts	Sustainability
Overall goal	Are the "project purpose" and "overall goal" still meaningful as objectives at the time of evaluation?	Whether the "project purpose" has been achieved, and how much contribution did "outputs" make?	To what extent have "inputs" been converted to "outputs"?	What positive and negative effects, either direct or indirect has the implementation of the project had?	To what extent will the recipient country's organizations be able to retain the positive effects of the project after the withdrawal of cooperation?
Project purpose					
Outputs					
Inputs					

Source: “*Monitoring and Evaluation Based on the PCM Method*”, FASID, March 2000

### 2.3 Schedule of the Study

The ex-post evaluation study was conducted in Myanmar from 24 September to 8 October 2007. Details of the study itinerary (Annex 5) and list of interviewees and main attendants of meetings (Annex 4) are attached.

## 3. EX-POST PROJECT PERFORMANCE

### 3.1 Performance of Project Purpose

ITC continues to carry out its tasks to further promote the Project Purpose and towards attaining the Overall Goal after the termination of Phase II in 2005. The Phase II produced five outputs in Ngamoeyeik project area. In this study, the continuation of outputs in the Ngamoeyeik irrigated area and present activities of ITC on IGA Project were assessed for the ex-post project performance.

In **Ngamoeyeik** (Yangon Division) during Phase II, construction of minor water channels, land levelling and farm roads for 15 **intensive type** test farms (62 acres) and 36 **extensive type** test farms (310 acres) were carried out. The ITC Hlegu Sub-Office was also constructed during Phase II. After the Phase II termination, activities in Ngamoeyeik model area are being implemented under the supervision of the Yangon Division Irrigation Maintenance Office to which ITC handed over all related responsibilities after Phase II. Farmers continue to grow summer paddy in both intensive and extensive type test farms. Farmers in intensive type test farms have controlled water individually and had a higher rice yield in FY 2007 compared with extensive type. Farmers in extensive type farms have developed small canals by themselves and actual irrigated area increased from 230-240 acres before 2005 to 310 acres today. ITC provides Yangon Division Irrigation Maintenance Office with technical supports to improve the irrigation system of the entire Ngamoeyeik irrigated area. Some photos are attached to show farmers’ active participation in water management in Ngamoeyeik after Phase II. (Annex 13)

The **IGA** project started in April 2005 to improve the water management in the three Intermediate Goal Areas; **Zalettaw** and **Mazin** (Bago Division) and **Tabuhla** (Yangon Division) through technologies achieved in Phase II. Tabula reservoir is located in Yangon Division and Zalettaw and Mazin Dams are in Bago Division. All five outputs and corresponding activities of Phase II are succeeded to IGA project except for the intensive type test farm water management study because the construction of intensive test farm is very costly. Technical Book and the Table to Monitor Irrigation Projects produced by Phase II are being used in IGA Project. The work plan is scheduled to start with Zalettaw first, Mazin next and Tabuhla last. All field works of IGA such as construction of minor water channels are planned to be completed by the end of FY 2007 for Zalettaw test farms, and by FY 2009 for Tabuhla test farms. As for Mazin, exiting water channels are under renovation by IGA project.

For IGA project, ID formed **Joint Coordination Committee (JCC)** chaired by Director General of ID as a decision making body, **Implementing Committee (IC)** chaired by Director of Designed Branch to support necessary requirement for IGA and to evaluate the progress of IGA. To facilitate project activities at field level, **Working Groups** were formed consisting of twelve staff members from ITC including an assistant director (the Deputy Principal of ITC), staff of Bago and Taikkyi Township Irrigation Maintenance Office, staff of Myanma Agriculture Service (MAS) and Settlement and Land Records Department (SLRD) at township level and farmers in each target area. This implementation arrangement was prepared as mentioned in the Project Completion Report of the Project Phase II Follow-up. The organizational chart of IGA project is attached (Annex 12).

### 3.2 Achievement related to Intermediate Goal

To achieve the intermediate goal, ITC has applied all five outputs of the Phase II except intensive type test farm study, and the tasks are assigned to corresponding five sections. The 7<sup>th</sup> Implementing Committee meeting of IGA Project was held in Hlegu where all working groups submitted their present achievement, issues and needs. It is premature for this study in September 2007 to assess the full achievement of IGA project which is still halfway to its project term (April 2005 - March 2010). But achievements to date of each section summarized below are found quite adequate.

#### **Water Management for Main Facilities (WM I) Section:**

WM I is mainly responsible for improving water management and maintenance of main facilities (main and branch canals) in the target areas.

- 1) Survey and evaluation on the present water management: Discharge data for the preparation of H-Q curves of Zalettaw canal system were measured in FY 2005 and FY 2006. Rating curves of each canal in Zalettaw irrigation system were developed. Field survey works, data collection and analysis in Tabuhla and Mazin are underway.
- 2) Study on techniques to improve irrigation facilities: In Zalettaw, study on sedimentation and conveyance losses in the canal was conducted and documentation of “Report on Conveyance Losses” was prepared. Then the development of Unsteady Flow Simulation Model was initiated to study its flow capacity and hydraulic phenomena.
- 3) Improvement of operation and maintenance techniques of irrigation facilities: Auto water level observing system (pressure type) was installed in Zalettaw reservoir and staff gauges (float types) were installed in the Zalettaw canal system for monitoring irrigation water. Zalettaw irrigation system was studied by the analysis of Water Distribution Plan for two irrigation season, FY 2005 and FY 2006. In Tabuhla and Mazin only daily inflow and outflow data are being collected and studied.

#### **Water Management for Terminal Facilities (WM II) Section:**

WM II section is responsible for improving on-farm (after the outlet of main facilities) irrigation system, which includes test farm construction to study appropriate arrangement of watercourse and to analyse comparative data before and after the watercourse installation in the test farm.



- 1) Survey and evaluation on present water management in the study area: In Zalettaw, data on flow, water consumption and attainment time were collected from two conventional areas in FY 2006. Study in Zalettaw test farm will start in the next summer paddy (around November 2007)
- 2) Study on techniques to improve terminal facilities and water management in test farms: In Zalettaw, the construction of extensive type test farms (130 acres) was completed by March 2007. In Tabula, site office will be constructed in coming dry season (around November 2007) and farmlands were selected for extensive test farm (230 acres) in agreement with farmers. Survey on test farm design and cost estimation was completed in October 2007 and construction of test farm will be started in coming dry season. In Mazin due to its small irrigable area, renovation works of existing irrigation facilities are already underway.

**System Development (SD) Section:**

SD is responsible to support water management activities by developing technical supporting system - Land Use Ledger System (LULS), Hydraulic Simulation Program (HSP) and Water Balance Simulation Program (WBSP). In Zalettaw area, SD has applied LULS, HSP and SBSP gained from Project Phase II to support other sections' field activities.

- 1) Survey of main and branch canals: Field survey works on canals were finished for Zalettaw in January and for Mazin in February 2007 and report preparation is in progress.
- 2) Survey on test farms: With the construction of Zalettaw test farms completed by March 2007, survey will start in November 2007 in Zalettaw.
- 3) Inflow study: Inflow data for Zalettaw and Mazin reservoirs are being collected and studied. Selection of appropriate model is in progress. In Tabuhla, this task will be carried out in 2008.
- 4) Modification of WBSP: For Zalettaw, WBSP was already modified. For Mazin the work has started in the third quarter of FY2007. For Tabuhla, the work will start in March 2008.
- 5) Measuring dam storage: Measuring for Zalettaw reservoir was finished in December 2006 and report preparation is in progress. It will start in March 2008 for Mazin and FY 2008 for Tabuhla.

**Irrigation Information Management (IIM) Section:**

IIM is responsible to develop data storage system for retrieving data and information that is to be applied for planning water distribution and management. In addition to the IGA activities, IIM supports township-level Irrigation Maintenance Offices of Bago TS, of Taikkyi TS and of Hlegu TS to monitor irrigation projects by using the Table to Monitor Irrigation Project.

- 1) The Table to Monitor Irrigation Project: As for the Zalettaw area, the Table to Monitor for FY 2005 and FY 2006 were made and its task on storage of salient data and irrigation project data format were finished. IIM section has carried out the tasks since 2005 in yearly basis in collaboration with Irrigation Maintenance Office in Bago TS and Taikkyi TS.
- 2) Development of Storage System: To develop irrigation facilities information management system, necessary data have been collected since 2005. Establishment of GIS system for Zalettaw has been completed 50% in October 2005. As for the Mazin, the GIS database system was established 100% in October 2007. Modification of LULS in IGA Project is on going since 2005.

**Training section:**

Training section is conducting trainings in cooperation with other sections to disseminate irrigation technologies to ID staff as well as farmers in the IGA target areas and other projects. In addition, the section distributes reference books to be used for the water management training in the whole country. The section also prepares teaching materials for ID staff in various fields.

The PDMe suggests one of Verifiable Indicators as “The water management training is implemented twice a year from 2005”. ITC has conducted seven water management trainings since 2004 for 175 ID staff, among which 16 were from the IGA area. Also, ITC has conducted five water management trainings for 230 farmers in the IGA Project since 2005. In FY 2007, ITC will conduct two farmers’ trainings, one for Mazin and another for Tabula. Due to such training programs, farmers have contributed their labours to IGA activities such as maintenance of water channel and construction of water courses. (Annex 14)

Table 1: Water Management Training Courses conducted by ITC for ID Staff

Title of Training	Fiscal Year	No. of trainee	Target Area	Day	No. from IGA
1. Unsteady Flow Simulation and Irrigation Operation Plan for Staff Officer	2004	5	IGA Project	5	5
2. Operation and Maintenance and Management of Canal System based on Basic Irrigation Information and Water Management for Terminal Facilities	2004	30	Maintenance staff of ID including IGA	2	3
3. Basic Irrigation Information Management and on-farm Water Management for CI & ACI	2004	22	Maintenance staff of ID including IGA	2	2
4. Unsteady Flow Simulation and Irrigation and Operation Plan for Staff Officer	2005	5	IGA Project	5	5
5. Basic Irrigation Information Management and On-farm Water Management for CI & ACI	2005	36	Maintenance staff of ID including IGA	2	1
6. JICA Follow-up Seminar for Ex-participants	2006	30	The whole country	1	-
7. Basic Irrigation Information Management and On-farm Water Management for CI & ACI	2007	47	Maintenance staff of ID including IGA	2	-

Source: Training Section of ITC

Table 2: Water Management Training Courses conducted by ITC for Farmers in IGA Project

Title of Training	Fiscal Year	No. of trainee	Target Area	Duration	
				From	To
1. Watercourse Wise Water Users’ Association for Leader of Watercourse	2005	50	Zalettaw	12-9-05	16-9-05
2. Watercourse Wise Water Users’ Association for Leader of Watercourse	2005	50	Mazin	28-11-05	2-12-05
3. Effective Use of Irrigation Water with Farmers’ Participation	2005	30	Zalettaw	18-1-06	23-1-06
4. Effective Use of Irrigation Water with Farmers’ Participation	2006	50	Mazin	5-3-07	7-3-07
5. Effective Use of Irrigation Water with Farmers’ Participation	2006	70	Zalettaw	19-3-07	21-3-07

Source: Training Section of ITC

The PDMe suggests another Verifiable Indicators as “Materials of water management training and its implementation plan are set up by March 2005”. ITC uses Technical Book produced by the Phase II (Follow-up) as a training material to irrigation maintenance officers for IGA and other projects after getting

approval of the Irrigation Technology Authority (ITA) of ID. ITC staff confirmed during this study that the Technical Book is very useful to disseminate water management technology through ID engineers and all units of irrigation area and to implement advanced water management techniques in irrigation projects in Myanmar. The Table to Monitor Irrigation Projects was also distributed to irrigation projects and offices throughout the country by the Planning and Works Branch Office of ID as a useful material to monitor and to evaluate current situation and the efficiency of each irrigation project. These materials are being used for IGA Project and the conclusion can be drawn that the Verifiable Indicator was met.

### 3.3 Achievement related to Overall Goal

The Intermediate Goal was introduced in 2001 because the Overall Goal wasn't considered achievable in about 10 years. Progress of IGA project is nothing but the achievement related to Overall Goal but even today there is still a wide gap between the Intermediate Goal and Overall goal discerned and it is still difficult for ITC to attain the Overall Goal. The Verifiable Indicator of Overall Goal is "Total yields in irrigated fields are increased through efficient irrigation water use" and its target areas are the whole country. In Myanmar, there are more than 327 irrigation works until 2006 (Annex 11). The mandate of ITC is mainly to provide technical support to irrigation projects and conducting trainings for ID staff and farmers. Toward achieving the Overall Goal, ITC has delivered trainings and workshops on water management throughout the country, not limited to the Intermediate Goal Areas. Table 3 shows the number of trainings conducted by ITC from Phase I to September 2007.

Table 3: All training courses conducted by ITC until September 2007

	ITC Phase I	ITC Phase II	After the Phase II				total
			FY 2005	FY 2006	FY 2007	Sub-total	
No. of courses	130	126	22	18	7	47	303
No. of trainees	3,160	4,571	740	810	280	1,830	9,561

Source: "Training Section of ITC" (\* Fiscal Year 2007 will be ended in 31 March 2008)

After the Phase II, from FY 2005 to FY 2007, ITC conducted total 47 trainings for 1830 trainees. These included water management training courses; 4 trainings for 118 ID staffs after FY 2005 (Table 1), 5 trainings for 250 farmers in IGA (Table 2) and 5 trainings for 330 farmers in other areas than IGA (Table 4). Training curricula for them incorporates experiences from the Phase II. Table 4 shows five farmer trainings in other areas than IGA for 330 farmers in Kinda (Mandalay Division), Swa Chung (Bago Division) and Ngamoeyeik (Yangon Division) irrigated areas where ITC is also collecting data (Annex 15).

Table 4: Water Management Training Courses conducted by ITC for farmers in other irrigated areas

Title of Training	Fiscal Year	No. of trainee	Target Area	Duration	
				From	To
1. Watercourse Wise Water Users' Association for Leader of Watercourse	2005	50	Ngamoeyeik	3-10-05	7-10-05
2. Water Management Training Course 1	2006	70	Kinda	20-9-06	23-9-06

3. Water Management Training Course 2	2005	70	Kinda	9-2-07	12-2-07
4. Water Management Training Course 3	2006	70	Swa Chaung	19-3-07	21-3-07
5. Water Management Training Course 3	2007	70	Kinda	11-6-07	12-6-07

Source: "Training Section of ITC"

In Ngamoeyeik area, on-farm water management study has been carrying out in cooperation with Japanese Institute for Irrigation and Drainage (JIID) and the study on Irrigation Water Management and its development Potential in Myanmar in Kinda, Ngamoeyei and Swa Chaung projects in collaboration with Japan Society for the Promotion of Science.

The Project Completion Report of ITC Project Phase II (Follow-up) indicates the approach of IGA that the ITC will continue water management study on further three project areas, Tabula, Zalettaw and Mazin. IGA project serves as a good opportunity for the staff of ITC to apply their knowledge and experiences gained from the Phase II on their own account. By the end of IGA project, three Technical Books for appropriate water management in the three irrigation areas will be submitted, which is one of the three Verifiable Indicators for the Intermediate Goal. Completed reports and results are being compiled and edited occasionally in preparation for the Technical Book by each section since 2005-06.

The ITC has supplied a Technical Book and the Table to Monitor Irrigation Projects not only to IGA but also to irrigation projects and offices across state and division. There is, however, no feedback to ITC except for feedback from IGA. Receiving feedback from various irrigation projects is beneficial for ID to improve its irrigation technology on water management so that the technology can suit with local condition. Establishing irrigation water management system at ID should be considered to review feedback from projects and offices by technical groups of ID supported by ITC.

#### 3.4 Follow-up of the Recommendations by Terminal Evaluation Study

The terminal evaluation in September 2003 made recommendations for both Japan and Myanmar to take;

- 1) Japan: further assistance for Myanmar
  - Regarding the three fields in which the outputs have not been achieved (and therefore the corresponding sections of the technical book haven't been completed), further assistance from Japan is necessary in accordance with the degree of non-achievement of the Project Purpose
- 2) Myanmar: appropriate preparation for the acceptance of the further assistance from Japan
  - Appropriate organizational structure and personnel assignment and budget of ITC need to be maintained as in the Phase II project.
  - ITC should include the contents of both water management and agronomy in the training for ID engineers and farmers, in collaboration with MAS.
  - Regarding equipment/machinery, the Myanmar side has agreed that all equipment/machinery provided in the project should be used after the project period is completed.

Recommended Follow-Up for the Phase II was implemented from April 2004 to January 2005 (10 months). As

indicated in the Follow-up Completion Report of January 2005, it successfully achieved its purpose. Training on farming techniques in conjunction with water management training were carried out by ITC in collaboration with MAS. Extension services and training on farming system for farmers in irrigation areas are conducted by MAS as their regular duties. As stated later, most of the equipment used in fields is utilized in the IGA Project, too.

## 4. RESULTS

### 4.1. Impact of the Project

#### 4.1.1. Achievement of Expected Impacts

##### 4.1.1.1. The Overall Goal

###### (1) Increase of Total Yields

The impact of improved water management technology on raised agricultural productivity (Overall Goal) or increased total yields (Indicator for Overall Goal) is a consequential, logical expectation but it hasn't been observed yet in four project areas. The Verifiable Indicator in PDMe to assess the achievement of Overall Goal is "total yields in irrigated fields are increased through efficient irrigation water use". There were, however, discussions on the applicability of this indicator in the terminal evaluation for the Phase II in 2004 because rice yield is affected by various factors such as local soil conditions, use of fertilizer, pest prevention, selection of varieties, agricultural machines, marketing and financial capacity of farmers to improve any of these factors and because yield cannot be increased only by irrigation water.

Table 5: Average Yields of Summer Paddy (Union and four irrigation areas)

Fiscal Year	Area					
	Union*		Ngamoeyeik**	Zalettaw**	Mazin**	Tabuhla**
	(Monsoon)	(Summer)	(Summer)	(Summer)	(Summer)	(Summer)
2002	63.73	79.17	74.90	75.00	70.00	74.90
2003	66.21	81.18	76.17	77.00	71.00	76.36
2004	68.19	83.57	77.99	78.00	73.00	76.98
2005	70.22	86.19	80.83	79.00	74.00	78.57
2006***	71.76	87.29	-	80.00	75.00	79.85

Source: \*: MAS, \*\*: MAS township offices in Hlegu, Bago and Taikkyi Townships (provided by ITC)

Unit: Basket/acre (\*\*\*) the number in 2006 is Provisional Actual

As in the above table, average yields per acre of Summer Paddy in four project areas are lower than that of average Union level yield. The availability of irrigation water for summer paddy in the four areas is much more favourable than other areas as a whole because of their location in lower Myanmar with more precipitation. Provided that the statistics is reliable, better availability of irrigation water in the four areas hasn't led to the increase of average yields in summer paddy yet.

With the availability of irrigation water, farmers have an opportunity to use their land more than once a year to grow crops, especially as summer paddy in lower Myanmar. Irrigation water is one of the basic condition to motivate farmers to grow crops as proper irrigation system can secure an appropriate timing and volume of watering to their plots. In addition, the abolition of rice quota system to the government in 2003 encouraged rice production of farmers due to rising price at harvest time. The yield of summer paddy is also higher than monsoon paddy because of less damage from pest and weed during dry season. The table shows the average yield of the summer paddy in four irrigated areas and Union are higher than the average yields of monsoon paddy (Union)

Availability of irrigation water is one of the basic incentives for farmers to make more use of their land to generate income for their lives. Without improvement of irrigation facilities, there is no opportunity for farmers to grow summer paddy.

## (2) Increase of cropping intensity

To assess the achievement toward the Overall Goal, cropping intensity was suggested as an alternative indicator by precedent evaluations in recognition of the fact that rice yield is affected by not only irrigation water but also many other factors. The cropping intensity is defined as the ratio of the Gross Area Sown (Net Irrigable Area + Irrigated Area) over Net Irrigable Area. The national average of mixed and multiple cropping intensities is 157.1% in FY 2005 as shown in the statistics of MOAI. Cropping intensity of Ngamoeyeik, Tabula, Zaletaw and Mazin areas based on data collected by the Table to Monitor Irrigation Project under IGA is much higher than national average.

Table 6: Cropping Intensity

Particular	Unit	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005
Sown area under various crops	(Ha'000)	15,845	16,146	16,721	17,431	18,659
Net Area Sown	(Ha'000)	10,654	10,818	11,043	11,415	11,877
Mixed & multiple cropping area	(Ha'000)	5,191	5,327	5,678	6,017	6,783
Cropping intensity	%	148.7	149.2	151.4	152.7	157.1

Source: Myanmar Agriculture at a Glance 2006 (The Ministry of Agriculture and Irrigation)

Table 7: Cropping Intensity in Ngamoeyeik and IGA Project Areas and the Union

Name of Project		Irrigable Area (Acre)	Irrigated Area (Acre)	Cropping Intensity (%)
Ngamoeyeik	FY 2004	40,894	25,697	162.8
	FY 2005		27,908	168.2
	FY 2006		28,052	168.6
Tabula	FY 2004	39,214	36,363	192.7
	FY 2005		33,902	186.5
	FY 2006		34,036	186.8
Zaletaw	FY 2004	1,790	838	146.8
	FY 2005		1,091	160.9
	FY 2006		1,359	175.9
Mazin	FY 2004		439	165.0

	FY 2005	675	500	174.1
	FY 2006		583	186.4

Source: Irrigation Information Management Section of ITC (Table to Monitor Irrigation Project)

Data of the four irrigated areas shows cropping intensity in four irrigated areas is higher than the union average. It also shows a trend of increasing cropping intensity by year. It is attributed to improvement of irrigation system. Continuous data collection in target areas is necessary to see the result of the improvement of irrigation system and the Table to Monitor Irrigation Projects continues to be used as one of such data source. The Table to Monitor Irrigation Projects records irrigated areas in each of irrigation system in every summer paddy season.

An extensive test farm in Zalettaw will be an example of the increase of cropping intensity through the improvement of irrigation facilities. Zalettaw irrigation facilities (the main canal, branch canals, direct minor discharge and minor water channels) were completed by ID in 1999 with a total irrigable area of 1,790 acres. In one of its tail portions, only 20 acres was irrigated out of a sown area of 120 acres even after the completion in 1999. This tail portion was selected as a test farm by ITC for IGA Project, and four water courses (terminal branches from minor water channels) were built in March 2007 upon agreement of farmers on their participation in IGA project. Until that time, traditional plot-to-plot irrigation with lower canal densities had been used by farmers. After the development of water courses, remaining 100 acres are expected to be irrigated starting from November 2007 for summer paddy. IGA Project will thus contribute to the increase of the cropping intensity in this tail portion from 117% to possible 200%. The increase of cropping intensity directly contributes to the increase of agricultural productivity and resulting income of farmers.

### (3) Usefulness of Technical Book and Table to Monitor Irrigation Projects

The Technical Book and the Table to Monitor Irrigation Projects produced by Phase II are appraised as very useful by ITC staff and are being used in the IGA Project. The description on construction method of watercourse in the Technical book is beneficial not only for ITC staff but also for farmers who apply these techniques to get appropriate water for their farmlands. The Table to Monitor Irrigation Project helps ID staff evaluate the situation of each irrigation project and find issues to improve the irrigation system in each area. At present, ITC staff mainly uses these two materials to advance the IGA Project.

#### 4.1.1.2. The Intermediate Goal

##### (1) Opportunity to apply outputs of Phase II

IGA Project is the main activity of ITC toward achieving the Overall Goal as proposed and authorized by the mid-term evaluation in 2001. Setting the Intermediate Goal made it possible for ITC staff to apply knowledge and experiences gained from the Phase II to similar project activities on their own accounts. To implement IGA project, JCC, IC and working groups were formed as per recommendations. Through the IGA project, moreover, coordination and cooperation among offices of ID, other governmental organizations and farmers' groups have continued at field level, which will enable them to experience finding means and ways together to extend water management technology throughout the country.

## (2) Accumulation of technical capacity

Implementation of IGA project allows ITC staff not only to have an opportunity to apply their knowledge and experiences from Phase II but also to accumulate and extend their technical expertise. Through field experiences, ITC staff is being capacitated to evaluate the present situation of irrigation water management and to find solution to improve each irrigation system to suit with local needs. The IGA project is aimed at providing ID local officers concerned and farmers in the target areas with technical support necessary for developing the irrigation system. After the training, ID staff in each target area involves in IGA activities. So, field office staff also has the chance to apply knowledge and experience gained from the training at fields.

### 4.1.1.3. Assumption for the Intermediate Goal and the Overall Goal

At present the 4<sup>th</sup> Short Term Five Year Plan (2006-07 to 2010-11) is being implemented. In order to contribute to the Plan, 5 strategies were laid down for the development of agriculture sector (Myanmar Agriculture in Brief 2007):

- (1) Development of new agricultural land
- (2) Provision of sufficient irrigation water
- (3) Provision and support of agricultural mechanization
- (4) Application of modern agro-technologies
- (5) Development and utilization of modern varieties.

Among the five strategies, provision of sufficient irrigation water is clearly mentioned. To materialize this strategy, MOAI has laid the six measures for irrigation development:

- 1) the construction of new dam reservoirs and dams
- 2) the proper management for the storage and utilization of run-off water from watershed areas
- 3) the renovation of existing reservoirs for raising storage capacity and efficient delivery irrigation water
- 4) the diversion of water from streams and rivulets, during high water levels into adjacent ponds or depressions for storage with sluice gates.
- 5) the lifting of water from rivers and streams through pump irrigations
- 6) the efficient utilization of ground water

Development of irrigation facilities continues to be a priority for the government that has already invested in developing irrigation system for a long time. Between 1988 and 2006, the government has completed 189 irrigation facilities. There are altogether 372 irrigation facilities in Myanmar until 2006. 40 systems are being constructed at present.

Table 8: Coverage of irrigated area in Myanmar (000'ha)

Descriptions	1988/89	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06
Net Area Sown	8,055	10,476	10,654	10,818	11,043	11,415	11,877
Net Irrigated Area (IA)	1,018	1,910	1,985	1,869	1,960	1,927	2,235
% of Net IA	12.6	18.2	18.6	17.3	17.7	16.9	18.8
Multiple Cropping IA	151	527	539	639	611	685	733



% of Gross IA	14.8	27.6	27.2	34.2	31.2	35.6	32.8
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Data: Myanmar Agriculture at a Glance 2006 (MoAI)

#### 4.1.2. Causality between the Project and the Impacts

The Project Purpose of the Phase II aimed at improving irrigation technology for Ngamoyeik project. The IGA Project aims at the same for Zalettaw, Mazin and Tabuhla. The Overall Goal aims at the same in all nation-wide irrigation projects. By disseminating the improved technology, the impact of the project was expected be realized in the end as the Overall Goal of raised agricultural productivity, mainly by way of training and dissemination of technical materials to officers and farmers. Considering the ex-post project performance and its achievements to date indicated in the previous section, there is an increasingly demonstrated causal relationship (as shown in cropping intensity) between the Project Purpose and the Intermediate Goal though it is still premature to make the conclusion in this evaluation study on its halfway to the end of IGA project. On the other hand, the causality between the Project Purpose and the Overall Goal is yet to be seen over the time because the relationship is logical but factual data hasn't been observed yet on the improvement of irrigation technology obtained by the Phase II and its contribution to the increase of agricultural productivity at nation-wide.

#### 4.1.3. Unexpected Significant Positive/Negative Impacts

##### (1) Positive impacts

**Profit increased in Ngamoyeik Test Farm:** Comparison of profit between intensive type and extensive type test farm per acre in FY 2005 Ngamoyeik area indicates the intensive type is 65% higher than extensive type with net profit. The higher profit in the intensive type has demonstrated the benefit of better water management under the same local condition.

Table 9: A sample case of profit comparison between Intensive and Extensive type farm

Test Farm Type	Yield	Gross Profits	Costs
Intensive	76	304,000 Kyats (= 76* 4,000 Kyats)	Costs of cultivation in extensive type is about 10% higher than intensive type due to
Extensive	49	196,000 Kyats (= 49* 4,000 Kyats)	

Yield is based on data of ITC in FY 2005. Unit of Yield: basket/acre

**Motivation raised of farmers in Zalettaw test farm:** The construction work of extensive type test farms in Zalettaw (130 acres) was completed in March 2007. In replying to a question by the evaluation study on how they will respond to the introduction of double cropping of rice starting from November 2007, some farmers said they would grow rice more intensively and invest more on fertilizer and seeds and that he would probably use a small tractor. On a question asking cost and profit balance, one farmer answered he would expect yield of 100 baskets/acre (the target yield of rice by MoAI) and profit of 200,000 Kyats/acre after deducting 150,000 Kyats/acre for costs. Another farmer expected profit of 150,000 Kyats/acre on less yields than 100 baskets/acres. In general, farmers were motivated with the new system introduced. Such higher motivation of

farmers is a positive impact by IGA project.

**Confidence of ITC staff acquired:** Staff of ITC has applied their experiences and knowledge gained from the Phase II to the IGA project and it is beneficial for them to upgrade their technical expertise through implementing IGA activities and try to meet local needs of farmers. IGA staff was confident in explaining the progress of their activities throughout this evaluation study. IGA staff was also confident in requesting budget necessary for IGA project to their head office. The confidence also makes them to discuss and share their experiences on water management with other international experts such as JIID and JCIR.

**Workload reduced of ID staff:** Deputy Principal of ITC said the burdens of ID staff had decreased in Ngamoeyeik area because farmers recognized their role and responsibilities to construct water courses and to maintain irrigation facilities through trainings. In addition, farmers have the ability to draw water distribution plan by themselves in their watercourses or canals.

**Activity of WUA to solve problems:** According to an explanation of ITC staff, after farmers training as mentioned in Table 2 and Table 4, problems about water distribution between upstream and downstream farmers have been decreased and the spirit of cooperation have been established among water user associations(WUA). In Thanatpyin Minor-5 Water Users' Group in Ngamoeyeik (Hlegu Township, Yangon Division), activities of the WUA are very active, conducting regular meeting for necessary maintenance work and collection of maintenance fees. Staff of IIM Section of ITC provided 5-day training in October 2005 (Table 4) with the support of Hlegu TS Irrigation Maintenance Office on subjects as follows; (Annex 16)

- 1) Organization of watercourse wise Water Users' Association
- 2) Functions and regulation of watercourse wise Water Users' Association
- 3) Construction, maintenance, operation and management of watercourses and channels
- 4) On farm water management
- 5) Video show and study tour
- 6) Special lecture for water management and discussion (ID head office, MAS, SLRD etc.)

**Intensive farm established by farmers:** According to Deputy Principal, in Ngamoeyeik there are altogether 630 acres of farmland were developed by farmers very similar to the intensive type test farm of the Phase II. The locations of these areas are Minor-5 and Direct Minor-6 areas. Although land preparation for such intensive type is very costly, those affordable farmers realized the benefit of intensive type test farms is higher than the extensive or conventional. It is also one of the positive impacts of the project.

## (2) Negative impacts

Environmental impact assessment wasn't conducted for any of irrigation projects in Myanmar. Since irrigation system changes greatly the ecological system in a whole corresponding basin, irrigation projects by ID, as well as the Phase I/II and IGA Project are likely to have affected the ecology. However, any statistical data or observation on environmental impact was not available for this study. Two farmers in Mazin said their grass land for their buffalos was lost after construction of the Mazin reservoir. The reservoir was constructed by ID in 1999, before the beginning of IGA project, but a similar negative impact may take place in future.

## 4.2. Sustainability of the Project

### 4.2.1. Technical Aspect of Sustainability

Sustainability from technical perspective is largely high. Most of activities for the five outputs of Phase II have been incorporated into the IGA project, which assures the technical feasibility of IGA activities and consistency of irrigation technology with Phase II outputs. To date, progress of IGA project is adequate. The mandate of ITC are directly contributing to one of five strategies the Ministry of Agriculture and Irrigation has laid out - “provision of sufficient irrigation water” – and the Ministry is eager to improve water management technology as well as to develop irrigation facilities in the country. ITC with its current capacity is expected to make crucial contribution toward the MoAI strategy as well as to receive necessary support from MoAI if necessary.

Other than unavailability of spare parts and consumables due to shortage of foreign currency in ID, no specific technical barrier to sustainability was observed during this evaluation study, including the operation and management of IGA project until this stage.

### 4.2.2. Organizational / Human Resource Aspect of Sustainability

Sustainability from institutional perspective is high. ITC allocates adequate human resources for the implementation of IGA project. As of September 2007, ITC Bago (including ITC Hlegu Sub-office) is organized with one deputy director (Principal of ITC), one assistant director (Deputy Principal of ITC), 24 staff officers (SOs) and 122 staffers such as technical and administrative assistants, totalling 148 persons (Annex 6, 7 and 8). Among the 24 SOs in ITC, 11 are assigned as Working Group member of IGA under the direction of the assistant director: 4 from Water Management I (main facilities) Section, 3 from Water Management II (terminal facilities) Section, 2 from System Development, 1 from Irrigation Information Management Section and 1 from Training Section. The 12 persons including the assistant director were all former Phase II counterparts. As working group member for the IGA Project, local offices of the ID (irrigation maintenance office) and other departments under the MOAI (MAS and SLRD) in the three project areas are involved and participated in the activities according to their mandates.

ID has two Irrigation Technology Centres under its organizational structure; one is the ITC Bago (including ITC Hlegu Sub-office) with 148 officers and staff in total; the other is located in Patheingyi (Mandalay Division) with 103 officers and staff. This Upper Myanmar ITC was established in 2003, reorganized from the facilities and capacity of Dam Construction Test Laboratories. At present, the Upper Myanmar ITC conducts trainings to ID staff on accounting, inventory management, soil and concrete laboratory test, in-service training for clerical staff. They lack of technical equipment and trained human resources to conduct water management trainings. Upgrading the organizational structure of ITC can be considered so that the Upper Myanmar ITC can be capacitated enough to conduct effective trainings for technological dissemination throughout the country. Promoting ITC training capacity and conducting Training for Trainers (TOT) for staffs of ID local offices can be also considered, an opportunity will be provided to each trainee to draw up of an action plan

which then will be carried out at each work place with support of ID and ITC. In line with ITC’s main mandate of conducting trainings for ID staff, remodelling of the way training is conducted to maximize its effectiveness is one of key measures for ITC to achieve the Overall Goal.

#### 4.2.3. Financial Aspect of Sustainability

Sustainability from financial perspective is high considering the budget allocation to ITC. The lack of foreign currency, however, to purchase spare parts and consumables may become an increasing hindrance for ITC to maintain and continue to utilize laboratory equipment.

The budget allocation to ITC has been adequate as per the table of ITC/ID yearly expenditure for Phase II and IGA project (Annex 9)

- During FY 1999 to FY 2004, counter budgets (capital budget) provided by ID for Phase II increased from 8 to 37 million Kyats per year.
- During FY 2005 to FY 2007, capital budget for IGA project increased from 20 to 188 millions Kyats per year.
- During FY 1999 to FY 2007, current budgets (for operation and administration) for ITC increased from 15 millions Kyats to 183 millions Kyats.
- Budgets for IGA project (capital budget) increased remarkably in FY 2005 and 2006 because of the construction of necessary irrigation facilities such as Zalettaw test farms, water canals and an office building.

Table10: Capital and Current Budget in FY 2007 for MoAI, ID and ITC

	Min. of Agriculture and Irrigation	Irrigation Department	ITC
Capital Budget	72,162 million Kyats	57,090 million Kyats	188 million Kyats
Current Budget	118,423 million Kyats	22,368 million Kyats	183 million Kyats

Capital Budget: for construction and procurement

Current Budget: for operation and administration

Despite the enough budget allocation, following observations should be noted.

- (1) Among two GPS instrument provided by Phase II, handheld controller of one GPS stopped functioning and remains out of operation as service agents don’t exist in Myanmar. Data processing is slow because Map Data Storing System (OCE 9400) is run on Windows 95 and not compatible with XP or other recent OS.
- (2) Some instrument may become out of operation shortly because of lack of spare parts or consumables (such as membrane and filters), the purchase of which requires foreign currencies. These instruments were provided by the grant aid in 1988 to the Construction Materials Test Laboratory of ITC for testing of dam construction materials for irrigation projects undertaken by ID. These spare parts and consumables aren’t locally available and have been used with repeated repairs for about 20 years. The shortage of foreign currencies in ID may result in an increasing hindrance to ITC operation.

(3) The Construction Materials Test Laboratory of ITC isn't involved in the IGA Project because its mandate to test dam construction materials isn't related to IGA project. However, in the long run, reduced capabilities of testing in the Laboratory will eventually affect all 327 irrigation projects in Myanmar as well as achieving the Overall Goal. (Annex 11)

#### 4.3. Analysis of Factors that have promoted project

##### 4.3.1. Impacts

Introduction of the Intermediate Goal provided a clear goal and timeframe for ITC to carry on the improvement of water management technology after the Phase II cooperation terminated. It also provided the opportunity for ITC staff to apply knowledge and experiences from the Phase II on the field as well as to accumulate and extend their technical expertise. Clarification of the realistic and achievable goal has certainly contributed to the continuance and development of onward project activities.

Rice quota system to the government was eased to a large extent in 1989 and completely abolished in 2003, resulting in the increased prices of rice at harvest time. Under the quota system, farmers sold rice to the Government at the prices of as low as 1/4 of the prevailed market prices. The abolishment in 2003 contributed to the increased farm-gate prices of rice. Currently rice is freely traded in the domestic market though its export is controlled and higher farm-gate prices motivate farmers to grow rice paddy. The quota system hadn't been applied to summer paddy but higher prices of rice after 2003 are the same.

##### 4.3.2. Sustainability

The evaluation study noticed the following three as contributing factors to increase the sustainability of Phase II and IGA project. In particular, the evaluation study had a strong impression that buildings, machinery and electrical facilities, laboratory and observation equipment including those delivered by the grant aid in 1986 (year when the Exchange of Note was concluded) have been well maintained by diligent efforts of ITC.

- Adequate, constant budget allocation by ID to ITC
- Assignment of former project counterparts to IGA project
- Efforts on good maintenance of facilities and equipment against aging degradation

#### 4.4. Analysis of Factors that have inhibited project

##### 4.4.1. Impacts

As for IGA project, the evaluation study found no particular factors that have inhibited the realization of Intermediate Goal except for the difficulty to procure spare parts and consumables. The evaluation study, however, noticed that the Overall Goal might not be achieved within its expected timeframe under the current ITC operational modality. A concrete plan doesn't exist on how ITC continuously strengthens its capacity and advance water management technology so that the current ITC activities can be accelerated towards achieving the Overall Goal. In this regard, through discussions with the ITC in this evaluation study, followings were identified;

- ITC can well handle its duties of technical support to small scale irrigation system such as Zalettaw and Mazin as the number of farmers involved is small. However, for large scale irrigation system such as Ngamoyeik and Tabuhla, extending effective support is more difficult because of the limited number of ITC staff. (see Table 7 for irrigable areas of each project site)
- Every irrigation areas have different hydrological condition and social situation. The larger target irrigation areas are, the more complicated these conditions become, which presents a challenge for planning and implementing the technical support.
- Localization of the irrigation technologies is necessary to meet the challenge. Adjusting the irrigation technologies to suit with local conditions required efforts of the counterparts and experts in the Phase II and Follow-up. Many subjects and issues still remain including research and development of low-cost water management technologies and of simplified way of adjusting the technologies to meet local conditions specific to target areas.

#### 4.4.2. Sustainability

Unavailability of spare parts and consumables of laboratory equipment, due to the shortage of foreign currency in ID to purchase them has influenced and will further affect the operation of ITC. With regard to the laboratory equipment, it should be noted that sustainability of the grant aid project can affect the sustainability of the Phase II even after 20 years. The market prices of rice can also influence availability for fertilizers, pesticides, farm machinery and other inputs that are needed by farmers.

#### 4.5. Conclusions

The ex-post project performance of the Phase II is high. ITC continues its activities in Ngamoyeik to further promote the Project Purpose of Phase II. ITC is also implementing the 5-year IGA project to establish appropriate water management technology in three irrigation areas (Zalettaw, Mazin and Tabuhla) by applying the outputs of Phase II. Considering the achievement to date related to IGA project, it is possible for ITC to achieve the Intermediate Goal by its target year of 2010. The production of technical books for each irrigation area, the main verifiable indicator of Intermediate Goal, is in progress and can be completed as planned. Evaluation on achievement related to Overall Goal indicates that it is difficult for ITC to attain the Overall Goal because of its far-reaching scope and its set timeframe of about 10 years as the 2001 mid-term evaluation already concluded. There are, however, many positive and significant impacts observed after Phase II toward achieving the Overall Goal in terms of capacity of ITC staff and activity of Water User Association. Also, the sustainability is evaluated as largely high from technical, institutional and financial perspective. In line with its main mandate of providing technical supports to irrigation projects and of conducting training for ID staff and farmers, ITC is currently trying to identify a feasible way to extend its technical support to more than 300 irrigation areas throughout the country. ITC needs to strengthen its capacity for research and development on, for example, how to maximize the effectiveness of training and how to adjust irrigation technologies to suit with local conditions at low-cost and in a viable way at field level.

## 5. RECOMMENDATIONS AND LESSONS LEARNED

### 5.1. Recommendations

For ITC, it is recommended that;

- (1) ITC balance human resources and allocation of assignments among the 5 sections if considering a consequent project after the IGA. While conducting IGA activities, it has been noticed that there are differences in workload among the five sections of ITC in accordance with their tasks and function. WM II is responsible for improvement of irrigation system at field level by constructing watercourse and test farms and it requires much efforts of staff and ITC resources.
- (2) ITC strengthen its capacity for research and development, for example, to further promote irrigation technologies to suit with local conditions at low-cost and in a viable way at field level, based on the achievement and experiences on Phase I/II and IGA project. Remodelling the way training is conducted to maximize its impacts can also be considered for ITC to effectively deliver its technical supports for irrigation projects across the country.
- (3) ITC collect accurate and constant data of crop production including paddy in project areas in collaboration with MAS and SLRD with a view to measure the impacts of Phase II outputs towards achieving the Intermediate Goal and Overall Goal. MAS and SLRD compose working groups for IGA implementation along with ITC.

For ID, it is recommended that;

- (1) ID explore a possibility, if needed, of whether experts of relevant technical fields can be invited to ITC for reviewing its current organizational capacity and for suggesting feasible ways to accelerate ITC activities. Achievement of the overall goal is subject to future technical supports by ITC to nation-wide irrigation projects.
- (2) ID consider the reorganization of ITC structures to capacitate the Upper Myanmar ITC with proper mandate and role, financial and human resources so that the newly established centre can provide water management trainings for ID staff and farmers along with ITC Bago.
- (3) ID help ITC staff improve their technical expertise in each respective field through opportunities such as attending technical training, seminar and workshop in abroad as well as in-country. ID also consider establishing an Irrigation Water Management System in ID to collect and review feedback from technical groups on a Technical Book and the Table to Monitor Irrigation Projects distributed by ITC. The feedback from various field conditions is helpful to improve the technical capacity of ITC staff on water management.

For JICA, it is recommended that;

- (1) JICA assist ITC in acquiring spare parts and consumables for and in repairing of test instruments and laboratory equipment, which has been impossible due to the shortage of foreign currencies in ITC especially in recent years. ITC can't fully utilize its equipment without such necessary maintenance service, follow-up on rehabilitating the equipment delivered by precedent projects can be considered.

## 5.2. Lessons Learned for JICA and Counterpart

- (1) Farmer participation to water management is demonstrated important as the mobilization of a water user association through farmers training by ITC has caused several, significant impacts. These impacts include problem-solving among farmers on water distribution, voluntary maintenance of irrigation facilities, reduction of workload of ID staff and establishment by farmers of intensive type farms the viability of which in Myanmar was questioned and removed from IGA project because of its high construction costs.
- (2) Introduction of Intermediate Goal is beneficial when a wide gap between Project Purpose and Overall Goal is identified. It provided a clear goal and timeframe for ITC to carry on the improvement of water management technology after the Phase II. It also provided the opportunity for ITC staff to apply knowledge and experiences from the Phase II on the field as well as to accumulate and extend their technical expertise. Similarly, setting another interim goal may be beneficial to bridge the wide gap between the Intermediate Goal and Overall Goal, which allows the counterpart agencies and JICA to make the process visible and clear for attaining the Overall Goal.
- (3) In PDMe of Phase II, the Verifiable Indicator for the Overall Goal is general in its scope and its applicability was questioned in the previous evaluation study, leading to the introduction of Intermediate Goal. Difficulty of achieving the Overall Goal observed in this evaluation study is attributed to the way the Overall Goal and its indicators were set, instead of due to current project activities. Revision of the Overall Goal can be considered by taking opportunity of various evaluations.

## 6. FOLLOW-UP SITUATION

There have been no further follow-up actions after the termination of the Follow-up (2004 - 2005) of the Phase II.



Annex 1. Project Design Matrix (August 2003)

Project Design Matrix (PDM-e)

Date: 22 August, 2003

Project Area: Ngamoyeik Irrigation Project

Duration: April 1, 1999 ~ March 31, 2004

Target Group: Irrigation Department (ID) Engineers

Summary of the Project	Verifiable Indicators	Means of Verification	Important Assumptions
<p>1. Overall Goal</p> <p>To raise agriculture productivity through improvement of irrigation technology.</p>	<p>Total yields in irrigated fields are increased through efficient irrigation water use.</p>	<p>Agricultural statistics</p>	
<p>1' Intermediate Goal</p> <p>To establish appropriate water management technology in the three irrigation areas.</p>	<p>1'-1) Three technical books for appropriate water management in the irrigation areas* are submitted by March 2009.</p> <p>1'-2) The water management training is implemented twice a year from 2005.</p> <p>1'-3) Materials of water management training and its implementation plan are set up by March 2005.</p> <p>Note) * : Tabuhla, Zalehtaw, Mazin irrigation areas</p>	<p>Annual report of ID</p>	<p>- Irrigation facilities will be improved by using the project proposal</p>
<p>2. Project Purpose</p> <p>To upgrade the irrigation technology especially in water management in Ngamoyeik Project Area as a model, applying the basic irrigation technology which was achieved through the Phase I Project.</p>	<p>1) A technical book for appropriate water management for the project area is submitted by March 2004.</p> <p>2) Counterparts can lecture the appropriate water management.</p>	<p>1) Annual report of ID</p> <p>2) Interview</p>	<p>-Dissemination of water management technology developed by the project</p> <p>- Agricultural development policy will continue</p>

<p>3. Outputs</p> <p>1) Irrigation technology of water management and maintenance in main facilities is improved.</p> <p>2) Study method for water management of terminal irrigation system is improved.</p> <p>3) Technical supporting system for water management is improved.</p> <p>4) Irrigation information management technology is improved to monitor irrigation projects.</p> <p>5) Water management technology is disseminated to technical staff of Irrigation Department and farmers in test farm through training.</p>	<p>1-1) Proposal reports on improvement of main facilities and its operation and maintenance techniques are prepared by March 2004.</p> <p>1-2) Counterparts' technical capacity will be improved.</p> <p>2-1) Proposal reports on study methods for improvement of terminal facilities will be prepared by March 2004.</p> <p>2-2) Counterparts' technical capacity will be improved.</p> <p>3-1) Technical supporting system for water management is used by March 2004.</p> <p>3-2) Proposal Manuals for reservoir capacity survey are prepared by March 2004.</p> <p>3-3) Counterparts' technical capacity will be improved.</p> <p>4-1) Data collection and processing of irrigation projects will be started by March 2004.</p> <p>4-2) Monitoring on water management will be started by March 2004.</p> <p>4-3) Counterparts' technical capacity will be improved.</p> <p>5-1) 26 times of training for 790 ID staffs will be conducted by March 2004.</p> <p>5-2) 9 times of training for 460 farmers will be conducted by March 2004.</p> <p>5-3) Training master plan will be prepared and approved by ID by March 2003.</p>	<p>1-1) Annual report of ID 1-1) Project monitoring report</p> <p>1-2) Experts' interviews 1-2) Counterparts' interviews</p> <p>2-1) Annual report of ID 2-1) Project monitoring report</p> <p>2-2) Experts' interviews 2-2) Counterparts' interviews</p> <p>3-1) Annual report of ID 3-1) Project monitoring report 3-2) Annual report of ID 3-2) Project monitoring report 3-3) Experts' interviews 3-3) Counterparts' interviews</p> <p>4-1) Annual report of ID 4-1) Project monitoring report 4-2) Annual report of ID 4-2) Project monitoring report 4-3) Experts' interviews 4-3) Counterparts' interviews</p> <p>5-1) Annual report of ID 5-1) Project monitoring report 5-1) ID staff focus group 5-2) Annual report of ID 5-2) Project monitoring report 5-2) Farmer focus group 5-3) Annual report of ID 5-3) Project monitoring report</p>	<p>- The knowledge and experience acquired through the Project is continuously extended.</p>
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<p>4. Activities</p> <p>1) Water Management for Main Facilities</p> <p>1-1) Survey and evaluation on present water management in model area</p> <p>1-2) Study on techniques to improve irrigation facilities</p> <p>1-3) Improvement of operation and maintenance techniques of irrigation facilities</p> <p>1-4) Preparation of materials for training</p> <p>2) Water Management for Terminal Facilities</p> <p>2-1) Survey and evaluation in present water management in study area</p> <p>2-2) Study on techniques to improve terminal facilities and water management in test farm</p> <p>2-3) Preparation of materials for training</p> <p>3) System Development</p> <p>3-1) Development of data base system of irrigation area</p> <p>3-2) Development of supporting programs for water management</p> <p>3-3) Improvement of monitoring method of water storage of reservoir</p> <p>3-4) Preparation of materials for training</p> <p>4) Irrigation Information Management</p> <p>4-1) Study on monitoring method of water management in existing irrigation projects</p> <p>4-2) Improvement of storage system of irrigation information</p> <p>4-3) Preparation of materials for training</p> <p>5) Training</p> <p>5-1) Implementation of training for the above four fields</p> <p>5-2) Formulation of training master plan</p>	<p>Input</p> <p>(Japanese Side)</p> <p>1. Dispatch of Experts</p> <p>(1) Long-term experts</p> <ul style="list-style-type: none"> <li>- Chief Advisor/ Irrigation Information Management</li> <li>- Coordinator/ Training</li> <li>- Water Management for Main facilities</li> <li>- Water Management for Terminal Facilities</li> <li>- System Development</li> </ul> <p>(2) Short-term Experts will be dispatched when necessity arises</p> <p>2. Provision of machinery and equipment</p> <p>3. Training of counterpart personnel in Japan</p> <p>4. Local cost</p> <p>(Myanmar Side)</p> <p>1. Counterparts</p> <p>(1) Project Director</p> <p>(2) Deputy Project Director</p> <p>(3) Project Manager</p> <p>(4) Two Assistant Directors</p> <p>(5) Counterparts for each experts</p> <p>(6) Management staff</p> <p>(7) Technical staff</p> <p>(8) Other staff as needed</p> <p>2. Land, building and facilities</p> <p>(1) Land and facilities for the Project</p> <p>(2) Office and other facilities for Japanese Experts</p> <p>(3) Facilities to keep provided machinery</p> <p>(4) Other facilities</p> <p>3. Local cost</p>	<p>- Same counterparts should be assigned more than two years</p> <p>- Institutional collaboration between Branches and Divisions in Irrigation Department</p> <p>- Institutional collaboration among Myanmar Agricultural Services, Settlement &amp; Land Records Department, Department of Agriculture Planning, and Irrigation Department</p> <p>Pre-conditions</p> <p>- Land for test farm is prepared</p>
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## Annex 2. Ex-Post Evaluation Grids with Findings

### 1. Continuation of the Project Activities after 2005

Questions for Evaluation		Required data and information	Findings
Main Categories	Sub Categories		
Inputs of project resources by the Irrigation Department (ID)	Staff in ITC Bago and ITC Hlegu Sub-Office	<ul style="list-style-type: none"> <li>Name list of officers in ITC Bago and ITC Hlegu Sub-Office assigned for the present project activities</li> <li>Name list of officers in irrigation maintenance authorities assigned for the present project activities</li> </ul>	<ul style="list-style-type: none"> <li>The ITC Phase II project (April 1999 – January 2005) was emphasized to improve the water management in Ngamoeyik Irrigation System in cooperation between ID and JICA. After the termination of Phase II, ID continues to implement water management study in accordance with PDMe (the Project Design Matrix for final evaluation of Phase II) where the Intermediate Goal was introduced for three target areas. ID started Intermediate Goal Areas (IGA) project in April 2005 to achieve the Intermediate Goal during its project duration of 5 years.</li> <li>The objective of IGA Project is to improve the water management through the technologies achieved from Phase II. in three Intermediate Goal Areas (Zalettaw, Mazin and Tabuhla ) during its project period (April 2005 – March 2009). The purposes of IGA Project are as follows:               <ol style="list-style-type: none"> <li>To improve the operation and management of main facilities in IGA</li> <li>To improve the operation and management of terminal facilities in cooperation with the water users based on the experiences on model farmlands that will be constructed in IGA.</li> <li>To disseminate the technology achieved from Phase II to the farmers and staff personnel of IGA.</li> </ol> </li> <li>All the five outputs and corresponding activities of Phase II are succeeded to the IGA Project except for intensive type water management study.</li> <li>As of September 2007, ITC Bago (including ITC Hlegu Sub-office) is organized with one deputy director (Head of ITC), one assistant director (Deputy Head of ITC), 24 staff officers and 122 staffers such as technical and administrative assistants, totaling 148 persons. The IGA Project is implemented by ITC in collaboration with Bago Division and Yangon Division Irrigation Maintenance Offices.</li> <li>A Working Group for IGA Project was formed in 2005 for each target area. Among the 24 staff officers in ITC, 11 persons are assigned as Working Group member of IGA under the direction of the assistant director.               <ol style="list-style-type: none"> <li>Four from Water Management I (main facilities) Section</li> <li>Three from Water Management II (terminal facilities) Section</li> <li>Two from System Development Section</li> <li>One from Irrigation Information Management Section.</li> <li>One from Training Section</li> </ol> <p>These 12 persons including the assistant director were the counterparts of Phase II. WM I and WM II Sections are housed in ITC Hlegu Sub-Office. SD, IIM and Training Section are in ITC Bago</p> </li> <li>As working group members for IGA Project, staff of Irrigation Maintenance Offices of ID, MAS and SLRD in the three project areas participate in the activities in line with their mandates.</li> </ul>

	Equipment	<ul style="list-style-type: none"> <li>• Procedures taken for maintenance of main equipment in Hlegu Sub-Office delivered by Phase II project</li> <li>• Status of the main equipment</li> </ul>	<ul style="list-style-type: none"> <li>• Most equipment provided by Phase II are used by WM I and WM II Section in ITC Hlegu Sub-Office for field activities (level meters, current meters, level recorders, vehicles and others) and the others are used in ITC Bago. These equipment for on-field data collection and data mapping are also used for IGA Project.</li> <li>• Among two GPS provided by Phase II, a handheld controller of one GPS stopped functioning and remains out of order as service agents don't exist in Myanmar. Data processing is slow because Map Data Storing System (OCE 9400) is run on Windows 95 and is not compatible with XP or other recent OS</li> <li>• Some instruments may become out of function shortly because of the lack of spare parts or consumables (such as membrane and filters), the purchase of which requires foreign currencies, These instruments were provided by the grant aid in 1988 to the Construction Materials Test Laboratory of ITC for testing of dam construction materials for irrigation projects undertaken by ID. These spare parts and consumables are not locally available and have been used with repeated repairs for about 20 years. The shortage of foreign currencies in ID results in increasingly limited use of instruments.</li> <li>• The Construction Materials Test Laboratory of ITC is not involved in IGA Project because its mandate to test dam construction materials is not related to IGA Project. However, in the long run, reduced capabilities of testing in the Laboratory will eventually affect all the 327 irrigation projects in Myanmar, as well as an achievement of the overall goal of Phase II.</li> </ul>
	Operation budgets	<ul style="list-style-type: none"> <li>• Current (routine) budget allocated for ITC and ID in FY 2003 to 2007</li> <li>• Budgets (allocation and expenditure) for ITC from FY 2003 to FY 2006; data to update Annex-7 in the Evaluation Report on 4 September 2003</li> </ul>	<ul style="list-style-type: none"> <li>• The amount of current and capital budget allocation in FY2007 for ID; <ol style="list-style-type: none"> <li>1) Current budget (for operation and administration) is 22,368 millions Kyats,</li> <li>2) Capital budget (for construction and procurement) is 57,090 millions Kyats</li> <li>3) Those for MOAI: current 118,423 million Kyats, capital 72,162 million Kyats.</li> <li>4) Number of officers and staff of ID total is around 20,000 persons.</li> </ol> </li> <li>• During FY1999 to FY2004, counter budgets (capital budget) for Phase II project increased from 8 to 37 million Kyats per year, provided by ID</li> <li>• During FY 2005 to FY 2007, capital budgets for IGA Project increased from 20 to 188 millions Kyats per year, allocated by ID</li> <li>• From FY 1999 to FY 2007, the current budget of ITC increased from 15 millions Kyats (FY 1999) to 183 millions Kyat (FY2007).</li> <li>• Budgets for IGA Project (capital budget) increased remarkably in FY 2005 and 2006 because of the construction of necessary irrigation facilities such as test farms, water canals and office buildings. In FY 2007, the IGA Project budget (capital budget of 188 million Kyats) is almost equal to the current budget for ITC (183 million Kyats).</li> </ul>

Organization of ITC and its activities	Development of ITC institution	<ul style="list-style-type: none"> <li>• Was ITC reorganized to ITRDC (Irrigation Technology Research and Development Center)?</li> <li>• If yes, new mandates of ITRDC and irrigation maintenance authorities</li> </ul>	<ul style="list-style-type: none"> <li>• ITC is a subordinate of the Design Branch under Head Office of the Irrigation Department. Presently ID has two ITCs; one is located in Bago Division with officers and staff of 148 persons in total and the other is in Patheingyi (Mandalay Division) with 103 officers and staff. ITC in Mandalay is under direction of the principal of ITC in Bago.</li> <li>• To strengthen activities of the two ITCs, the ITRDC was planned to be established as a Branch of ID. According to the Follow-up Completion Report (January 2005), ITRDC will have 7 technical sections; Soil Laboratory, Concrete Laboratory, Hydraulic Laboratory, Water Management, System Management, Criteria (design) and Training.</li> <li>• ID expressed their expectations on the technical support from JICA to establish ITRDC.</li> </ul>
Continuance of achievements of the project purpose and five outputs	Activities by ITC after January 2005.	<ul style="list-style-type: none"> <li>• Contribution by ITC for improving irrigation technologies (planning of irrigation and/or operation of facilities) in IGA Project</li> </ul>	<ul style="list-style-type: none"> <li>• In Ngamoeyeik during Phase II, construction of minor water channels, land leveling and farm roads for 15 intensive test farms (62 acres) and 36 extensive test farms (360 acres) were carried out. The ITC Hlegu Sub-Office was also constructed during Phase II.</li> <li>• IGA Project has the same project activities as Phase II. The only difference is that IGA Project has three target areas whereas Phase II had one target area (and also intensive-type study is excluded.)</li> <li>• All the five outputs of Phase II have been applied for the three target areas in IGA Project. The work plan (plan for operation) is scheduled to start with Zalettaw first, Mazin next, and Tabuhla last. All field works of IGA such as construction of minor water channels, land leveling and farm roads, and field offices are planned to be completed by the end of FY 2007 for Zalettaw test farms, and by FY 2009 for Tabuhla test farms. As for Mazin, existing water channels are under renovation by IGA Project.</li> <li>• In Zalettaw, construction works for test farms (130 acres) was completed by March 2007 and the first study will start in coming summer paddy season (around November 2007).</li> <li>• In Tabuhla, construction works for test farms (230 acres planned) are scheduled to start in FY 2008.</li> <li>• In Mazin some renovation works for water management study and monitoring are already done. There planned no major construction of irrigation facilities because of its small irrigable area (675 acres)</li> <li>• IGA Project aims at providing ID local officers concerned and farmers in the target areas with technical support necessary for developing the irrigation system. Project activities of IGA Project are divided into five categories in accordance with the five outputs of Phase II; Water Management for Main Facilities, Water Management for Terminal Facilities, System Development(Technical Supporting System), Irrigation Information Management and Training.</li> <li>• Outcomes of the four categories above, except for Training, will result in Technical Books, which will give a guidance for operating and maintaining the irrigation system for each target areas. Categories of the Water Management for Main and Terminal Facilities also plan to produce materials for training.</li> </ul>

	Duties and responsibilities of the five sections of ITC for IGA	<ul style="list-style-type: none"> <li>(Relating questions) Continued activities of the five outputs of Phase II;             <ol style="list-style-type: none"> <li>Water Management for Main Facilities</li> <li>Water Management for Terminal Facilities</li> <li>System Development (Technical Supporting System)</li> <li>Irrigation Information Management</li> <li>Training</li> </ol> </li> </ul>	<ul style="list-style-type: none"> <li>Water Management I (main facilities): To improving water management and maintenance of main facilities (main and branch canals) in the target areas, their tasks in IGA Project are as follows; 1) Survey and evaluation on the present water management, 2) Study on technique to improve irrigation facilities, 3) Improvement of operation and maintenance techniques of irrigation facilities, 4) Preparation of material for training and 5) Technical book.</li> <li>Water Management II (terminal facilities): To improve on-farm irrigation system after the outlet of main facilities, their tasks in IGA Project are as follows; 1) Survey and evaluation on present water management in the study area, 2) Study on techniques to improvement of terminal facilities and water management in test farm, 3) Preparation of training material and 4) Technical book.</li> <li>System Development: In Phase II, this section has supported the water management activities by developing Technical Supporting System – Land Used Ledger System (LULS), Hydraulic phenomenon simulation program and Water balance simulation program. Their tasks in IGA Project are as follows; 1) Survey of main and branch canals, 2) Survey of test farms, 3) Inflow study, 4) Modification of Water balance simulation program (LULS and Hydraulic simulation program don't need tuning) and , 5) Measuring of dam storage and 6) Technical book.</li> <li>Irrigation Information Management: Main objective of this Section is to develop data storage system for retrieving data and information that is to be applied for planning water distribution and management. In IGA Project, their tasks are as follows; 1) The Table to Monitor Irrigation Project, 2) Development of storage system and 3) Technical book.</li> <li>Training: To disseminate irrigation technologies to ID staff personnel and farmers in the target areas, the section is cooperating with other sections to implement trainings and prepare teaching materials.</li> </ul>
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## 2. Impacts

Questions for Evaluation		Required data and information	Findings												
Main Categories	Sub Categories														
Probability of achievement of the <b>overall goal</b> in the country	Increase of total yields in irrigated fields through efficient irrigation water use	<ul style="list-style-type: none"> <li>Yields of rice and other products in irrigated and rain-fed areas by divisions and states from 1999–00 to 2006–07</li> </ul>	<ul style="list-style-type: none"> <li>In publicized statistics (Myanmar Agriculture in Brief 2007 by MoAI, Myanmar Agriculture at a Glance 2006 by DAP, MoAI and Statistical Yearbook 2004 by CSO, MoNPED), only the national average is available for yields of the various crops including rice. There is also no statistical classification between rain-fed (Monsoon) paddy and summer paddy.</li> </ul> <p>Yield per Harvested Acre of Selected Crops</p> <table border="1" data-bbox="1003 1190 1854 1254"> <thead> <tr> <th>Year</th> <th>1990/91</th> <th>1997/98</th> <th>1999/2000</th> <th>2001/02</th> <th>2003/04</th> </tr> </thead> <tbody> <tr> <td>Paddy (Rice)</td> <td>57</td> <td>59</td> <td>63</td> <td>66</td> <td>68</td> </tr> </tbody> </table> <p>Unit: 46lb(basket)/acre Data: Statistical Yearbook 2004</p>	Year	1990/91	1997/98	1999/2000	2001/02	2003/04	Paddy (Rice)	57	59	63	66	68
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- Although not being publicized, statistical information of Myanmar Agriculture Service (head office) and township offices in the Hlegu, Taikkyi and Bago Townships were made available for the evaluation study on the statistical classification between rain-fed (Monsoon) and summer paddy

Averages Yields of Union Level Monsoon and Summer Paddy and average yield of summer paddy in four irrigation areas ( Provisional Actual)

Year	Area					
	Union**		Ngamoeyeik*	Zalettaw*	Mazin*	Tabuhla*
	Monsoon Paddy	Summer paddy	Summer paddy	Summer paddy	Summer Paddy	Summer Paddy
2002-03	63.73	79.17	74.90	75.00	70.00	74.90
2003-04	66.21	81.18	76.17	77.00	71.00	76.36
2004-05	68.19	83.57	77.99	78.00	73.00	76.98
2005-06	70.22	86.19	80.83	79.00	74.00	78.57
2006-07	71.76	87.29	-	80.00	75.00	79.85

Unit: 46lb (basket)/acre

Source:\*\*; MAS Headquarter \*; MAS offices in Bago, Hlegu and Taikkyi Townships

- During this evaluation there were discussions on applicability of the indicator, which asks if “Total yields in irrigated fields are increased through efficient irrigation water use”. The same discussion took place in the terminal evaluation for the Phase II in 2004. Rice yields is not increased only by irrigation because it is affected by various factors such as local soil conditions, use of fertilizer, pest prevention, selection of varieties, agriculture machines, marketing conditions and financial capability of farmers to invest their money for improving any of these factors. However, irrigation water is one of the basic conditions to motivate farmers to risk their money for such investments.

Cropping intensity

- Cropping intensity in irrigated and rain-fed areas by divisions and states from 1999-00 to 2006-07

- To assess the achievement towards the overall goal, cropping intensity was suggested as an alternative indicator by the precedent evaluations.
- $\text{Cropping Intensity} = \frac{\text{Gross area sown (Net Irrigable Area + Irrigated Area)}}{\text{Net Irrigable Area}}$
- Net irrigable area is the area calculated for a dam or reservoir to be able to cover and provide irrigation water based on its storage capacity. During monsoon, the Net irrigable area is sown by rain-fed. During summer season, only irrigated area out of the net irrigable area can be sown with water actually delivered due to proper irrigation facilities.
- The national average of mixed and multiple cropping intensities is 157.1% in FY 2005 as in the statistics of MOAI below.



#### Cropping Intensity

Particular	Unit	2001-02	2002-03	2003-04	2004-05	2005-06
Sown area under various crops	(Ha' 000)	15,845	16,146	16,721	17,431	18,659
Net Area Sown	(Ha' 000)	10,654	10,818	11,043	11,415	11,877
Mixed & multiple cropping area	(Ha' 000)	5,191	5,327	5,678	6,017	6,783
Cropping intensity	%	148.7	149.2	151.4	152.7	157.1

Source: Myanmar Agriculture at a Glance 2006 (The Ministry of Agriculture and Irrigation)

- Data collected by “the Table to Monitor Irrigation Project” under IGA Irrigation Information Management indicates that the four irrigation areas have higher cropping intensities than the union average. It also shows a trend of growing cropping intensity by year.

#### Cropping Intensity of four Irrigation Projects

Project Name		Net Irrigable Are (Acre)	Irrigated Area (Acre)	Cropping Intensity (%)
		(1)	(2)	(1)+(2) / (1)
Ngamoeyiek	2004-05	40,894	25,697	162.8
	2005-06	40,894	27,908	168.2
	2006-07	40,894	28,052	168.6
Tabuhla	2004-05	39,214	36,363	192.7
	2005-06	39,214	33,902	186.5
	2006-07	39,214	34,036	186.8
Zalettaw	2004-05	1,790	838	146.8
	2005-06	1,790	1,091	160.9
	2006-07	1,790	1,395	175.9
Mazin	2004-05	675	439	165.0
	2005-06	675	500	174.1
	2006-07	675	583	186.4

- An extensive test farm in Zalettaw will be an example for the increase of cropping intensity through the improvement of irrigation facilities. Zalettaw irrigation facilities (the main canal, branch canals, direct minor discharge and minor water channels) were completed by ID in 1999 with a total irrigable area of 1,790 acres. In one of its tail portions, only 20 acres was irrigated out of a sown area of 120 acres even after the completion in 1999. This tail portion was selected as a Test Farm by ITC for IGA Project, and four water courses (terminal branches from minor water channels) were built in March 2007 upon agreement of farmers on their participation in IGA project. After development of the water courses, remaining 100 acres are expected to be irrigated in 2007 summer season. IGA Project will thus contribute to the increase of the cropping intensity in this tail portion from 117% to possible 200%.

Alternative source of information	<ul style="list-style-type: none"> <li>• Yields of rice and other products in Ngamoyeik test farms from 1999–00 to 2006–07</li> <li>• Yields of rice and other products in Tabuhla, Zalettaw, Mazin from 1999–00 to 2006–07</li> </ul>	<ul style="list-style-type: none"> <li>• Data of yield of Summer Paddy in test farms in Ngamoyeik was made available for comparison with average yield of the entire irrigated areas of Ngamoyeik. ITC collected the data from the 4 leading farmers among 15 of intensive test farms and 12–15 farmers among 36 farmers in the extensive test farms. The collected data represented 50% of both intensive and extensive test farms.</li> </ul> <p>Average yields (Basket/Acre) of Summer Paddy in the Ngamoyeik irrigated areas</p> <table border="1" data-bbox="974 300 2094 363"> <thead> <tr> <th>Project</th> <th>1999/00</th> <th>2000/01</th> <th>2001/02</th> <th>2002/03</th> <th>2003/04</th> <th>2004/05</th> <th>2005/06</th> <th>2006/07</th> </tr> </thead> <tbody> <tr> <td>Ngamoyeik</td> <td>67.79</td> <td>72.8</td> <td>77</td> <td>74.9</td> <td>76.17</td> <td>77.99</td> <td>80.83</td> <td>N.A.</td> </tr> </tbody> </table> <p>50 baskets = around one MT, 2.47 acre = one ha. Source: MAS through ITC, September 2007</p> <p>Yields (Basket/Acre) of Summer Paddy in Intensive and Extensive Test Farms in Ngamoyeik</p> <table border="1" data-bbox="974 480 1478 571"> <thead> <tr> <th>Model</th> <th>2003/04</th> <th>2004/05</th> <th>2005/06</th> </tr> </thead> <tbody> <tr> <td>Intensive</td> <td>86</td> <td>86</td> <td>76</td> </tr> <tr> <td>Extensive</td> <td>43</td> <td>42</td> <td>49</td> </tr> </tbody> </table> <p>Source: Interview by ITC, September 2007</p> <ul style="list-style-type: none"> <li>• In the 4 project areas, rice is the main crop. Beans, tomato, chili and other vegetables are also cultivated mainly for domestic consumption and for marketing in case of surplus.</li> </ul>	Project	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	Ngamoyeik	67.79	72.8	77	74.9	76.17	77.99	80.83	N.A.	Model	2003/04	2004/05	2005/06	Intensive	86	86	76	Extensive	43	42	49																																														
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Assumptions to achieve the overall and intermediate goal	<ul style="list-style-type: none"> <li>• Share of the agriculture sector in GDP and export from 2001/02 to 2006/07</li> <li>• Effect of the abolishment of the quota system of rice to the government in April 2003 to the development of rice production in Myanmar.</li> <li>• Priorities given to irrigation projects in the 5 Year National Development Plan (FY2006 to FY2010)</li> </ul>	<p>National Production, Consumption and Investment (At Constant Producers' Prices) (Value: Kyat in Billion)</p> <table border="1" data-bbox="974 778 1966 1058"> <thead> <tr> <th rowspan="2">Particular</th> <th colspan="2">2000–01*</th> <th colspan="2">2002–03</th> <th colspan="2">2004–05</th> </tr> <tr> <th>Value</th> <th>%</th> <th>Value</th> <th>%</th> <th>Value</th> <th>%</th> </tr> </thead> <tbody> <tr> <td>(A) Good</td> <td>60.6699</td> <td>60.5</td> <td>2,091.8</td> <td>65.7</td> <td>2,685.6</td> <td>65.2</td> </tr> <tr> <td>1. Agriculture</td> <td>33.6589</td> <td>33.6</td> <td>1,409.4</td> <td>44.3</td> <td>1,698.8</td> <td>41.2</td> </tr> <tr> <td>2. Livestock &amp; Fishery</td> <td>8.3103</td> <td>8.3</td> <td>258.6</td> <td>8.1</td> <td>373.5</td> <td>9.1</td> </tr> <tr> <td>3. Forestry</td> <td>0.8665</td> <td>0.9</td> <td>16.4</td> <td>0.5</td> <td>16.4</td> <td>0.4</td> </tr> <tr> <td>(B) Services</td> <td>16.6598</td> <td>18.6</td> <td>342.6</td> <td>10.8</td> <td>473.9</td> <td>11.5</td> </tr> <tr> <td>(C) Trade Value</td> <td>20.9451</td> <td>20.9</td> <td>750.3</td> <td>23.6</td> <td>959.8</td> <td>23.3</td> </tr> <tr> <td>(D) GDP (A+B+C)</td> <td>100.2748</td> <td>100.0</td> <td>3,184.7</td> <td>100.0</td> <td>4,119.4</td> <td>100.0</td> </tr> </tbody> </table> <p>MNPED, Central Statistical Organization, 2006 *The total value of net output and services (GDP) for 2000–01 are calculated at 1985–86 constant producers' prices. That of 2001–2002 and forward is calculated at 2000–01 constant producers' prices.</p> <p>Export of rice (Unit: 000' MT)</p> <table border="1" data-bbox="974 1206 1960 1270"> <thead> <tr> <th>Year</th> <th>1999/00</th> <th>2000/01</th> <th>2001/02</th> <th>2002/03</th> <th>2003/04</th> <th>2004/05</th> </tr> </thead> <tbody> <tr> <td>Rice</td> <td>54.9</td> <td>251.4</td> <td>939.2</td> <td>793.5</td> <td>168.5</td> <td>182.0</td> </tr> </tbody> </table> <p>MNPED, Central Statistical Organization, 2006</p>	Particular	2000–01*		2002–03		2004–05		Value	%	Value	%	Value	%	(A) Good	60.6699	60.5	2,091.8	65.7	2,685.6	65.2	1. Agriculture	33.6589	33.6	1,409.4	44.3	1,698.8	41.2	2. Livestock & Fishery	8.3103	8.3	258.6	8.1	373.5	9.1	3. Forestry	0.8665	0.9	16.4	0.5	16.4	0.4	(B) Services	16.6598	18.6	342.6	10.8	473.9	11.5	(C) Trade Value	20.9451	20.9	750.3	23.6	959.8	23.3	(D) GDP (A+B+C)	100.2748	100.0	3,184.7	100.0	4,119.4	100.0	Year	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	Rice	54.9	251.4	939.2	793.5	168.5	182.0
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- Abolishment of the quota system in 2003 contributed to the increased price of rice at harvest time by reflecting market price except the variety of “Ngasein” according the table below. Price trend shows a remarkable contrast between 2001–02 and 2002–03.

Prices of Rice at Harvest Time (Kyats/MT)

Year	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06
Ngasein	15,826	15,826	73,044	54,783	58,435	58,435
Medone	18,261	18,261	99,827	75,966	80,348	85,218
Emata	16,557	16,557	77,914	63,305	73,044	86,679
Ngakywe	19,478	19,478	109,566	80,348	85,218	92,522
Kauknyin	19,478	19,478	163,132	211,828	168,001	187,480

MOAI, 2006

- The 4<sup>th</sup> Short Term Five Year Plan (2006 to 2010) is being implemented with altogether 19 main objectives for the development of various sectors. Among these objectives, the following are for the development of agriculture sector (NPED: 2006, December);
  - to extend the setting up of agro-based industries and other required industries in building an industrialized nation,
  - to extend the agriculture, livestock and fishery sectors in order to meet the local demand for self sufficiency and to promote exports,
  - to make endeavors for meeting the targeted yield per acre of the designated crops (100 basket/acre for rice),
  - to expand new cultivable land for agriculture use.
- In order to contribute to the national development, the followings strategies for agriculture sector development were laid down ( Myanmar Agriculture in Brief 2007)
 

Strategies:

  - Development of new agricultural land
  - Provision of sufficient irrigation water
  - Provision and support for agricultural mechanization
  - Application of modern agro-technologies
  - Development and utilization of modern varieties.
- Among the five strategies, “Provision of sufficient irrigation water” is clearly mentioned. In order to materialize the second strategy, MoAI has laid six measures for irrigation development
  - the construction of new reservoirs and dams
  - the proper management for the storage and utilization of run-off water from the watershed areas
  - the renovation of existing reservoirs for raising storage capacity and efficient delivery of irrigation water
  - the diversion of water from streams and rivulets, during high water levels into adjacent ponds or depressions for storage with sluice gates
  - the lifting of water from rivers and streams through pump irrigations
  - the efficient utilization of ground water.

		<ul style="list-style-type: none"> <li>Coverage of target areas and achievements by Summer Paddy Program (commenced in FY 1992)</li> </ul>	<ul style="list-style-type: none"> <li>Summer Paddy Production Program, starting 1992, aims at increasing the production of rice for self sufficiency and for exports. Annex 11 indicates the construction of dams and reservoirs increased through the Summer Paddy Program especially in Lower Myanmar.</li> </ul> <p>Coverage of irrigated area in Myanmar (000' ha)</p> <table border="1" data-bbox="974 268 2087 454"> <thead> <tr> <th>Descriptions</th> <th>1988/89</th> <th>2000/01</th> <th>2001/02</th> <th>2002/03</th> <th>2003/04</th> <th>2004/05</th> <th>2005/06</th> </tr> </thead> <tbody> <tr> <td>(A) Net Area Sown</td> <td>8,055</td> <td>10,476</td> <td>10,654</td> <td>10,818</td> <td>11,043</td> <td>11,415</td> <td>11,877</td> </tr> <tr> <td>(B) Net IA</td> <td>1,018</td> <td>1,910</td> <td>1,985</td> <td>1,869</td> <td>1,960</td> <td>1,927</td> <td>2,235</td> </tr> <tr> <td>% of net IA</td> <td>12.6</td> <td>18.2</td> <td>18.6</td> <td>17.3</td> <td>17.7</td> <td>16.9</td> <td>18.8</td> </tr> <tr> <td>Multiple cropping IA</td> <td>151</td> <td>527</td> <td>539</td> <td>639</td> <td>611</td> <td>685</td> <td>733</td> </tr> <tr> <td>% of gross IA</td> <td>14.8</td> <td>27.6</td> <td>27.2</td> <td>34.2</td> <td>31.2</td> <td>35.6</td> <td>32.8</td> </tr> </tbody> </table> <p>IA: irrigated area; Data – Myanmar Agriculture at a Glance 2006 (MoAI)</p>	Descriptions	1988/89	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	(A) Net Area Sown	8,055	10,476	10,654	10,818	11,043	11,415	11,877	(B) Net IA	1,018	1,910	1,985	1,869	1,960	1,927	2,235	% of net IA	12.6	18.2	18.6	17.3	17.7	16.9	18.8	Multiple cropping IA	151	527	539	639	611	685	733	% of gross IA	14.8	27.6	27.2	34.2	31.2	35.6	32.8
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<p>Probability of achievement of the <b>intermediate goal</b> in three target areas: (Zalettaw, Tabuhla, Mazin)</p>	<p>Progress of each category of IGA Project to date</p>	<ul style="list-style-type: none"> <li>Mater Management for Main Facilities (Category 1)</li> <li>Water Management for Terminal Facilities (Category 2)</li> <li>Application of the technical supporting system (land use ledger system, hydraulic phenomenon simulation and water balance simulation) (Category 3)</li> <li>Irrigation Information Management (Category 4)</li> <li>Process to draft the technical books for three target areas</li> </ul>	<ul style="list-style-type: none"> <li>Activities for the three target areas of IGA Project are not being undertaken in parallel. The progress of each categories (section) to date are as follows according to the reports on the 7<sup>th</sup> Implementing Committee Meeting for IGA project held on August 30 2007:</li> </ul> <p><u>MW I section:</u></p> <ol style="list-style-type: none"> <li>Discharge data for the preparation of H-Q curves of Zalettaw canal system measured in 2005-06 and 2006-07 irrigation season. Rating curves of each canal in Zalettaw irrigation system were developed. Field survey works, data collection and analysis for Tabuhla and Mazin are under way.</li> <li>To improve irrigation facilities, it is necessary to know the existing condition and properties of the canal system. In Zalettaw, study on sedimentation and conveyance losses in the canal was conducted and documentation of "Report on Conveyance Losses" was prepared. Then development of unsteady flow simulation model was initiated to study its flow capacity and hydraulic phenomena.</li> <li>For improvement of operation and maintenance techniques, auto water level observing system (pressure type) was installed in Zalettaw reservoir and auto water level gauges (float types) were installed in the Zalettaw canal system (at the downstream of the main canal and upstream of right canal). Zalettaw irrigation system was studied by the analysis of Water Distribution Plan for two irrigation seasons, 2005-06 and 2006-07. For Tabuhla and Mazin, only daily inflow and out flow data are being collected and studied.</li> <li>Departmental instructions, irrigation manuals and other references related to water management have been collected and studied. Training materials issued by the Project Phase II plays an important role as references in this study.</li> <li>Completed reports and results are being compiled and edited occasionally in preparation of the technical book.</li> </ol>																																																

WM II section:

- 1) Data collection on flow, water consumption and attainment time were collected in Ngamoeyeik and Zalettaw (two conventional areas) in 2006–07 season. Zalettaw test farm study will start in the next summer paddy season (around November 2007).
- 2) The construction of Zalettaw extensive type test farm (130 acre) was completed by March 2007. In Tabuhla, the site office will be constructed in dry season (from November 2007). Selection of test farm areas (230 acres) and conventional areas finished. Survey on test farm design and cost estimation was completed in October 2007 and the construction of test farm will start in coming dry season. Farmers agreed with the construction of test farms. In Mazin due to its small irrigable area, renovation works of existing irrigation facilities are already under way.
- 3) Necessary data, information and related documents are being collected for training material preparation.
- 4) Completed reports, necessary data and information are compiled and collected For technical book.

SD section:

- 1) In Zalettaw and Mazin, field survey works on canals finished in January and February 2007 respectively and report preparation is in progress. In Tabuhla, the task will be carried out in FY 2008.
- 2) Survey of test farm is scheduled to start in last quarter of FY 2007 in Mazin and in FY 2008 in Tabuhla.
- 3) Inflow data for Zalettaw and Mazin reservoirs are being collected and studied. Selection of appropriate model is under progress. In Tabuhla, this task will be carried out in 2008.
- 4) Water balance simulation program for Zalettaw was modified. It has started in Mazin in the third quarter of FY 2007. In Tabuhla it is scheduled to start in March 2008.
- 5) Measuring dam storage for Zalettaw was finished in December 2006 and report preparation work for this task is under progress. It is scheduled to start in last quarter of FY 2007 in Mazin and FY 2008 in Tabuhla.
- 6) Preparation of technical book, reports, documents and required data and information are being collected.

IIM section:

- 1) The Monitoring Tables for the three target areas were made. IIM section has carried out the task since 2005 in yearly basis in collaboration with maintenance offices of Bago and Taikkyi townships.
- 2) Development of storage system: For Tabuhla, the task on Storage of Salient Data (SSD) and 60% of Irrigation Project information Data Form (IPDF) was completed, and 30% of modification of Land Use Ledger System (LULS) and Irrigation Facilities Information Management System (IFIMS) has been finished. For Zalettaw, 60% of the task on SSD, IPDF, LULS and IFIMS have been finished. 50% of the establishment of GIS have also been finished in Zalettaw. For Mazin, the task on SSD and IPDF has been finished and data collection for IFIMS has been continued. Establishment of GIS for Mazin was completed 100%, and it needs only modification.
- 3) Necessary materials, data and information are being collected of technical book preparation.

	<p>Training materials and training plans for three target areas</p>	<ul style="list-style-type: none"> <li>• Have training materials and training implementation plans been completed for three target areas?</li> <li>• If yes, when?</li> </ul>	<ul style="list-style-type: none"> <li>• To prepare Technical Book for each target area, reports and results are being compiled and edited occasionally in preparation for the technical book by each section. WM I plans to finalize Technical Book for Zalettaw by the end of FY 2007, for Mazin by FY 2008, and for Tabuhla by FY 2009, while other three sections plan to do for all three target areas together by the end of FY 2009.</li> <li>• Training activities in IGA Project are divided into two; training for ID and training for farmers. For both of them, training is aimed at water management. Water management courses were conducted for 150 farmers in Zalettaw and 100 farmers in Mazin by September 2007. Farmers' trainings for Mazin and Tabuhla are going to be conducted by March 2008.</li> <li>• Materials for training have also been prepared in accordance with progress of the field works in each target area. Implementation of farmer training is organized by IIM section, in collaboration with other three sections (WM I, WM II and Training Section).</li> </ul>																																												
	<p>Records of water management trainings for personnel involved in three target areas</p>	<ul style="list-style-type: none"> <li>• Time and number of participants of the training</li> <li>• List of lecturers</li> </ul>	<ul style="list-style-type: none"> <li>• In Zalettaw, farmer training has been conducted three times so far. In a training course, 30 to 70 farmers participated. One training course takes usually 5 days. Lectures in total of 8 persons conduct training; they are from IIM (2 persons), WM I (1), WM II (3), MAS (1) and ID local maintenance office (1). Cost of one training course is around 1.6 millions Kyats. The costs include printing of handouts, lunch, refreshments, souvenir and transport. All costs are borne by ITC.</li> </ul> <p>Water Management Training Courses for Farmers conducted by ITC for IGA Project</p> <table border="1" data-bbox="990 772 2022 1201"> <thead> <tr> <th rowspan="2">Title of Training</th> <th rowspan="2">Fiscal Year</th> <th rowspan="2">No. of trainee</th> <th rowspan="2">Target Area</th> <th colspan="2">Duration</th> </tr> <tr> <th>From</th> <th>To</th> </tr> </thead> <tbody> <tr> <td>1. Watercourse Wise Water Users' Association for Leader of Watercourse</td> <td>2005-06</td> <td>50</td> <td>Zalettaw</td> <td>12-9-05</td> <td>16-9-05</td> </tr> <tr> <td>2. Watercourse Wise Water Users' Association for Leader of Watercourse</td> <td>2005-06</td> <td>50</td> <td>Mazin</td> <td>28-11-05</td> <td>2-12-05</td> </tr> <tr> <td>3. Effective Use of Irrigation Water with Farmers' Participation</td> <td>2005-06</td> <td>30</td> <td>Zalettaw</td> <td>18-1-06</td> <td>23-1-06</td> </tr> <tr> <td>4. Effective Use of Irrigation Water with Farmers' Participation</td> <td>2006-07</td> <td>50</td> <td>Mazin</td> <td>5-3-07</td> <td>7-3-07</td> </tr> <tr> <td>5. Effective Use of Irrigation Water with Farmers' Participation</td> <td>2006-07</td> <td>70</td> <td>Zalettaw</td> <td>19-3-07</td> <td>21-3-07</td> </tr> <tr> <td>Total</td> <td></td> <td>250</td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p>Source: Training Section of ITC</p>	Title of Training	Fiscal Year	No. of trainee	Target Area	Duration		From	To	1. Watercourse Wise Water Users' Association for Leader of Watercourse	2005-06	50	Zalettaw	12-9-05	16-9-05	2. Watercourse Wise Water Users' Association for Leader of Watercourse	2005-06	50	Mazin	28-11-05	2-12-05	3. Effective Use of Irrigation Water with Farmers' Participation	2005-06	30	Zalettaw	18-1-06	23-1-06	4. Effective Use of Irrigation Water with Farmers' Participation	2006-07	50	Mazin	5-3-07	7-3-07	5. Effective Use of Irrigation Water with Farmers' Participation	2006-07	70	Zalettaw	19-3-07	21-3-07	Total		250			
Title of Training	Fiscal Year	No. of trainee	Target Area					Duration																																							
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1. Watercourse Wise Water Users' Association for Leader of Watercourse	2005-06	50	Zalettaw	12-9-05	16-9-05																																										
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Total		250																																													

	Implementing Committee	<ul style="list-style-type: none"> <li>• When Implementing Committee for IGA was organized?</li> <li>• List of committee members or participating authorities and institutions</li> <li>• Main issues that have been concluded by the committee so far</li> </ul>	<ul style="list-style-type: none"> <li>• Implementing Committee for IGA Project was organized before April 2005.</li> <li>• The committee is organized with officials from ID, MAS and SLRD as planned in Annex-3 of the Follow-up Completion Report in January 2005.</li> <li>• The committee reports to DG of ID in quarterly basis on progress of IGA Project and problems encountered if any and countermeasures for them.</li> <li>• Joint Coordination Committee of Phase II was closed after January 2005.</li> </ul>
<p>Various effects by the project;</p> <p>Or effects of efficient use of water resources (time and appropriate volume of water) and water delivery to fields with equity</p>	Positive impacts	<ul style="list-style-type: none"> <li>• Effects for alleviating disputes among water users</li> <li>• Increase of production of other crops in the Ngamoyeik model area</li> <li>• Increase of agriculture income of farmers in the Ngamoyeik model area</li> <li>• Other positive impacts if any</li> </ul>	<ul style="list-style-type: none"> <li>• Staff of ITC is conducting IGA project activities on his own account by applying their experiences gained from Phase II. IGA staff was confident in explaining progress of their activities throughout this evaluation mission. IGA staff is also confident in requesting budget needed for IGA Project to be provided by ID to accomplish their tasks.</li> <li>• Deputy Principal of ITC said the workload of maintenance staff of ID has decreased in Ngamoyeik, Mazin and Zalettaw areas because farmers take responsibilities for construction of water courses, operation and maintenance of irrigation facilities as a result of farmers training. The trainings extended knowledge for farmers to understand their role and responsibilities for operation and maintenance of irrigation facilities.</li> <li>• According to an explanation by staff of ITC, after farmers training, problems about water distribution among upstream and downstream have been decreased and members of water user association work more closely than before on operation and maintenance works. An example was given of Thanatpyin Minor-5 Water Users' Association which is one of the model associations in Ngamoyeik irrigated area in Hlegu township. (Annex 16)</li> <li>• Interview with farmers in Zalettaw IGA Test Farm: In response to a question on how they will respond to the introduction of the new system (double cropping of rice) in December 2007, one of the farmers said he will grow rice more intensively and invest more on fertilizer and seeds and that he will probably use a small tractor. On a question asking cost and profit balance, one farmer answered that he assumes a yield of 100 baskets/acre (the target yield of rice by MoAI) and profit of 200,000 Kyats/acre after deducting 150,000 Kyats/acre for cost (gross income of 350,000 kyats/acre). In general farmers were motivated with the new system introduced. Such higher motivation of farmers is a positive impact by IGA Project.</li> </ul>
	Negative impacts	<ul style="list-style-type: none"> <li>• Has any EIA been conducted in the Ngamoyeik model area or other irrigation project areas so far?</li> <li>• If yes, how were results of the assessment?</li> <li>• Other negative impacts if any</li> </ul>	<ul style="list-style-type: none"> <li>• Environmental Impact Assessment was not conducted for any of the irrigation projects in Myanmar. Since an irrigation system changes greatly the ecological system in a whole corresponding basin, irrigation projects by ID, as well as Phase I/II and IGA Project are likely to affect the ecology. However, any statistical data or observation on environmental impact was not available in this study.</li> <li>• Two farmers in Mazin said their grass land for their buffalos was lost by the construction of Mazin reservoir. The reservoir was constructed by ID in 1999, before the beginning of IGA project.</li> </ul>

	Impacts unclassified	<ul style="list-style-type: none"> <li>• How many farmer households are engaged in agriculture in the Ngamoyeik model area?</li> <li>• Among them, how many are land owners and how many are agriculture labors?</li> <li>• What and how much effect the agriculture labors have been received by the project phase-I and II?</li> </ul>	<ul style="list-style-type: none"> <li>• In Mazin and Zalettaw, following data were obtained through the interview in Mazin and Zalettaw; Mazin: Total households in the area: 840 HH Farmers who have the land tilling right: 240 HH Among above, those benefiting from irrigation: 115 HH (48%) Agriculture labor: 600 HH (who do not have the land tilling right and provide labor to earn money)</li> <li>Zalettaw Total households in the area: 990 HH (estimate) Farmers who have the land tilling right: 390 HH (estimate) Among above, those benefiting from irrigation: 350 HH (90%) Agriculture labor: 600 HH (who do not have the land tilling right and provide labor to earn money)</li> <li>• There is no information available on Ngamoyeik.</li> </ul>
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### 3. Sustainability

Questions for Evaluation		Required data and information	Findings
Main Categories	Sub Categories		
Policy and administration system	National economy	<ul style="list-style-type: none"> <li>• Share of the agriculture sector in GDP and export</li> <li>• Effects of the abolishment of the rice quota system on rice production in Myanmar</li> </ul>	Refer to the findings of “1. Continuation of the Project Activities after 2005”.
		<ul style="list-style-type: none"> <li>• Economic effects on farmers in the lower Myanmar and the abolishment of the rice quota system</li> </ul>	<ul style="list-style-type: none"> <li>• In lower Myanmar there was no summer paddy before 1992. Farmers used to grow only rain-fed paddy. Due to the introduction of Summer Paddy Program, in lower Myanmar, farmers grow paddy in summer season with irrigation water. Construction of irrigation facilities encourages farmers to grow double cropping of rice. Rice quota system was not applied to summer paddy.</li> <li>• Due to the different climatic condition, in the upper Myanmar, farmers used to grow paddy by irrigation water dating back to the first century..</li> </ul>
	National policies	<ul style="list-style-type: none"> <li>• Five Year National Development Plan</li> <li>• Implementation of the nation-wide Summer Paddy Program.</li> </ul>	Refer to the findings of “1. Continuation of the Project Activities after 2005”.
Institutional and financial side	Continuation of the project activities	<ul style="list-style-type: none"> <li>• Budgetary support for ITC</li> <li>• Status of POU in ITC</li> <li>• Continued or discontinued achievements of the 5 project outcomes</li> </ul>	<p>Refer to the findings of “1. Continuation of the Project Activities after 2005”.</p> <ul style="list-style-type: none"> <li>• Activities for the five outputs of Phase II are applied to IGA Project, except intensive test farm study, as shown in the Follow-up Completion Report in January 2005.</li> <li>• The budget allocation for ITC is sufficient. The shortage of foreign currency, however, prevents ID from acquiring necessary spare parts and consumables items for laboratories of ITC, putting its equipment under limited use.</li> </ul>



Technical side		<ul style="list-style-type: none"> <li>Any technical constraints upon sustaining of operation of ITC and irrigation maintenance authorities</li> </ul>	<ul style="list-style-type: none"> <li>According to an observation by WM I Section of ITC, time and human resources are limited to accomplish all the tasks on water management study during the summer paddy season for each target area (in Zalettaw, Mazin and Tabuhla). WM I Section thinks it is essential to assign more technical staff to IGA Project because the project period is only five years for three target areas.</li> <li>It took 6 years for Phase II to complete all activities for one target area. IGA Project is planned to complete tasks for three target areas within 5 years. ID operates 327 irrigation works throughout the country. (Annex 11). This number is planned to increase by 40 in coming years. Achieving the overall goal in the county requires formulating a different approach than the IGA type approach (preparation of technical book for each target area and training materials for dissemination of water management technology based on data collection and water management study by ITC on each site).</li> <li>There was no specific technical problem indicated or detected at this stage of IGA Project within in ITC during this evaluation mission.</li> </ul>
Factors to sustain or inhibit the project benefits		<ul style="list-style-type: none"> <li>Among all the five project outputs, which output is found not so effective for further improvement of the irrigation technologies?</li> <li>If any, what are its reason(s)?</li> </ul>	<ul style="list-style-type: none"> <li>ITC has five sections corresponding to the five outputs of Phase II. In IGA Project, due to the nature of the activities of each section, there have different workloads among five sections of ITC. While IIM, SD and Training sections take their duties in support IGA project, WM I and II carry out their tasks mainly for the field works. WM II has the responsibility to construct test farms and to monitor on-farm water management. These tasks take time and need many resources of ITC and other ID offices.</li> </ul>

### Annex 3 Questionnaire

#### Irrigation Technology Center Project Phase II and Follow-up in the Union of Myanmar

Phase II: April 1999 to March 2004, Follow-up: April 2004 to January 2005

#### 1. Continuation of the Project Activities after 2005

Inputs of the project resources by the Irrigation Department

	<ol style="list-style-type: none"> <li>1. Name list of officers in Bago ITC and Hlegu Sub-Office assigned for the present project activities</li> <li>2. Name list of officers in irrigation maintenance authorities assigned for the present project activities</li> <li>3. Procedures taken for prevention maintenance for the main equipment in Hlegu Sub-Office delivered by the project</li> <li>4. Status of the main equipment</li> </ol>	<p>ITC Main Office Hlegu Sub-Office</p>
	<ol style="list-style-type: none"> <li>5. Percentage of the current (routine) budget allocated for ITC in the ID budget in FY 2003 to 2007</li> <li>6. Budgets (allocation and expenditure) for the ITC from FY 2003 to FY 2006; data to update Annex-7 in the Evaluation Report on 4 September 2003</li> </ol>	<p>ID ITC</p>

Organization of the ITC and its activities

	<ol style="list-style-type: none"> <li>7. Was ITC reorganized to ITRDC (Irrigation Technology Research and Development Center)?</li> <li>8. If yes, new mandates of ITRDC and irrigation maintenance authorities (roles of both institutions for developing and operating the irrigation system in the country); including updates of Annex-2 of the Follow-up Completion Report in January 2005</li> </ol>	<p>ID ITC</p>
	<ol style="list-style-type: none"> <li>9. Application of the technical supporting system (land use ledger system, hydraulic phenomenon simulation and water balance simulation) to other areas than the Ngamoyeik model area</li> <li>10. Irrigation information management for monitoring irrigation projects in various states</li> <li>11. Training for the technical officers in the irrigation maintenance authorities from various states</li> </ol>	<p>ITC</p>

	<p>12. Actual cases of contribution by the ITC for improving irrigation technologies (planning of irrigation and/or operation of facilities) in irrigation projects in other states especially in the upper Myanmar, if any</p> <p>13. (Spare question) Examples for continued achievements of five outcomes;</p> <ol style="list-style-type: none"> <li>1) Water management in main facilities</li> <li>2) Water management in terminal facilities</li> <li>3) Technical supporting system</li> <li>4) Irrigation information management</li> <li>5) Training</li> </ol>	
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## 2. Impacts

Probability of achievement of the **overall goal** in the country

	<p>14. Yields of rice and other products in irrigated and rain-fed areas by states from 1999-00 to 2006-07; collection of the MOIA statistics including "Myanmar Agriculture in Brief-2007" and "Agriculture at a Glance 2007"</p> <p>15. Cropping intensity in irrigated and rain-fed areas by states from 1999-00 to 2006-07; collection of the MOIA statistics including "Myanmar Agriculture in Brief-2007" and "Agriculture at a Glance 2007"</p> <p>16. Yields of rice and other products in Ngamoyeik model area from 1999-00 to 2006-07</p> <p>17. Yields of rice and other products in Tabuhia, Zalehtaw, Mazin from 1999-00 to 2006-07</p>	MOAI or ID
	<p>18. Share of the agriculture sector in GDP and export from 2001/02 to 2006/07</p> <p>19. Effects to development of summer paddy in the lower Myanmar by abolishment of the delivery system of rice in April 2003</p> <p>20. Priorities given to irrigation projects in the 5 Year National Development Plan (2005 to 2009?)</p> <p>21. Coverage of target areas and achievements by Summer Paddy Program (commenced in 1992-93)</p>	MOAI or ID

Probability of achievement of the **intermediate goal** in three irrigation areas: Tabuhia, Zalehtaw, Mazin

	<p>22. Progress of data collection for summer paddy irrigation season</p> <p>23. Progress of data collection for rain-fed paddy season</p> <p>24. Progress of data analysis and drafting technical books Information for above three questions may include updates of Annex-3 of the Follow-up Completion Report in January 2005</p> <p>25. Have training materials and implementation plans been completed for three projects?</p> <p>26. If yes, when?</p> <p>27. Time and number of participants of the training</p> <p>28. List of lecturers</p>	ITC
	<p>29. When Implementing Committee for the intermediate goal was organized?</p> <p>30. List of committee members or participating authorities and institutions; including updates of Annex-3 of the Follow-up Completion Report in January 2005</p> <p>31. Main issues that have been concluded by the committee so far</p>	ID or ITC

Various effects given by the project

	<p>32. Effects for alleviating disputes among water users</p> <p>33. Increase of production of other crops in the Ngamoyeik model area</p> <p>34. Increase of agriculture income of farmers in the Ngamoyeik model area</p> <p>35. Other positive impacts if any</p>	ITC or MAS
	<p>36. Has any EIA been conducted in the Ngamoyeik model area or other irrigation project areas so far?</p> <p>37. If yes, how were results of the assessment?</p> <p>38. Other negative impacts if any</p>	ITC
	<p>39. How many farmer households are engaged in agriculture in the Ngamoyeik model area?</p> <p>40. Among them, how many are land owners and how many are agriculture labors?</p> <p>41. What and how much effect the agriculture labors have been received by</p>	ITC or MAS

	the project phase-I and II?	
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### 3. Sustainability

	42. Past or present economical effects towards farmers in the lower Myanmar by highly prioritized development for summer paddy and the delivery system of rice	ID or ITC
	43. Any technical constraints upon sustaining of operation of the ITC and irrigation maintenance authorities	ITC
	44. Among all the five project outcomes, which outcome is found not so effective for further improvement of the irrigation technologies? 45. If any, what are its reason(s)? 1) Water management in main facilities 2) Water management in terminal facilities 3) Technical supporting system 4) Irrigation information management 5) Training	ITC

#### Annex 4. Interviewees and Main Attendants of Meeting

Name	Title	Organization
H.E. U Ohn Myint	Deputy Minister	MOAI
U Zaw Win	Deputy Director General	ID, MOAI
U Ohn Gaing	Director	Design Branch, ID
Daw Htay Htay Win	Deputy Director	ITC
U Soe Htun Aung	Assistant Director	ITC
U Zaw Zaw Latt	Staff Officer	WMI, ITC
Daw Than Than Oo	Staff Officer	WM I, ITC
U Aung Win Swe	Staff Officer	WM I, ITC
Dr. Maung Maung Naing	Staff Officer	WM II, ITC
U Myo Zaw Zaw	Staff Officer	WM II, ITC
U Kyaw Lin Oo	Staff Officer	SD, ITC
Daw Htar Htar Win	Staff Officer	Training Section, ITC
Dr. Aung Than Oo	Staff Officer	IIM, ITC
U Win Kyi	Staff Officer	CMTL, ITC
U Tin Shwe	Staff Officer (Lab.)	CMTL, ITC
U Than Tun Aung	SAE	Bago MO
U Kyaw Min	Chairman, WUG	Farmer, Mazin
U Zaw Win Han	SAE	Zalethaw MO
U San Htin	DY-2 (canal)	Farmer, Zalethaw
U Kyaw Shwe	DY-2 (canal)	Test Farm, Zalethaw

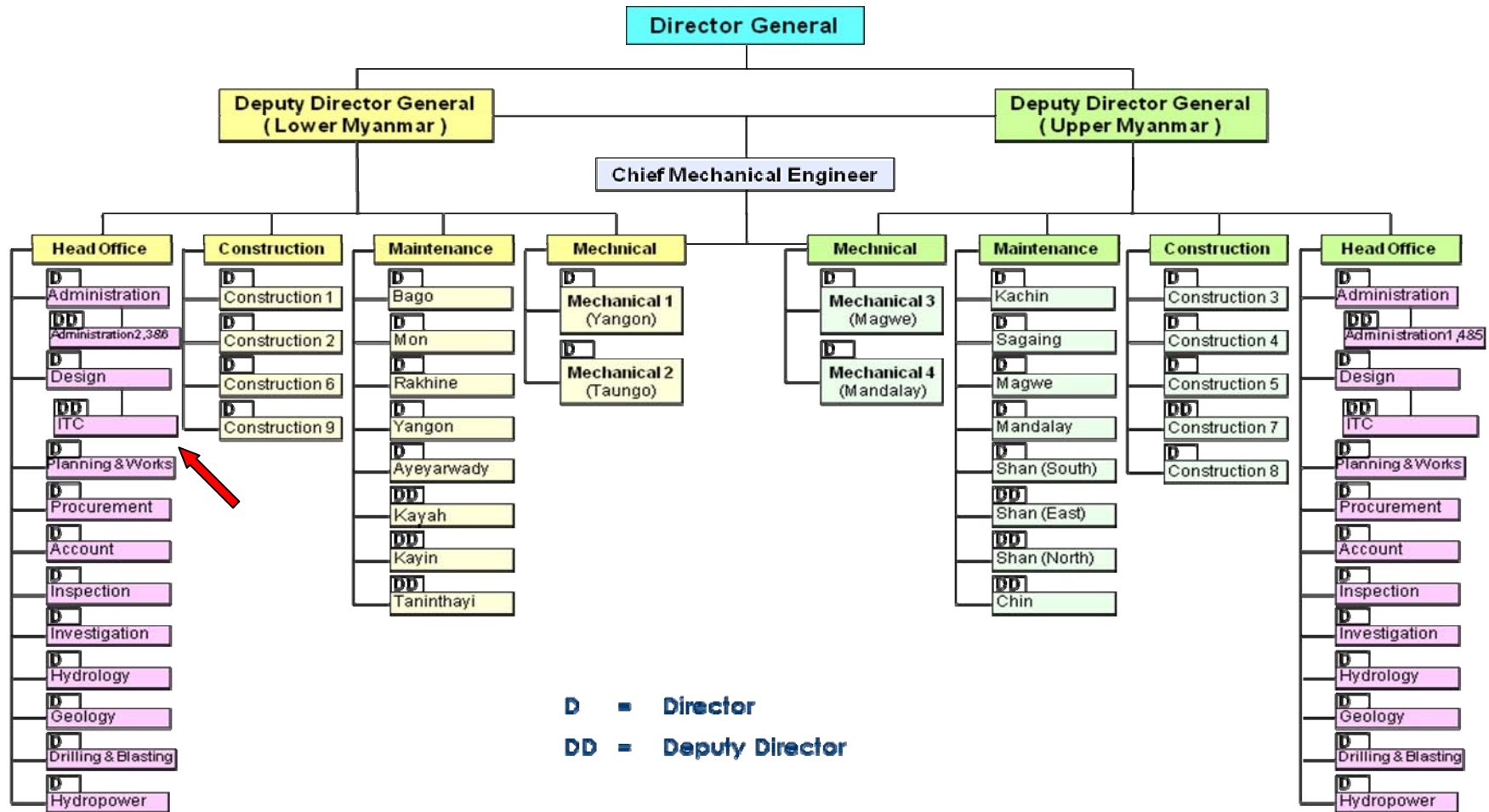
#### Abbreviations

MOAI: Ministry of Agriculture and Irrigation  
 ID: Irrigation Department  
 ITC: Irrigation Technology Center  
 MO: Maintenance Office  
 WM I: Water Management I Section  
 WM II: Water Management II Section  
 SD: System Development  
 IIM: Irrigation Information Management Section  
 CMTL: Construction Material Test Laboratory  
 WUG: Water user group

Annex 5. Schedule of Consultant on Ex-post Evaluation of ITC Project Phase II

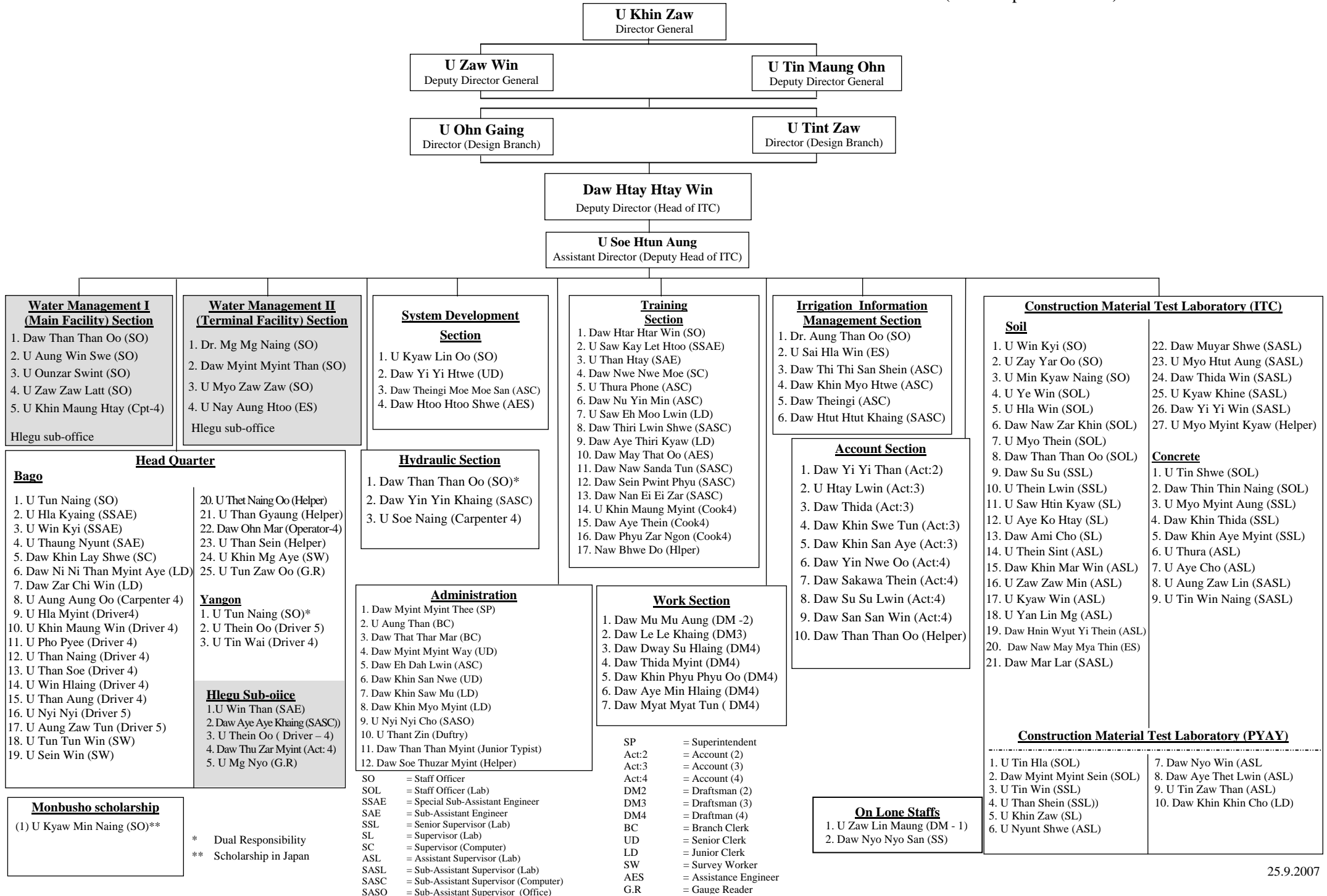
No	Date	Day	Time	Place	Activities	Stay	
1	23-Sept.	Sun		Arrive at Yangon airport (TG 305, 19:00)		Yangon	
1	24-Sept.	Mon	a.m.	JICA Myanmar Office	Briefing and information collection	Yangon	
			p.m.	Irrigation Department (ID)	Courtesy call and interview		
2	25-Sept.	Tue	a.m.	Leave for Bago ITC		ITC, Bago	
			p.m.	ITC, Bago	Interview and discussion		
3	26-Sept.	Wed	a.m.	Mazin Dam	Facility observation, group interview with farmers		
			p.m.	ITC, Bago	Interview and discussion		
4	27-Sept.	Thu	a.m.	Zalathaw Dam, Extensive type test farm for the IGA	Facility observation, group interview with farmers		
			p.m.	ITC, Bago	Interview and information collection		
5	28-Sept.	Fri		ITC (Bago) and ITC (Helegu)	Information collection Return to Yangon (p.m.)		Yangon
6	29-Sept.	Sat		Hotel Mariners (standing by)	Document preparation		
7	30-Sept.	Sun		Hotel Mariners (standing by)	Document preparation		
8	1-Oct.	Mon		Hotel Mariners (standing by)	Document preparation		
9	2-Oct.	Tue		Hotel Mariners (standing by)	Document preparation		
10	3-Oct.	Wed		Hotel Mariners (standing by)	Document preparation		
11	4-Oct	Thu		ITC, Bago	Discussion on finding based on the draft outline report		
12	5-Oct.	Fri		JICA Myanmar Office	Document preparation		
13	6-Oct.	Sat			Document preparation		
14	7-Oct.	Sun			Document preparation		
15	8-Oct.	Mon	a.m.	JICA Myanmar Office	Submission of the draft outline report	Yangon	
			p.m.	Irrigation Department	Presentation of the outline report		
15	9-Oct.	Tue		Leave for Bangkok (10:00AM, TGA304)			

## Annex 6. Organization Chart of the Irrigation Department





Annex 7. ORGANIZATION CHART OF ITC AND STAFF PERSONNEL OF EACH SECTION. (As of September 2007)



## Annex 8. List of Office Staffs at ITC-Bago (September - 2007)

No.	Desisnation	Pay Scale (Kyat)	Sanctioned	Appointed	Vacant
1	Deputy Director	120000- 2000-130000	1	1	-
2	Assistant Director (Civil)	100000-2000-110000	1	1	-
3	Staff Officer (Civil)	80000-2000-90000	19	15	-4
4	Staff Officer (Lab:)	`	9	9	-
	<b>Sub - Total</b>		<b>30</b>	<b>26</b>	<b>-4</b>
1	Special Sub-Asst: Engineer	45000-1000-50000	3	3	-
2	Senior Supervisor (Laboratory)	`	8	7	-1
3	Senior Supervisor (Computer)	`	1	-	-1
4	Accountant (1)	`	1	-	-1
5	Superintendent	`	-	1	+1
6	Accountant (2)	39000-1000-44000	1	1	-
7	Branch Clerk	`	2	2	-
8	Sub-Asst: Engineer (Civil)	`	4	3	-1
9	Supervisor (Laboratory)	`	11	4	-7
10	Supervisor (Computer)	`	4	2	-2
11	Draftman (2)	`	1	1	-
12	Senior Clerk	33000-1000-38000	4	3	-1
13	Accountant (3)	`	5	4	-1
14	Engineering Surveyor	`	3	3	-
15	Asst: Supervisor (Laboratory)	`	13	12	-1
16	Asst: Supervisor (Computer)	`	5	7	+2
17	Draftman (3)	`	2	1	-1
18	Carpenter (3)	`	1	-	-1
19	Technician (Mechanic) (3) (Civil)	`	1	-	-1
20	Junior Clerk	27000-1000-32000	7	7	-
21	Accountant (4)	`	8	5	-3
22	Asst: Engineering Surveyor	`	4	2	-2
23	Sub: Asst: Supervisor (Laboratory)	`	14	8	-6
24	Sub: Asst: Supervisor (Computer)	`	8	7	-1
25	Sub: Asst: Supervisor (Labourhead)	`	1	-	-1
26	Sub: Asst: Supervisor (Office)	`	1	1	-
27	Junior Typist	`	2	1	-1
28	Telephone Oporator (4)	`	1	1	-
29	Draftman (4)	`	5	5	-
30	Chief Cook (4)	`	2	3	+1
31	Driver (4)	`	9	9	-
32	Carpenter (4)	`	1	2	+1
33	Technician (Mechanic) (4)	`	1	-	-1
34	Duftry	21000-1000-26000	1	1	-
35	Senior - Labour	`	1	-	-1
36	Driver (5)	`	4	3	-1
37	Helper	15000-1000-20000	7	5	-2
38	Survey Worker	`	4	4	-
39	Gauge Reader	`	2	2	-
40	Durwan	`	3	2	-1
	<b>Sub- Total</b>		<b>156</b>	<b>122</b>	<b>-35</b>
	<b>Total</b>		<b>186</b>	<b>148</b>	<b>-39</b>

**Annex 9. YEARLY EXPENDITURE OF THE IRRIGATION DEPARTMENT ON ITC PROJECT PHASE II**

No.	Particulars	1999-00		2000-01		2001-02		2002-03		2003-04	
		Budget Allotment	Expenditure	Budget Allotment	Expenditure	Budget Allotment	Expenditure	Budget Allotment	Expenditure	Budget Allotment	Expenditure
	<b><u>CURRENT BUDGET</u></b>										
1	Salary of ITC Staff Personal	1,917,700	1,918,372	8,800,000	8,801,973	9,500,800	9,496,596	9,899,900	9,894,712	10,152,900	8,406,467
2	Internal Travel Allowance	850,000	849,547	850,000	850,003	1,204,000	1,125,512	1,038,800	1,038,433	1,505,000	1,016,597
3	Labour and Transporting Charges	146,500	146,468	172,200	172,135	284,100	281,378	356,900	356,948	531,700	225,726
4	Taxes	15,000	13,810	30,700	30,690	50,000	50,800	163,000	162,975	173,900	100,760
5	Office accessories, Publication, Newspapers, Uniform & Charges	1,305,500	1,296,373	965,500	965,596	2,764,500	2,747,986	2,352,700	2,352,725	3,441,100	3,986,955
6	Electricity Power Charges	347,870	347,858	300,000	299,947	344,000	317,036	271,500	271,514	312,000	252,867
7	Telephone Charges	284,940	284,933	200,000	200,000	373,600	373,501	348,100	348,731	1,200,000	1,500,442
8	Maintenance Charges of Machines & Equipment	250,000	249,925	258,800	258,825	393,300	393,265	357,700	357,720	520,000	528,415
9	Maintenance Charges of Buildings	1,151,500	1,147,957	1,380,000	1,382,399	1,882,100	1,882,031	2,528,000	2,565,426	7,000,000	2,052,738
10	Maintenance Charges of Vehicles	674,000	650,025	359,700	359,745	812,300	812,230	829,400	829,440	2,150,000	717,250
11	Charges of Diesel, Motor Sprit, Engine Oil & Lubricant	3,960,000	3,822,676	4,016,000	4,016,012	4,160,400	4,148,378	4,418,800	4,427,240	5,221,000	4,728,440
12	Others O/M	2,326,000	2,316,080	2,508,700	2,508,707	2,942,400	2,942,385	3,273,500	3,273,534	5,790,000	4,085,256
13	Expenditure for Training	2,500,000	2,496,190	2,675,200	2,675,228	2,913,000	2,707,395	3,600,000	3,895,170	7,445,900	7,792,905
14	Roads	-	-	-	-	-	-	-	-	4,500,000	2,021,652
15	Welfare money	-	-	-	-	-	-	-	-	3,100,000	1,508,226
16	Others S/R	-	-	-	-	-	-	-	-	-	-
	<b>Total</b>	15,729,010	15,540,215	22,516,800	22,521,261	27,624,500	27,278,494	29,438,300	29,774,566	53,043,500	38,924,694
	<b><u>CAPITAL BUDGET</u></b>										
1	Technical Co-operation Program (TCF)	8,000,000	7,987,671	31,500,000	31,336,400	17,120,000	17,119,776	22,215,000	21,328,257	17,477,000	17,305,561
2	Intermediate Goal Area (IGA)	-	-	-	-	-	-	-	-	-	-
	<b>Total</b>	8,000,000	7,987,671	31,500,000	31,336,400	17,120,000	17,119,776	22,215,000	21,328,257	17,477,000	17,305,561
	<b>Grand Total</b>	23,729,010	23,527,886	54,016,800	53,857,661	44,744,500	44,398,271	51,653,300	51,102,824	70,520,500	56,230,255

**YEARLY EXPENDITURE OF THE IRRIGATION DEPARTMENT ON ITC PROJECT (IGA)**

No.	Particulars	2004-05		2005-06		2006-07		2007-08 (Up to 31.8.07)	
		Budget Allotment	Expenditure	Budget Allotment	Expenditure	Budget Allotment	Expenditure	Budget Allotment	Expenditure
	<b><u>CURRENT BUDGET</u></b>								
1	Salary of ITC Staff Personal	10,269,000	10,303,726	10,257,400	10,242,043	79,185,000	79,270,582	83,904,000	31,999,000
2	Internal Travel Allowance	1,712,100	1,613,298	1,222,200	1,221,864	1,298,800	1,298,581	1,231,000	1,036,039
3	Labour and Transporting Charges	2,887,000	2,886,969	2,402,600	2,385,784	5,809,100	5,267,752	4,939,700	1,935,515
4	Taxes	258,000	257,345	142,000	141,555	292,800	247,425	284,000	156,338
5	Office accessories, Publication, Newspapers, Uniform & Charges	5,192,000	5,189,855	5,000,000	4,279,465	8,927,500	6,014,640	6,055,200	1,482,460
6	Electricity Power Charges	305,700	305,058	805,000	801,968	18,853,800	18,838,674	12,800,000	762,750
7	Telephone Charges	2,073,500	2,073,472	4,300,000	4,298,460	7,799,700	6,930,655	2,529,700	2,182,923
8	Maintenance Charges of Machines & Equipment	510,500	510,450	874,000	873,935	892,100	892,075	2,028,800	538,405
9	Maintenance Charges of Buildings	3,109,700	3,109,673	3,022,000	3,021,978	2,146,700	2,146,690	4,741,300	4,071,998
10	Maintenance Charges of Vehicles	2,168,600	2,148,486	1,610,000	1,605,573	2,154,000	2,153,965	1,466,800	925,582
11	Charges of Diesel, Motor Sprit, Engine Oil & Lubricant	4,724,300	4,724,318	17,500,000	17,499,952	32,805,700	32,805,654	32,608,800	13,954,025
12	Others O/M	6,709,900	7,578,743	11,360,000	11,359,818	10,616,600	10,616,549	6,868,000	4,732,415
13	Expenditure for Training	10,995,400	11,045,804	13,424,900	13,424,940	18,720,100	17,681,910	12,872,500	4,143,510
14	Roads	5,376,000	5,370,291	6,100,000	6,107,199	17,149,000	17,149,010	4,248,000	-
15	Welfare money	8,900,000	9,043,548	9,350,800	9,077,976	-	-	-	-
16	Others S/R	-	-	1,000,000	4,360,820	8,690,500	8,690,544	6,030,000	2,551,660
	<b>Total</b>	65,191,700	66,161,036	88,370,900	90,703,330	215,341,400	210,004,706	182,607,800	70,472,620
	<b><u>CAPITAL BUDGET</u></b>								
1	Technical Co-operation Program (TCP)	37,249,000	37,249,209	-	-	-	-	-	-
2	Intermediate Goal Area (IGA)	-	-	20,735,000	20,735,268	120,043,300	120,433,713	187,704,000	35,169,345
	<b>Total</b>	37,249,000	37,249,209	20,735,000	20,735,268	120,043,300	120,433,713	187,704,000	35,169,345
	<b>Grand Total</b>	102,440,700	103,410,245	109,105,900	111,438,599	335,384,700	330,438,420	370,311,800	105,641,965

Annex 10. Progress of Construction Material Test Laboratory

Sr; No.	Kinds of Tests	No. of Tests									
		4/99 ~ 3/00	4/00 ~ 3/01	4/01 ~ 3/02	4/02 ~ 3/03	4/03 ~ 3/04	4/04 ~ 3/05	4/05 ~ 3/06	4/06 ~ 3/07	4/07 Up to Date	Total
	<b><u>Soil Mechanic</u></b>										
1	Grain Size Test	158	75	162	51	53	56	10	200	74	839
2	Atterberg Limit Test	178	187	128	61	50	50	8	183	60	905
3	Specific Gravity Test	180	165	157	73	53	52	10	189	62	941
4	Standard Compaction Test	134	126	132	34	34	40	12	152	52	716
5	Permeability Test	72	68	58	10	34	25	3	123	53	446
6	Consolidation Test	35	24	32	15	11	10	2	24	18	171
7	Direct Shear Test	64	78	70	23	15	12	2	145	49	458
8	Triaxial Test (Std;)	21	24	25	8	10	12	2	10	20	132
9	Emersion Test	35	45	48	27	15	35	5	186	55	451
10	Unconfined Compression Test	-	5	-	-	-	-	5	1	2	13
11	Cone Penetration Test	-	2	2	3	-	-	-	-	-	7
12	Plate Bearing Test	1	3	-	-	-	-	-	2	-	6
13	Large Scale Triaxial Compression Test	-	2	4	3	3	3	-	11	14	40
	<b><u>Water Quality Test</u></b>										
1	Water Quality Test	5	7	5	4	30	38	15	16	39	159

Source: ITC, 2007

## Annex 10 (Continued)

## Actual Implementation of Requested Sample from Various Project of Irrigation Department

Sr. No.	Kinds of Tests	No of Tests									Total
		4/99 ~ 3/00	4/00 ~ 3/01	4/01 ~ 3/02	4/02 ~ 3/03	4/03 ~ 3/04	4/04 ~ 3/05	4/05 ~ 3/06	4/06 ~ 3/07	4/07 up to Date	
	<u>Concrete Technology</u>										
1	Physical Test of Cement	11	36	81	30	51	5	46	105	95	460
2	Physical Fine Aggregate	55	67	269	59	72	62	128	132	49	893
3	Physical Coarse Aggregate	116	173	381	65	120	95	87	79	33	1149
4	Tensile Test of Steel Bars	43	173	292	15	30	136	200	70	146	1105
5	Com: str: Test of Cone:	48	247	840	822	524	713	623	353	330	4500
6	Phy: Properties of Rock	-	-	8	43	104	81	322	81	44	683
7	Trial Mix Design	2	6	13	10	7	6	9	9	4	66

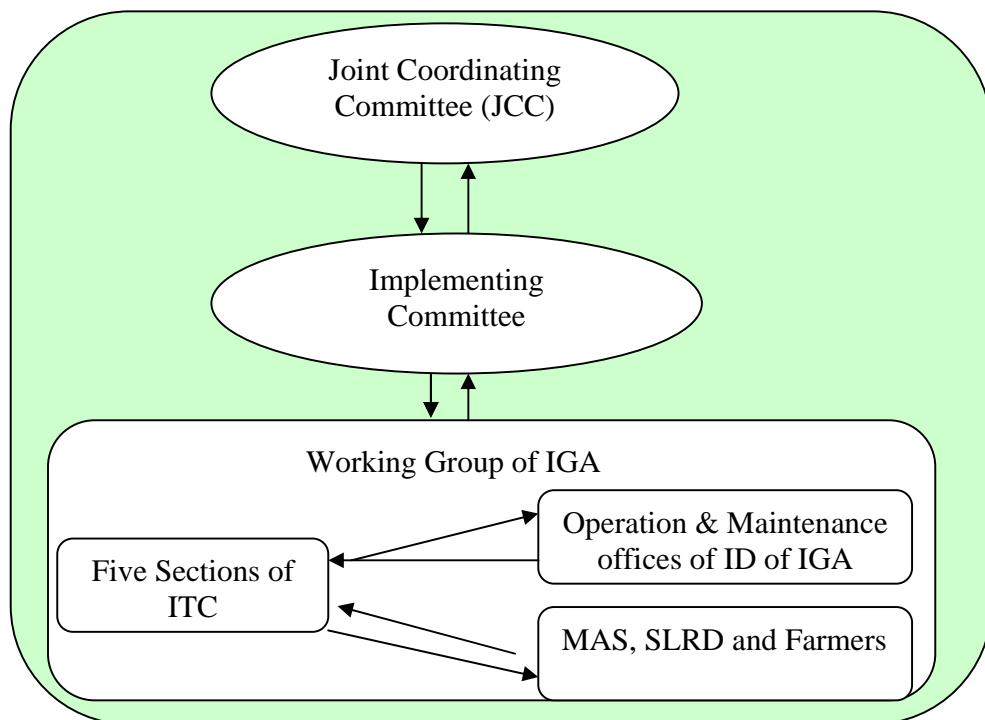
Source: ITC, 2007

**ANNEX-11-**  
**STATE AND DIVISION - WISE IRRIGATION WORKS IN DIFFERENT ERA**  
**( UNION OF MYANMAR)**

No.	State/Division	Between Ancient Myanmar Kingdom		Between 1962 and 1988		Between 1988 and 2006		Total	
		No.	Beneficial Area (Acre)	No.	Beneficial Area (Acre)	No.	Beneficial Area (Acre)	No.	Beneficial Area (Acre)
1	Kachin State	-	-	3	23,837	-	-	3	23,837
2	Kayar State	2	3,240	5	28,361	2	3,150	9	34,751
3	Kayin State	-	-	6	5,723	1	100 (+Town water)	7	5,823 (+ Town water)
4	Chin State	-	-	-	-	1	500	1	500
5	Sagaing Division	6	381,065	2	3,500	20	757,009	28	1,141,574
<b>6</b>	<b>Taninthayi Division</b>	-	-	-	-	<b>1</b>	<b>Town Water</b>	<b>1</b>	<b>Town Water</b>
7	Bago Division	10	14,384	6	107,489	42	785,470	58	907,343
8	Magway Division	7	162,634	4	21,458	32	293,838	43	477,930
9	Mandalay Division	38	288,251	23	234,480	48	384,269 (+ Town water)	109	907,000 (+ Town water)
10	Mon State	2	800	1	557	9	93,800	12	95,157
11	Rakhine State	-	-	2	60 (+ Town water)	4	450 (+ Town water)	6	510 (+ Town water)
12	Yangon Division	-	-	-	-	17	274,395	17	274,395
13	Shan State	-	-	17	57,450	4	111,843	21	169,293
14	Ayeyarwaddy Division	4	2,910	-	-	8	287,421	12	290,331
	<b>Total</b>	<b>69</b>	<b>853,284</b>	<b>69</b>	<b>482,915</b>	<b>189</b>	<b>2,992,245</b>	<b>327</b>	<b>4,328,444</b>

Source: ITC

**Annex (12-): Organization Chart of IGA Project and Implementing Organization**





**Farmers' Participation in Water Management in Ngamoeyeik after Phase II**

**Minor 5 Area (Out side of test farm area)**



Farmers observed situation of water channel



Discussion between WUAs



After the maintenance works done by farmers

**Direct Minor 6 Area (Out side of test farm area):**



Observation and discussion at field



Sharing labour for maintenance works



After renovation of canal

**Ngamoeyeik Irrigated Area:**



Location of old watercourse



New watercourse constructed by farmers to get water up to tail portion



Farmlands are prepared for 2008 Summer Paddy

### ITC Activities for IGA Project

#### Zaletaw Irrigated Area:



Farmers Training



Discussions made by farmers



Observation tour by ITC

#### Mazin Irrigated Area:



Farmers Training conducted by ITC



Discussion between ID staffs and farmers



Organizing Water Users Association

#### Required irrigation facilities constructed by ITC for IGA in Mazin:



Irrigation facilities constructed by ITC in Mazin: Irrigation facilities constructed by ITC in Mazin

#### Participation of farmers in IGA activities in Mazin:



Farmers contributed their labour for construction of watercourse and watercourse after construction



ITC Activities other than IGA

**Kinda Dam:**



Lecture given by ITC



Discussion between farmers



Get feedback from farmers

**Zaungtu Dam:**



Farmers Training conducted by ITC



Discussion made by farmers



Lecturer given to farmers

**Ngamoeyik Area (Out side Area of test farm ):**



ITC conducted Farmers Training



Sharing views by farmers



Collecting feedbacks from

## Thanatpyin Minor – 5 Water Users' Group

### 1. Location

Kwin No. 1028-A and 1028-B  
Thanatpyin Village  
Hlegu Township  
Yangon Division, Myanmar

### 2. Canal System

- Minor-5 of Left Ngamoeyeik Branch Canal, Ngamoeyeik Irrigation Project
- Irrigable Area 520 Acre
- Discharge 6 ~ 7 cusecs
- Length of canal 8,400 ft
- Watercourse 20 Nos. with Myaunggaungs (or) Leader of Watercourse.

### 3. Objective

- (1) Efficient Use of Farmlands through proper Irrigation and Drainage.
- (2) Equal and Efficient Water distribution to all member farmers' paddy fields through their participation without dispute and waste of water.
- (3) Quick Action for any emergency and water shortage to prevent crop damage.

### 4. Organization

Established in 1998 and present organization is as follows

(1) Chairman of VPDC	Chairman
(2) U Pan Ngwe (farmer)	Member
(3) U San Aung (farmer)	Member
(4) U Tin Hla (farmer)	Member
(5) U Hla Tun (farmer)	Member
(6) U Soe Myint (farmer)	Member
(7) U Myo Win (farmer)	Member
(8) U Khin Maung Win (farmer)	Secretary
Member (1) of VPDC	
(9) Member Farmers	65 Nos.

## 5. Participation by farmers

Per acre Maintenance cost is about 300 Ks/Acre for Minor-5 in 2005 and yearly Maintenance of Watercourse.

<u>Year</u>	<u>Maintenance Cost by member farmers</u>
1998	55,000 Ks
1999	75,000 Ks
2000	110,000 Ks
⋮	⋮
2005	150,000 Ks

## 6. Irrigation Management

- Inspection tour by members of Water Users' Group to Minor-5 and its watercourses one month before irrigation season starts.
- Meeting with all member farmers to make decisions for necessary maintenance works.
- Maintenance of watercourses by farmers with leadership of Myaunggaungs (or) Leaders of watercourse.
- Collection of maintenance fees for repair of Minor-5 canal from beneficial farmers.
- Repair of Minor-5 canal with the close supervision by tail area farmers of Minor- 5 and members of Water Users' Group.
- Meetings for expenditure of maintenance cost and O & M works during irrigation season.

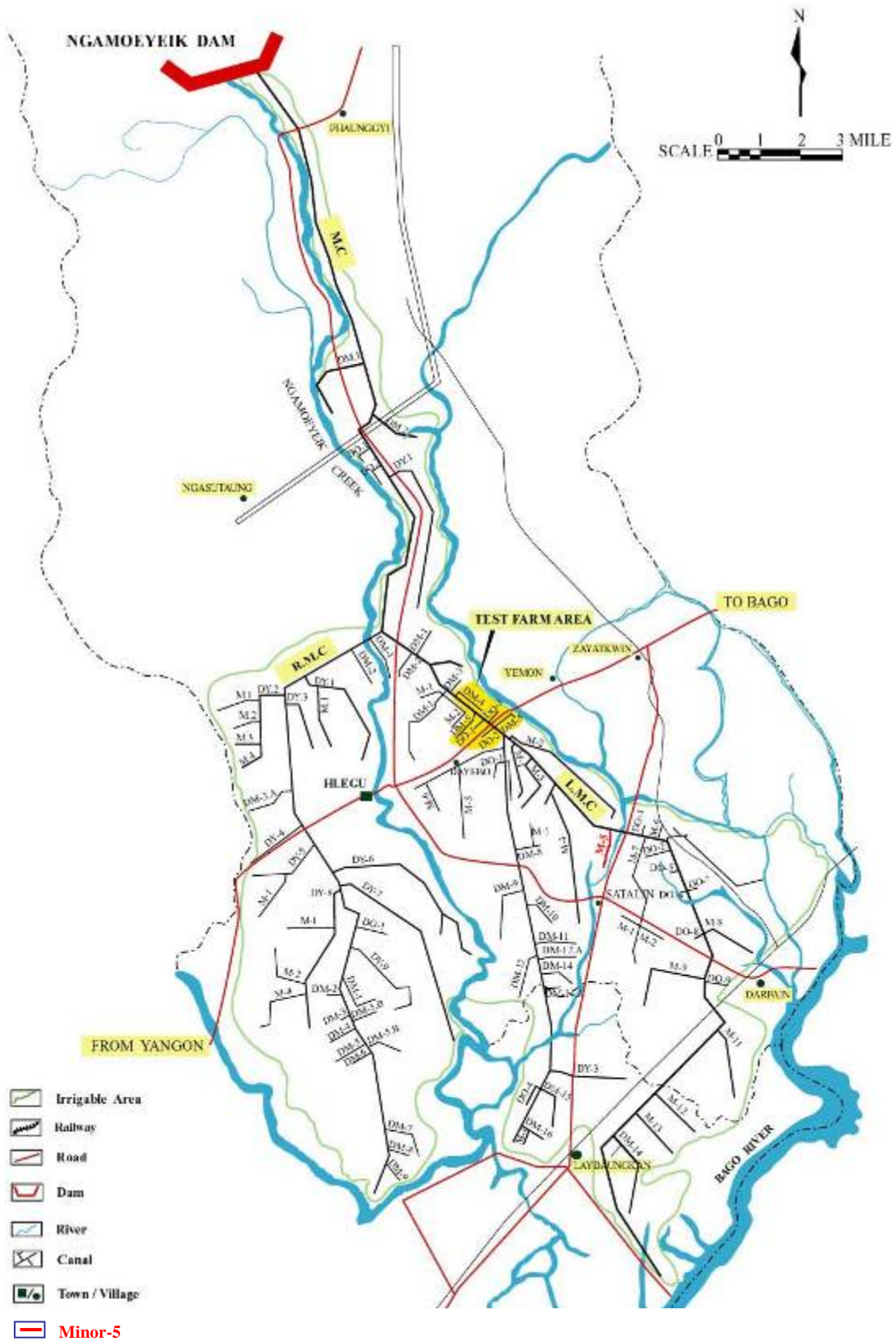
## 7. Supporting conditions

- (1) Good topography of irrigable area of Minor-5 for easy maintenance by farmers.
- (2) Farmers are from the same village and some of them are relatives.
- (3) Farmers received the training for irrigation practice and how to organize Water Users' Group in 1998.
- (4) Regular Maintenance by Water Users' Group and farmers yearly.
- (5) The Water Users' Group Size is not so big and small at their beginning of Water Users' Group to get the good results or outputs.

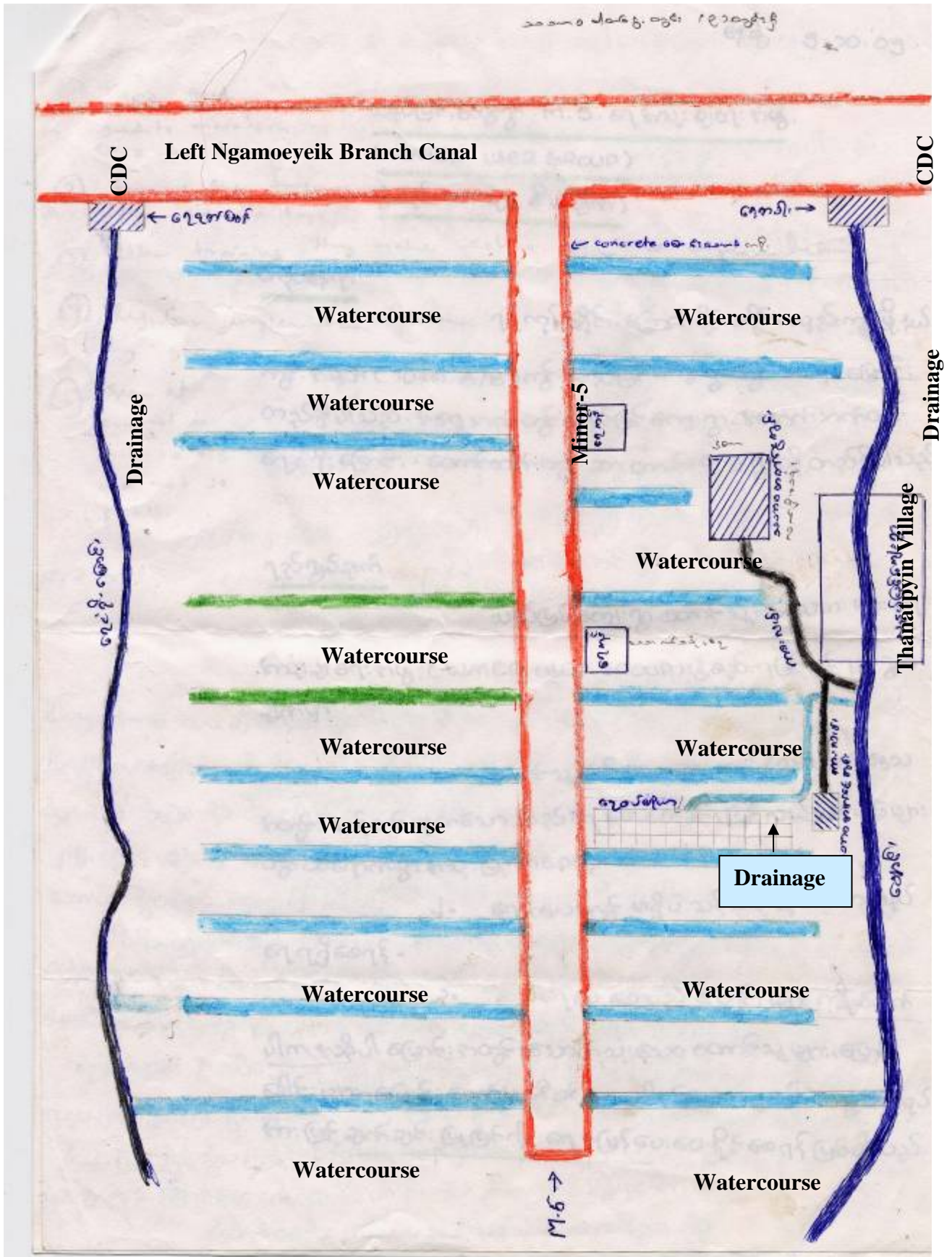
## 8. Activities of Irrigation Information Management Section of ITC (Bago) with Thanatpyin Minor-5 Water Users' Group

- Training in October 2005 on Watercourse Wise Water Users' Association for Leaders of Watercourse or Myaunggaung and on dissemination the experience of Thanatpyin Minor-5 Water Users' Group to other canal area in Ngamoeyeik Irrigation Project.
- 3 times of study tour to Thanatpyin Minor-5 Water Users' Group with the participants of Training for Myaunggaungs (or) Leaders of Watercourse wise Water Users' Association for Zalathtaw & Mazin Irrigation Projects, Intermediate Goal Area (IGA) of ITC Project Phase II.
- Preparation for joint study with JICA or JIID on Thanatpyin Minor-5 and Minor-7 of Left Ngamoeyeik Branch Canal Water Users' Group.

# Location of Left Ngamoeyeik Branch Canal Minor-5 (Thanatpyin), Ngamoeyeik Irrigation Project



Lay Out of Left Ngamoeyeik Branch Canal Minor – 5 prepared by member farmers





## **Comments and Suggestions on Ex-Post Evaluation Study Report ITC Project Phase II and Follow-up in Myanmar**

*( Tin Maung Shwe, Executive Committee Member, Myanmar Academy of Agricultural,  
Forestry, Livestock and Fishery Sciences)*

### **Introduction**

With abundance of water resources in Myanmar, a number of irrigation schemes have been developed through construction of small, medium and large scale dams and reservoirs, and establishing pumping irrigation stations in most feasible areas to boost up the agriculture production. With these efforts, irrigated areas in the country are increasing significantly during last decade and consequently cropping intensity and crop production are increasing in irrigated areas. The government supported not only irrigation infrastructures but also irrigation facilities such as water pumps and irrigation networks. In addition, water user groups were formed in irrigated tracts to utilize water efficiently and effectively on their fields. Construction of Irrigation Technology Centre (ITC) in 1988 and technical cooperation ITC Project Phase I (1988-1998) by the grant aid of Japan was timely to support the developing irrigation projects in Myanmar. The ITC Project Phase II (1999-2004) and follow-up (2004-2005) for the Phase II have main objective of upgrading water management technology in project areas and disseminating this proven technology to the farmers to increase the crop yields as the overall goal of the project.

### **(1) Performance of Project Purpose**

Continuation of outputs in the Ngamoyeik irrigated area and activities done by ITC on IGA project are improving to achieve the targeted activities of the project according to the schedule. According to the organization chart of IGA Project and coordination mechanism among the committees and working groups, it is well pronounced to facilitate project activities at field level. Active participation and strong coordination of the working group members on activities at field level would play the important role to achieve the good results of the project performance. Farmers' participation on the project activities was satisfactory. Schedule and work plan for remaining activities to be done by the working groups are well prepared. The records of the activities implemented by each working group would be useful for monitoring and evaluation purpose.

### **(2) Achievement related to Project Impact**

The verifiable indicator of Overall Goal is mentioned in PDM as "Total yields in irrigated fields are increased through efficient irrigation water use" and its target areas of whole country. The yield components of crop are composed of many factors such as soil type, cultivation practices, utilization and application of suitable fertilizers, water management, crop varieties, and pest and disease control and among other. It is difficult to estimate exclusively the impact of improvement of irrigation technology on crop productivity. In

principle, the overall goal of any project can not be achieved by only specific project components. Other projects are required to fulfill the objectives of overall goal under program approach. The impact of the project can be fairly acceptable as long as purpose of the project is still relevant to the overall goal at this evaluation stage. Moreover the impact of the project is to be achieved after some years of the project completion. However, impact of the project can be observed from sample estimation in the targeted areas by conducting sample survey which can be estimated from comparison with information collected from baseline survey which is necessary to record the data and information as bench mark before project implementation. In this context, it is suggested that baseline surveys should be carried out in targeted areas of the project. Overall goal of the project should be closely relevant to the project purpose. Establishment of water management technology in three irrigated areas: Tabuhla, Zelettaw and Mazin would represent model for technology dissemination to other irrigated areas, which will reduce the gap between overall goal and purpose of the project. Follow up activities such as field visit and discussion between farmers in project areas and non-project areas will have the multiplier effect of the project.

Peas and beans cultivated areas and production are dramatically increasing from 1.8 million acres in 1988 to 9.89 million acres in 2007 due to increasing demand for export market. Therefore, peas and beans cultivation after monsoon paddy also contributes considerable extent of cropping areas to increase the cropping intensity. Those crops are sown with residual moisture after harvesting paddy. Cropping intensity as alternative indicator should be compared with that of non-project areas or other irrigation scheme instead of comparison with union cropping intensity statistics in order to realize the effect of introducing efficient water management technology exclusively.

It is difficult to disseminate the irrigation technology in large scale irrigation system to be handled by existing ITC staff and capacity. Helping hands from field extension agents like MAS and SLRD field staff are necessary in technology dissemination. Field staff from Water Resources Utilization Department (WRUD) can perform as potential extension agents to disseminate the irrigation technology to the farmers at field level. It is suggested that technology training program in ITC should be extended for the field staff from other related agencies under the same Ministry to understand the project objectives and implementation activities. It is also necessary to draw the long term work plan concerned with technology dissemination in other large scale irrigated areas, including the areas under pumping irrigation system. Performance of the above follow up programs would support to achieve the overall goal of the project.

### **(3) Sustainability of the Project**

Technical feasibility of IGA activities is corporate with the outputs of the project Phase II. With respect to the technical aspect of sustainability, technical feasibility of IGA activities, consistency of irrigation technology with Project II and support of Ministry of Agriculture and Irrigation to development of irrigation projects are the catalysts to streamline

the implementation of project activities after termination of the project. Under the different agro-ecological conditions in irrigation projects, pilot demonstration plots are needed to be established with support of ID staff trained by the project and technical supervision is to be done by ITC staff to suit with local condition. Provision of training capacity and promotion of training activities for water management in upper Myanmar (ITC) would be considered to enforce the sustainability of the project...

In view of human resource and institutional perspective, technical staff assigned in both ITCs in Bago and Patheingyi is satisfactory to carry out the project activities. To strengthen the activities of the two ITCs, the ITRDC (Irrigation Technology Research and Development Center) was planned to be established as a Branch of ID. Strengthening organizational structure for two ITCs to ITRDC can be observed to assure the sustainability of the project with respect to human resource development and promotion of institutional capacity. To support the achievement to overall goal of the project, training program for training of trainers (ToT) should also be extended to the farmers from large scale irrigation scheme. It is suggested that the establishment of Farmers Field School at representative sites of the irrigated projects would be conducive not only to strengthen the human resource development but also to support the technology dissemination in field level.

Evaluation study noted that the budget allocation to ITC has been adequate as yearly expenditure for Phase 11 and IGA project but some instruments may become out of operation shortly due to lack of spare parts, the purchase of which require foreign currencies. With the constraint in allocation of foreign currencies budget to ITC, ID can have to explore the possible way to support ITC. The required spare parts and instruments in ITC laboratory are utilized for testing of dam construction materials for irrigation projects of ID. Therefore, ID may find out this solution by managing the support to ITC from Construction Branch within the Department.

## **Conclusion**

It is expected that this comments and suggestions would not be redundant to the contents of main findings done by the JICA Evaluation Mission and just to consider the proposed idea as addendum to the main recommendations. The government has continuing strong support to development of irrigation sector which was illustrated in construction of dams and reservoirs and river pumping stations during the last decade. Establishment of another ITC at Patheingyi shows the awareness by the government to extend the transfer of irrigation technology to the farmers.

Motivation of farmers in the project areas is satisfactory in field operation as well as actively participation in physical works. Success criteria of the project activities, inputs and outputs would be useful in formulation of future technical projects and as baseline information for irrigation development projects in future.

事後評価調査結果要約表

評価実施部署：ミャンマー事務所

1. 案件の概要	
国名：ミャンマー連邦	案件名：灌漑技術センター計画フェーズ II
分野：農業開発	協力形態：プロジェクト方式技術協力
所轄部署：農業開発協力部農業技術協力課	協力金額：6億3千万円（フェーズ II）
協力期間：フェーズ II:1999年～2004年 フォローアップ:2004年～2005年	先方実施機関：灌漑局灌漑技術センター 日本側協力機関：農林水産省
他の関連協力：灌漑技術センター計画フェーズ I（1988年～1998年）	
<p><b>1-1 協力の背景と概要</b></p> <p>ミャンマー連邦において、農業は GDP の 52% を占め就業人口の 63% が従事する基幹産業であり、農業を中心とする経済発展が国家経済目標の最優先課題であったことから、ミャンマー政府は、灌漑面積の拡大による農業生産の増大をめざして、1992 年以降全国で灌漑開発を推進してきた。しかしながら生産現場における灌漑計画が未熟なこと、灌漑施設の操作・維持管理等の水管理技術が確立されていないこと等の理由から、依然として灌漑圃場に計画どおりに水が行き渡らない状況が見られた。</p> <p>こうしたことから、ミャンマー政府は今後の農業生産の安定・向上に資するため、灌漑面積の更なる拡大と、灌漑技術センター計画フェーズ I（1988-1998）の成果の継続的な発展を目的として、水管理関係技術の向上をめざすプロジェクト方式技術協力「フェーズ II（1999-2004）」の実施を日本政府に要請した。さらにフェーズ II の成果品である技術図書を完成させるため「フォローアップ（2004-2005）」が実施された。</p> <p>本事後評価は、協力終了後 2 年半の時点で、対象プロジェクトがどのような開発へのインパクトを発現しているか、また協力の効果が持続しているかを中心に、「フェーズ II」及び「フォローアップ」を対象として実施されたものである。</p>	
<p><b>1-2 協力内容（フェーズ II）</b></p> <p>バゴー市にある灌漑技術センター（Irrigation Technology Centre : ITC）を拠点とし、レグー市内のガモエを灌漑事業モデル地区に選定して試験圃場を整備し、①基幹施設水管理、②末端施設水管理、③システム開発、④灌漑情報管理、⑤研修の 5 つの分野において技術移転が行われた。</p> <p>(1) <u>上位目標</u> 灌漑技術の改善により農業（コメ）生産性が向上する。 （プロジェクト終了約 10 年後における達成目標）</p> <p>(2) <u>中間目標</u> 中間目標地区（ザラト灌漑地区、マジン灌漑地区、タブラ灌漑地区）で適切な水管理技術が確立される。 （中間目標は、2001 年の中間評価時にプロジェクト目標と上位目標を橋渡しするために導入された、プロジェクト終了後約 5 年後における達成目標。）</p> <p>(3) <u>プロジェクト目標</u> フェーズ I で達成された基礎灌漑技術を適用し、ガモエ灌漑地区の水管理技術が向上する。</p> <p>(4) <u>成果</u></p> <ol style="list-style-type: none"> <li>1) 基幹施設における水の維持管理及び灌漑技術が向上する。</li> <li>2) 水管理の観点から、末端水利システムの検討手法が改善される。</li> <li>3) 水管理のための技術支援システムが改善される。</li> <li>4) 灌漑情報管理技術により灌漑事業のモニタリングが改善される。</li> <li>5) 研修を通じて農業灌漑省灌漑局の職員と試験圃場の農家に水管理技術が普及される。</li> </ol> <p>(5) <u>投入</u> （日本側）長期専門家派遣 13 名、短期専門家派遣 19 名、研修員受入れ 29 名、供与機材約 77 万 2 千米ドル、事業費負担約 50 万米ドル （ミャンマー側）カウンターパート配置 35 名、事業費負担約 2 百万チャット</p>	
2. 評価調査団の概要	
調査者	<p>(1) 奥田浩之、JICA ミャンマー事務所</p> <p>(2) Kyaw Lwin Oo、JICA ミャンマー事務所</p> <p>(3) 寺尾豊光、水産エンジニアリング（株）</p>

調査期間	2007年9月24日～2007年10月8日	評価種類：事後評価
<b>3. 実績の確認</b>		
<b>3-1 協力終了後のプロジェクト目標の持続状況</b>		
<p>フェーズ II のモデルサイトであるガモエ灌漑地区において、基幹水利施設、圃場の区画整理を行い用排水路を分離した Intensive Type 試験圃場（15 区画、62 エーカー）、末端水路だけを整備し区画整理は行わない Extensive Type 試験圃場（36 区画、310 エーカー）を整備し、水管理技術の普及が行われた。フェーズ II 終了後も、灌漑管理事務所のもと体系的なモニタリングや水管理情報が提供され、両試験圃場において活動は継続している。フェーズ II（フォローアップ）で作成された技術図書は、灌漑局職員や農家に対する水管理のための研修に利用され、有用性について非常に高い評価が得られている。</p>		
<b>3-2 中間目標の達成状況</b>		
<p>フォローアップ終了直後の 2005 年 4 月に、灌漑局は「中間目標」達成のため 5 年間の「中間目標地区（Intermediate Goal Area : IGA）」プロジェクトを独自の予算により開始した。IGA プロジェクトはフェーズ II のアウトプットを利用し、ガモエ灌漑地区で達成された水管理技術を、IGA（ザラト、マジン、タブラ）でも確立しようとするものである。IGA プロジェクトは現時点で開始後 2 年半であるが、これまで十分な進展が見られる。例えば、ザラト灌漑地区では試験圃場（130 エーカー）の整備が 2007 年 3 月に終了し、次乾季（2007 年 11 月）から研究調査が開始される。タブラ灌漑地区では試験圃場予定地（230 エーカー）が決定し、次乾季より整備が開始される予定である。圃場整備前・整備後の利水状況比較のため、また研修教材や各灌漑地区ごとの技術図書の作成のため、データや情報についての収集と整理も進んでいる。計画どおり活動が先行するザラト灌漑地区とマジン灌漑地区では、中間目標の達成は十分に可能と考えられる。</p>		
<b>3-3 上位目標の達成状況</b>		
<p>上位目標達成に向けた ITC の活動の中心が IGA プロジェクトである。上位目標の達成に向けては、ITC は全国の灌漑施設に対する技術支援のため、灌漑局職員及び農家に対する研修を実施し、またフェーズ II の成果である技術図書やモニタリング・テーブルの配付を、IGA に限らず全国的に行っているところである。しかし中間目標と上位目標の間の開きは依然として大きく、全国の 300 を超える灌漑施設を対象とする上位目標を ITC が 10 年程度で達成するのは難しい。</p>		
<b>3-4 終了時評価での提言の活用状況</b>		
<p>2003 年 9 月に実施されたフェーズ II 終了時評価では、①技術図書を完成させるために活動が遅れている分野に対するフォローアップの実施、②水管理技術と営農技術の指導を組み合わせた農家研修の継続、③供与機材の継続的活用と、3 項の提言がなされた。①フェーズ II のフォローアップについては 2004 年 4 月から 2005 年 1 月まで 10 ヶ月間実施され、②と③についても提言どおり実施されている。</p>		
<b>4. 評価結果の概要</b>		
<b>4-1 インパクト</b>		
<p>水管理技術の改善による「期待されるインパクト」、すなわち灌漑地区におけるコメ単収の増加（上位目標の達成指標）については、プロジェクト対象地区（ガモエ、ザラト、マジン、タブラ）でも未だデータには現れていない。単収は天候、病害虫、地理など多くの要因に影響されるので、これをもって水管理の効果をみるのは困難である。そこで代替の達成指標として提案された「作付強度」をみると、4 灌漑地区では全国平均より値が高く、また年々上昇傾向にあり、水管理技術の成果が確認された。</p> <p>「その他のインパクト」について、ガモエ地区では、水利組合の活動が活発化し、農家の定期的集まり、取水をめぐる農家間対立の減少、水利費の徴収、組合による施設の管理補修が行われる例がみられた。それにともない灌漑局職員の負担が軽減する一方で、IGA プロジェクトを自力で実施することにより灌漑技術業務に対する職員の自信の醸成が報告された。</p>		
<b>4-2 自立発展性</b>		
<ul style="list-style-type: none"> <li>● 技術的観点からの自立発展性は概ね高い。これまでの移転技術は IGA プロジェクトの中で着実に活用されており、中間目標の達成に向け成果も上がっている。</li> <li>● 組織的観点からの自立発展性は高い。ITC の技術職員 24 人の内、11 人が ITC 副ディレクターの指示の下に IGA プロジェクトの活動に従事しており、その全てがフェーズ II 実施の際のカウンターパートである。</li> <li>● 資金的観点からみた自立発展性は高い。ITC に配付される予算は充分と考えられる。一方で灌漑局全体にみられる外貨不足は、近年深刻な状況となっている。</li> </ul>		

#### 4-3 プロジェクトの促進要因

##### (1) インパクト

- 中間目標の導入は、ITC がフェーズ II 後も灌漑施設への技術向上支援を継続していくにあたり明確な目標の設定となり、また IGA プロジェクト実施を通して職員に実地業務を経験・蓄積する機会が付与された。
- 1989 年に一旦緩和された米の強制供出制度が 2003 年には完全に廃止され、庭先価格が大きく上昇したことから、乾季稲作を含めて農家のコメ生産に対する意欲が高まった。

##### (2) 自立発展性

- 灌漑局による ITC への安定した予算配布、元カウンターパートの IGA プロジェクトへの継続配置、ITC 機材の経年劣化に抗する良好なメンテナンス努力、の 3 点の促進要因が認められた。

#### 4-4 プロジェクトの阻害要因

##### (1) インパクト

上位目標の達成に向けて現在の ITC の技術普及活動の加速化していくための、研究開発を含め継続的に ITC の能力強化を図っていく具体的計画がなく、研修手法や対象拡大についても検討状況は弱い。

##### (2) 自立発展性

灌漑局における外貨不足のため、1988 年の無償援助時に供与された計測機器等の資機材で、必要なスペアパーツ及び実験用消耗品の購入が不可能なものについては、今後の使用継続が危ぶまれるものがある。

#### 4-5 結論

ITC の努力によりフェーズ II のプロジェクト達成状況は良く維持されている。中間目標の 2010 年までの達成は可能で、達成指標である技術図書の内容も進んでおり、ザラト灌漑地区とマジン灌漑地区では予定通りの終了が見込まれる。一方、上位目標については対象地域が全国であり、フェーズ II 終了約 10 年後という設定を考えると、達成は難しい。しかしながら活動を続けていく中で、ITC 職員の能力強化や水利組織の活性化などの効果が現れている。ITC の業務は、全国の灌漑地区に対する技術的支援と灌漑局職員と農家に対する研修の実施である。従って現在 ITC は、水管理技術向上の支援を全国 300 以上の灌漑地区に実施する方法を模索中である。

### 5. 提言と教訓

#### 5-1 提言

灌漑技術センターへの提言

- IGA プロジェクトを実施していく中で顕在化してきた ITC の各部門間の作業量格差を調整するため、関係職員の適切な配置計画を検討し、人的資源の投入均衡を図る。
- 現在の水管理技術を対象圃場の特定条件に合うよう修整・調整できるような低コストかつ現場で実行しやすい灌漑手法の開発といった灌漑技術の更なる向上、また、職員や農家に対する研修効果を最大化するような手法の開発のための、研究開発能力を強化する。
- IGA 実施のためのワーキンググループを ITC と共に構成するミャンマー農業公社、土地登記局と連携しながら、プロジェクト対象地区における作物生産にかかるデータの正確で継続的な収集を行う。

灌漑局への提言

- 上位目標の達成に向けて現在の技術支援活動が加速化していくよう、ITC の組織として能力強化を評価検討するような ITC への専門家受入れの可能性を検討する。
- 灌漑局下には、現在 2 つの ITC (バゴ、パテンジー) があるが、ITC パテンジーについては、ITC バゴと同様に水管理技術の研修を職員・農家に対し実施できるよう、役割、予算、人員等について強化を図る。
- 国内外の研修、セミナー、ワークショップなどへの出席を利用した ITC スタッフの各自分野における技術知識の向上を支援する。

JICA への提言

- 実験器具や建物設備に関し、スペアパーツや消耗品の購入や修理は、外貨不足が深刻な灌漑局では対応できない状況にあるので、フォローアップ等により必要な調達を行うことが望まれる。

#### 5-2 教訓

- ガモエ灌漑地区では農家への研修により水利組織の活動が活発化され、配水に係る定期会合の開催、灌漑施設の自主管理といった効果が現れていることから、水管理における農民参加の重要性が確認された。
- プロジェクト目標と上位目標との間に大きな開きが認められる時には、中間目標を導入することで上位目標への道筋を明確化し、その間を橋渡しすることが有益である。
- 現在みられる上位目標達成の困難さはプロジェクト活動によるものではなく、上位目標及びその達成指標の設定の仕方に起因するものであり、各種調査時に見直しを行うことも必要と考えられる。

