CHAPTER 4 IMPLEMENTATION OF PILOT PROJECTS

4.1 Purpose and Scope of Pilot Projects

4.1.1 Purpose of Pilot Projects

Based on the discussion made in previous chapters on identification of current problems, challenges and improvement measures, four components were prioritized for the D/P for the preservation of farming area, as follows: 1) agricultural and rural infrastructure as a main component, 2) farm management, 3) livelihood and income sources, and 4) mangrove windbreak trees. Careful study and verification for sub-projects from each component were required before formulating into the D/P. For this reason, selected sub-projects were implemented as a pilot project for verification.

The purpose of the pilot projects is to demonstrate and verify the contents of draft plans and designs of the sub-projects under four components. Henceforth, the results and outcomes from the pilot projects shall be used to finalize the D/P.

4.1.2 Basic Policy of Pilot Projects

One polder among 34 polders in the Project Area in Ayeyawady Division was selected as a pilot area for the implementation of the various activities proposed. It was so intended to implement all activities at one polder so that the operation and management of the pilot project would be efficiently carried out. Duration of the pilot project implementation was from April 2010 up to April 2011.

Important aspects to be clarified and verified through the pilot projects were focused on technical standards in design and construction, construction capacity, implementation process, implementing body, social and institutional acceptability, environmental soundness and financial viability. Results and outcomes of the pilot projects were evaluated together with government officers and farmers / villagers who participated in the pilot projects. Lessons from the pilot projects were carefully studied and used in the finalization of the draft D/P.

4.1.3 Scope of Pilot Projects

Scope and contents of the pilot projects were studied and determined on component basis as described in later sections. The following are the basic frame of four components:

(1) Agricultural and rural infrastructure will focus on the rehabilitation of polder dike and sluice gate, which are the most essential infrastructure for the preservation of farming area in the Ayeyawady Delta. Scale of polder dike rehabilitation considered one whole polder so that benefit can be obtained immediately when dike rehabilitation is completed under the pilot project.

(2) Farm management will focus on increase of rice production by extension of quality rice seed through the on-site rice seed production pilot project to produce certified rice seed by farmers.

(3) Livelihood and income sources will focus on the establishment of small business for income generation. Specifically, vegetable cultivation at very small-scale by landless households who are residing in the rural villages will be demonstrated.

(4) Mangrove windbreak trees will focus on replanting of mangrove trees along polder dike to protect dike embankment from tidal surge and storm.

4.1.4 Selection of Pilot Project Area

Two polders as a candidate for the pilot project site, namely Labutta North Polder in Labutta Township and Bogalay Daunggyi Polder in Bogalay Township were initially listed. As a result of the study, the

Labutta North Polder was selected for the pilot projects because of the following reasons.

(1) Labutta Township was the most affected area by Nargis in terms of number of dead and missing in the Project Area. Therefore it will be the most appropriate area for the pilot projects for urgent rehabilitation.

(2) Labutta Township used to be under Myaungmya District and recently under Labutta District merging with Ngaputaw Township which was under Pathein in August 2008 just after Nargis. District capital is located in Labutta North Polder where socio-economic activities are rapidly being expanded.

(3) In terms of accessibility in view of demonstration and exhibition of the model rehabilitation and training activities, Labutta North is more convenient than Bogalay Daunggyi. Labutta North can be accessed by only land while Bogalay Daunggyi can be accessed by land and river boats.

(4) Labutta North has been prioritized by the ID, MOAI. The arrangement of the C/P officers at the field level had been made when the JICA Project Team commenced the work in the Union of the Myanmar.

4.2 Government Laws, Regulations and Institutions related to Pilot Projects

(1) Land Acquisition Act

Some of laws enforced and procedures enacted under the reign of British Government still remain unchanged and effective. The Land Acquisition Act which was enacted in 1894 under the colonial administration stipulates procedures of land acquisition such as award of land, publication of notice, compensation and so on, and it is compiled in the Burma Code Volume X (1958). According to this act, a land collector shall compensate for land based on the decision by Court and the Court determines compensation considering market value of the land and damages to standing crops and trees and so on. In addition to that, 15% plus of the market value to a person interested in the land, given it is compulsory acquisition.

The act is seemingly still effective; some parts of the act above are cited in “Burma Irrigation Manual Volume II”, which is mentioned below. However, based on present situation this act has not been actually operational. In reality, the government does not compensate people for land acquisition based on a concept that it is not necessary to compensate since national projects are implemented for the public interest. Therefore, it is general that showing sympathy by certain payment for land acquisition (limited to damages to crops) is needed and enough instead of full-scale compensation. Remarkable complaint against this situation related to land acquisition for irrigation projects has not been reported so far, it is probably because any affected person can counter balance a loss of land by production increase by irrigation system to some extent.

(2) Burma Irrigation Manual Volume II

According to Burma Irrigation Manual Volume II, which was edited in 1948 and reprinted in 1962, a strip of land on each side of dam (tank) embankments shall be allocated with pillar setting by ID staff. Within the demarcated area, no lease or other permission shall not be given for cultivation purpose or residence. The width of strip on the outside of the embankments shall be within 50 feet from the toe of embankment for important tanks and within 25 feet for minor reservoirs. Moreover, concerning inner strip, the width is specified within 100 feet. It can be said that the width of strip depends on the scale. However, there is no mention about the scale of “important tank” and it is needed to determine the width of reserved area under ID control considering natural conditions at each site and scale of tank.

(3) Land Nationalization Act

The Article 38 of the Land Nationalization Act (1953) says, “If the President may deem beneficial to the State or to the agriculturalists, by growing some specific crops in some areas and by using specific

means to agricultural lands, the President may deem to apply or ask to apply specific crops or specific means to use on agricultural land respectively". The Article 39 the Land Nationalization Act (1953) says, "However, other provisions of this Act mentioned, the President or authority appointed by the President for this particular matter, may deem necessary, any agricultural land can be summoned to use specific mean or method", which means that farmlands can be acquired for the development projects, if the President deems it is beneficial for the State. On the other hand, the Article 39 also mentions that if and when there are projects for national development, related administrative bodies make sure that the minimum area of lands is to be nationalized and reasonable amounts of compensations are to be paid[1]. However, it does not clearly mention how to assess "reasonable amounts of compensations" and what kind of compensation shall be provided for the affected people.

(4) Customary Law

Since there is no regulation to stipulate the width of a strip of land concerning polder dike in the Union, the width to be reserved has been decided by ID technical officers considering surrounding natural conditions, scale of structures and so on. However, there is a customarily rule that does not allow anybody to cultivate or reside within 50 feet from toe of polder dike, which has been applied in the pilot project area since 1981. ID and TPDC personnel declared that the within 50 feet is as reserved area which is under the control of ID on the occasion of dike construction in 1981 and set some pillars showing the boundary. Given that this rule is acknowledged by both community side and township officers and that it is consistent with Burma Irrigation Manual Volume II to some extent, it is recommended to apply this ordinal rule to the Pilot Project.

4.3 Implementation and Result of Pilot Projects

4.3.1 Dike Embankment and Sluice Rehabilitation Pilot Project

(1) Purpose of Pilot Project

The purpose of pilot project is to verify safety (quality), cost and schedule based on construction technology in Myanmar by actual work and formulating best suitable design and construction plan.

Therefore, test embankment work as phase-1 was carried out for the purposes of evaluating improvement of embankment materials, selection of heavy equipments and also evaluation of ability of manual works, in order to determine appropriate construction method to be applied for major works in phase-2. In addition, phase-2 was carried out to master technology of construction and supervision for genuine rehabilitation of polder by ID in the future.

(2) Implementation and Result of Pilot Project

1) Phase-1 in Pilot Project

Test embankment was implemented at around station RD 180,000 in Labutta North Polder in accordance with six (6) different embankment methods as given in **Table 4.3.1-1** in April 2010.

Table 4.3.1-1 Contents and Quantity for Test Embankment

Test Case	Improved Method of Banking Soil	Method of Embankment	Quantity
Case-1 (Mechanic)	-Temporary dike -Natural drying up (2 days)	Excavation and Temporary dike: Dozer + Backhoe Embankment: Backhoe(damping) + Dozer(spreading and compaction) + Road roller(finishing of surface on embankment) Spreading depth: 30cm (finishing depth is 25cm)	L=200m V=700sud (2,000m3)
Case-2 (Mechanic)	Ditto	Excavation and Temporary dike: Dozer + Backhoe Embankment: Backhoe(damping) + Dozer(spreading) + Tamping roller (compaction) + Road roller(finishing of bank-surface) Spreading depth: 30cm (finishing depth is 25cm)	L=200m V=700sud (2,000m3)
Case-3	-Temporary dike	Excavation and Temporary dike: Dozer + Backhoe	L=200m

[1] This Act (English version) was cited from "The New Light of Myanmar" on 10th March, 2011

(Mechanic)	-Mixing coarse agree (gravel or crashed brick by 10% volume ratio)	Embankment: Backhoe(damping) + Dozer(spreading and compaction) + Road roller(finishing of surface on embankment) Spreading depth: 30cm (finishing depth is 25cm)	V=700sud (2,000m3)
Case-4 (Mechanic)	Ditto	Excavation and Temporary dike: Dozer + Backhoe Embankment: Backhoe(damping) + Dozer(spreading) + Tamping roller (compaction) + Road roller(finishing of bank-surface) Spreading depth: 30cm (finishing depth is 25cm)	L=200m V=700sud (2,000m3)
Case-5 (Manual)	Non improvement	Excavation: Dozer + Backhoe Slop: sand back, Compaction: vibrating tamper or compactor	L=100m V=350sud (1,000m3)
Case-6 (Manual)	-Temporary dike -Natural drying up(2 days)	Ditto	L=100m V=350sud (1,000m3)
Total			L=1,000m V=3,500sud (10,000m3)

i) Implementation of test embankment

- 24/3/2010: Meeting and confirmation with JICA study team, ID, Contractor and supervising Consultant on the test embankment site
- 29/3/2010: Commencement of stripping and excavation for existing dike and borrow pit
- 31/3/2010: Commencement of mechanical and manual embankment
- 19/4/2010: Completion of whole embankment works
- 20/4/2010: Inspection for the completion of embankment works

ii) Working volume and bulk factor of soil

The total embankment volume as built was 3,648 sud (=10,324 m3) for the dike length of 1,000m in the test embankment. Bulk factor of soil based on the actual result showed that C-value (compacted/ground) was 3,648/3,947=0.9 & L-value (loosed/ground) was 1/0.9=1.1. It was almost same value was assumed for the borrow pit width on plan of test embankment.

iii) Results of quality control

In accordance with compaction test of laboratory test for borrow pit soil, the quality control of embankment has been carried out to clear 1.4 t/m^3 as standard value which corresponds to D-value 90% of average maximum dry density on compaction test (refer to "laboratory test" in **Appendix 4**).

The result of field density test is shown in the following table and every mechanical embankment works (case-1~4) almost clear the above standard value (1.4 t/m^3). On the other hand, manual embankment (case-5~6) shows a value of about D-value 85% (1.3/1.55) of maximum dry density on compaction test and it is considered suitable as compared with Japanese standard of manual work.

Test Case	Average (t/m3)	Maximum (t/m3))	Minimum (t/m3)
Case-1	1.37	1.43	1.31
Case-2	1.43	1.49	1.31
Case-3	1.40	1.48	1.32
Case-4	1.46	1.58	1.38
Case-5	1.30	1.37	1.24
Case-6	1.28	1.32	1.24

iv) Evaluation for test embankment

Taking results of test embankment into consideration, case-1 (soil improvement by natural drying up and dozer compaction) shall be adopted for the method of major embankment works on pilot project phase-2 based on the following reasons.

- It is the most efficient and economical method.
- It has good quality (field dry density) for the embankment.
- It has good workability for the embankment works as compared with tamping roller under the condition of wet soil especially during the early dry season.

However, manual embankment using case-5 shall be adopted at the portion adjacent to houses or structures.

v) Construction photos

Compaction by dozer in case 1 & 3 (8 times passing on the same lane) in Test Embankment

Compaction by tamping roller in case 2 & 4 (6 times passing on the same lane) in Test Embankment

2) Phase-2 in Pilot Project

2-1) Dike Embankment

This work shall be carried out to pilot test project construction technology and supervision that will be used in the genuine rehabilitation of polder dike by ID in the future.

Construction method to be adapted for Phase-2 Pilot Project shall be the one that was evaluated as the most economical and technically viable in Phase-1 test embankment, namely "soil improvement by natural drying up and dozer compaction" method. Construction length will be determined through priority study for dike construction sections since the total dike length of Labutta North polder to be rehabilitated is 56 km which seems quite big volume of work.

Priority study is made in consideration of expected tidal waves and surge at high tide due to topographic condition of dike with relation to rivers. Priority ranking considerations were high and low priority, with the high priority sections to be included in the Phase-2 Pilot Project for implementation. Low priority sections are proposed to be implemented by ID in future arrangement.

As the result of the study, of the 56 km of total dike length evaluated a 39 km were evaluated as priority while 17 km as low priority as shown in **Table 4.3.1-2**.

Table 4.3.1-2 Priority Study of Dike Sections for Rehabilitation

No	Section (RD)	Length (km)	Average ECL (ft)	Bank Vol. Sud (m3)	Priority	Reasons of priority
1	2,500~46,000	13.3	6.0	69,000 (195,000)	High	ECL is lower than total average (6.9ft) and experienced overtopping by Nargis.
2	46,000~61,000	4.6	6.9	29,000 (82,000)	Low	Making dike inroad into inland side and keeping enough distance from Thet Ke Thaung River, it is judged as a little effect of wave in case of H.W.L.
3	61,000~79,700	5.7	7.6	18,000 (51,000)	High	ECL is high, however adjacent to above river and experienced overtopping.

4	80,000~90,000	Deduct (3.1)	8.2	—	—	Section of main road constructed by Road Project in MOC.
5	90,000~110,000	6.1	7.7	15,000 (42,000)	Low	Making dike inroad into inland side and keeping enough distance from above river, judged as a little effect of wave in H.W.L.
6	110,000~156,000	14.0	7.3	50,000 (142,000)	High	ECL is high, however adjacent to Thet Ke Thaung River & Kyauk Pyu River and worried overtopping due to wind direction.
7	156,000~177,800	6.6	7.7	30,000 (85,000)	Low	ECL is high and not adjacent to big river, so it is judged as a little effect of wave in H.W.L.
8	177,800~199,400 (Test bank: 179,600 ~182,900)	6.6 Deduct (1.00)	6.9	24,000 (68,000)	High	ECL is almost same as total av. (6.9 ft) and experienced overtopping. Besides it is adjacent to Ywe River and worried overtopping.
Total		**55.9**	**Total av. 6.9**	**235,000 (665,000)**		Except for 1.0 km by test embankment, 3.1 km by Road Project and 1.1 km by others.
Total of high priority		38.6		161,000 (456,000)		For implementation in Pilot Project Phase-2
Total of low priority		17.3		74,000 (209,000)		For future implementation

It is expected that difficulties will be encountered in terms of project budget or number of construction machine necessary for the work in case whole work is done by private contractors in one dry season. Therefore, two construction methods will be employed, namely force account work by ID and contracted work by private contractors. ID construction equipment will be utilized for the force account work to be carried out by ID. The following conditions were taken into account in the work distribution between ID and private contractors;

- Supplied equipment from ID shall be limited to 10 dozers and 10 backhoes.
- One dozer and backhoe shall be the basic set for embankment works and in this case backhoe work shall be into two (2) shifts as excavation of borrow pit during night time and embankment during day time.
- One dozer and backhoe shall be exclusive used for stripping and slope dressing work.
- Working ability of 1 set of dozer and backhoe shall be counted at 150 sud/day according to ID's actual results. This value corresponds to 75% as compared with the actual results of test embankment carried out in t April and it is evaluated for adequate ability considering conditions after maintenance of machine.
- From harvesting time of paddy to the beginning of rainy season, available working days shall be counted by 4 months between early December and early April. Furthermore, workable day ratio shall be counted as 25/30 with one (1) holiday per week.

i) Implementation of dike embankment in phase-2

Construction was commenced in early December 2010 after selection contractor. Actual implementation of dike embankment was completed at the end of March 2011 one week in advance of the schedule due to some innovations in the construction method and additional input of heavy equipment by ID, in spite of the unexpected consecutive rainfall and mechanical trouble between December and March. A total embankment volume was 179,192 sud (= 507,113 m3) for actual dike length of 38.6 km. (Refer to **Appendix A6-4**)

Table 4.3.1-3 Implementation Schedule for Dike Embankment Pilot Project

Year / Month / Items	2010			2011			Remarks
	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	
Mobilization (Plan)	▪▪▪▪▪▪▪▪						Including transportation of heavy equipment
(Actual)	▬▬▬▬						
Embankment (Plan)		▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪▪					
(Actual)		▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬					
Demobilization (Plan)						▪▪▪▪▪▪	Including transportation of heavy equipment
(Acrual)						▬▬▬▬	

ii) Results of quality control

Quality control by field density test was conducted based on standard D-value 90% (1.40 t/m^3) and lower limited D-value 85% (1.32 t/m^3) in accordance with results of test embankment in phase-1.

Results of quality control test were very satisfactory showing that mean D-value shows 94% (1.47 t/m^3) and lowest D-value shows 89% (1.39 t/m^3) for 474 numbers of tested samples in the whole embankment work site. (Refer to **Appendix A6-5**)

iii) Construction photos

Dike embankment in phase-2
Conditions of compaction by dozer

Dike embankment in phase-2
Conditions of slope dressing by backhoe

Dike embankment in phase-2
Conditions of existing polder dike surrounding Hpobe Sluice before rehabilitation

Dike embankment in phase-2
Dike raised up by about 1.2m (4ft) surrounding Hpobe Sluice after rehabilitation

2-2) Sluice Gates

Target of this work shall be the rehabilitation of the malfunctioned gates affected by Cyclone Nargis to prevent intrusion of saline water and to keep sound drainage and improve agricultural production. In addition, it would also be a showcase for ID in the implementation of master genuine rehabilitation of sluice gates in terms of technology and construction supervision in the future. .

There are existing nine (9) sluices with 96 appurtenant gates (48 flap gates and 48 slide gates) in Labutta North Polder. Generally, the rehabilitation method of the gates shall be divided into 'Replace' and 'Repair'. Taking cost reduction into consideration, the rehabilitation method that will be undertaken for each (gate leaf, guide frame and hoist) gate will be based on the results of the functional evaluation survey for these gates and concrete structure.

Evaluation method on the functional survey and criteria for selection of rehabilitation method is presented below. In addition, broken portion such as hoist bases shall be rehabilitated, and be replaced by new concrete.

Evaluation on the functionality of the gates shall be conducted using point system based on survey results as follows;

< Relation between gate conditions and converted point >

- 1 point for good condition, 2 points for medium condition 3 points for bad condition.

< Criteria for selection of rehabilitation method based on total points in each member of gate>

Table 4.3.1-4 Criteria for Selection of Rehabilitation Method for Sluice Gate

Method	Conditions of Gate	Member of Gate	Total Points	Evaluation Item and Example Point			Remarks (Items*Point)
				Corrosion	Damage	Function	
Replace (by new one)	Not good	Leaf & Hoist	More than equal 7	> 2	> 2	> 3	> 2i *2p+1i*3p
	Not good	Guide frame	More than equal 5	> 3	> 2	-	> 1i*2p+1i*3p
Repair	Medium	Leaf & Hoist	Between 6 and 5	2	2	2	3i*2p or 2i*2p+1i*1p
	Medium	Guide frame	4	2	2	-	2i*2p
Non Repair	Good	Leaf & Hoist	Less than equal 4	< 2	1	1	< 2i*1p+2i*1p
	Good	Guide frame	Less than equal 3	< 2	1	-	< 1i*2p+1i*1p

Results of detailed evaluation on each sluice is shown in **Table 4.3.1-6** (refer to **Appendix A6-2**) while rehabilitation quantity of gates is presented in **Table 4.3.1-5**.

Table 4.3.1-5 Quantity of Sluice Gate Rehabilitation

Gate Type	Whole Replacement (nos.)	Repair & Replacement (nos.)	No-Repair (nos.)	Remarks
Flap Gate	6	28 (*)	14	*Repair a part of leaf and replacement of arm, hinge and seal.
Slide Gate	34	-	14	

Table 4.3.1-6 Evaluation of Gate Function and Rehabilitation Method by Sluice

Name of Sluice	Gate Type (nos.)	Evaluation Point and Rehabilitation Method & Nos.										Repair of Concrete Works
		Gate Leaf			Gate Guide Frame			Gate Hoist			Non Repair	
		T-point	Replace	Repair	T-point	Replace	Repair	T-point	Replace	Repair		
1. Denetan	Flap (2)	5	-	2	-	-	-	-	-	-	-	-
	Slide (2)	7	2	-	5	2	-	7	2	-	-	Hoist base
2. Latwalkwal	Flap (5)	7	5	-	-	-	-	-	-	-	-	-

	Slide (5)	7	5	-	5	5	-	7	5	-	-	Hoist base
3. Mayan (S)	Flap (5)	5	-	5	-	-	-	-	-	-	-	-
	Slide (5)	7	5	-	5	5	-	7	5	-	-	Hoist base
4. Mayan (N)	Flap (5)	5	-	5	-	-	-	-	-	-	-	-
	Slide (5)	7	5	-	5	5	-	7	5	-	-	Hoist base
5. Labuttaloke	Flap (9)	3	-	-	-	-	-	-	-	-	9	-
	Slide (9)	4	-	-	3	-	-	3	-	-	9	-
6. Hpobe	Flap (10)	5	-	10	-	-	-	-	-	-	-	-
	Slide (10)	7	10	-	6	10	-	7	10	-	-	Hoist base
7. Danechaung	Flap (6)	5	-	6	-	-	-	-	-	-	-	-
	Flap (1)	9	1	-	-	-	-	-	-	-	-	-
	Slide (7)	7	7	-	5	7	-	7	7	-	-	Hoist base
8. Kyaukchaung	Flap (2)	3	-	-	-	-	-	-	-	-	2	-
	Slide (2)	3	-	-	3	-	-	4	-	-	2	-
9. Shansu	Flap (5)	4	-	-	-	-	-	-	-	-	5	-
	Slide (5)	4	-	-	3	-	-	4	-	-	5	-
Total	Flap (48)		6	28		-	-		-	-	14	-
	Slide (48)		34	-		34	-		34	-	14	6 sluices

Note: Total point (T-point) means the amount of each evaluation point on each member of gate.

Selection of material for sluice gates

Generally mild steel, cast iron, aluminum alloy and stainless steel shall be adopted for fabrication of new gate in case of replacement. Herein, stainless steel shall be selected due to the following reasons.

1) Stainless steel is most resistant material against corrosion among those shown in the right figure.
2) Considering maintenance in future, Myanmar made is better to repair and replace. Therefore, mild steel, cast iron and stainless steel will be adapted for the said purpose.

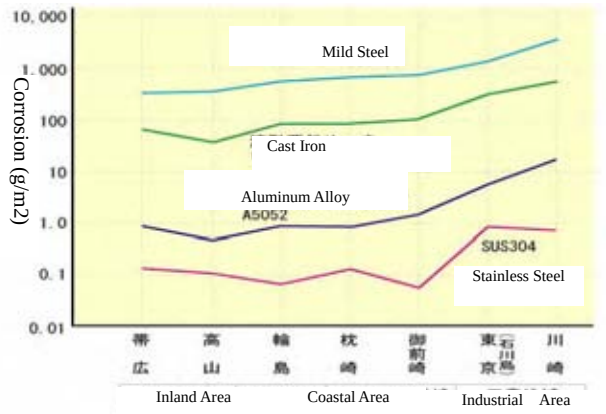


Figure 4.3.1-1 Corrosion Test for 5 Years

3) Actual results of usage of stainless steel exist in Myanmar (e.g. Shwe Hlay sluice by ID Construction No. 6) and at present no problem of corrosion has been seen after 7 years. On the other hand, serious problem of corrosion with the usage of mild steel gate has appeared like a big open hole within 3 years after completion of installation. Therefore, use of mild steel would cause deterioration of the gates seriously affected by salt water.
4) Financial comparison was made for those materials in consideration of material's life span as assumed. As a result, stainless steel was found the most economical material for the gate in the pilot project.
   - Fabrication cost for mild steel: 1,500,000 Kyats/no./5 years = 300,000 Kyats/year/no.
   - Fabrication cost by cast iron: 4,000,000 Kyats/no. /15 years = 270,000 Kyats/year/no.
   - Fabrication cost by stainless steel: 5,500,000 Kyats/no. /30 years = 180,000 Kyats/year/no.

i) Implementation of sluice gate in phase-2

Sluice rehabilitation work was commenced in early December 2010 after mobilization of the materials

and equipment. There were two categories of the work, i.e. repair of existing gates and new manufacture. For repair, existing gates were removed from the sluice then transported to Yangon for repair in the workshop. After repair gates were brought back to the sluice for installation. For new manufacture of the gate, new gates were manufactured in the workshop according to the design then brought to the site for installation.

Sluice rehabilitation was completed by the end of March 2011, one week ahead of the schedule due to well operation of the work. (Refer to **Appendix A6-4**)

Table 4.3.1-7 Implementation Schedule for Sluice Gates Rehabilitation

Year	2010		2011				Remarks
Month / Items	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	
Mobilization (Plan)	▪▪▪▪▪▪▪▪						Including dismantle and carry out existing gate
(Actual)	▬▬▬▬						
Workshop work (Plan)		▪▪▪▪▪▪▪▪	▪▪▪▪▪▪▪▪	▪▪▪▪▪▪▪▪	▪▪▪▪▪▪▪▪		20 nos./month
(Actual)		▬▬▬▬	▬▬▬▬	▬▬▬▬	▬▬▬▬		
Installation (Plan)		▪▪▪▪▪▪▪▪	▪▪▪▪▪▪▪▪	▪▪▪▪▪▪▪▪	▪▪▪▪▪▪▪▪		In order after fabrication and repair
(Actual)		▬▬▬▬	▬▬▬▬	▬▬▬▬	▬▬▬▬		
Demobilization (Plan)						▪▪▪▪▪▪▪▪	
(Actual)						▬▬▬▬	

ii) Results of quality control

Inspection in workshop was conducted to confirm suitable work condition and adequate water sealing was verified to secure by field water stop test using the following method.

< Water Stop Test for Flap Gate>

- Filling water upstream of flap gate before removal of coffer dam on both sides.
- To check the condition of water flow from slide gate after opening slide gate.
- If no water flows from slide gate, flap gate sealing is judged as good condition without leakage.

< Water Stop Test for Slide Gate>

- Consecutively the above test, dewatering flap gate side and filling water upstream of slide gate.
- To check the condition of water flow from flap gate.
- If no water flows from flap gate, slide gate sealing is judged as good condition without leakage.

iii) Construction photos

Sluice rehabilitation in phase-2
Inspection of trial manufacture in the workshop.

Sluice rehabilitation in phase-2
Installation of slide gate at Danedan Sluice.

	
Sluice rehabilitation in phase-2 Completed condition of flap gate in Hpobe Sluice. Under field water stop test for flap gate.	**Sluice rehabilitation in phase-2** Completed condition of slide gate in Hpobe Sluice. At the same time left photo, no leakage from slide gate means good sealing of flap gate.

(3) Training and Study Tour

For the purpose of training to ID engineers, part of embankment was done by ID engineer. Number of participants was initially 45 (15 civil engineers and 30 machine operators) from December to mid-February. It was then increased to 70 in February 2011 after ID mobilized additional equipment.

A study tour was held as shown in **Table 4.3.1-8**. According to the questionnaire survey during the workshop, 78% of participants indicated that mechanical & manual embankment and sluice rehabilitation showed good result and that the study tour was very effective for them.

Table 4.3.1-8 Summary of Study Tour on Dike and Sluice Rehabilitation Pilot Project

Date	25th (Fri.) – 27th (Sun.) March 2011 (site observation and work shop is on 26th)
Place	Labutta North Polder, Labutta Township, Ayeyawady Division
Attendants	ID 23 persons, DAP 2, Agri-Business News 2, General Administration Department 2
Objectives	1) To observe dike and sluice rehabilitation under JICA pilot project. 2) To learn design concept, construction plan, supervision and quality control. 3) To exchange views on the above items.

	
Study tour in polder dike and sluice pilot project Explanation of protection function for polder dike by mangrove at the planted site.	**Study tour in polder dike and sluice pilot project** Explanation and exchange of views on design concept, construction plan and others.

(4) Evaluation and Lessons from Pilot Project

Formulated design concept and construction plan were verified as suitable for safety (quality) of

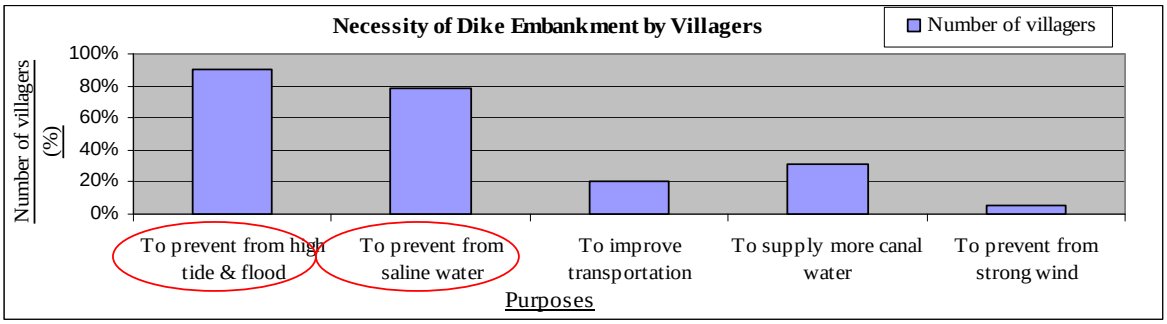
facilities, construction cost and construction schedule on the pilot project and evaluated as possible to reflect those results to D/P in accordance with following reasons.

1) Results of quality control test (field density test) were completely cleared target as well as secured necessary shape (ACL, crest width and slope gradient of dike) and function (sealing and operation of gate). (Refer to **Appendix A6-6**)
2) Most economical filling method based on test embankment was confirmed to be able to ensure quality and timely schedule of actual construction.
3) Resettlement of houses and effect to structure were minimized due to manual embankment and shifting alignment on dike, therefore these methods were considered to be effective for environmental and social consideration.
4) It is considered that check and maintenance of equipment before and under construction are most important to ensure a timely construction schedule based on the result of consecutive mechanic trouble shooting undertaken during pilot project.

(5) Villager Impact Survey on Polder Dike Embankment

Impact survey on polder dike embankment was conducted in November 2010 in the villages where dike rehabilitation was completed under the pilot project. The survey obtained answers from 60 households whose average age was 44, average years of residence in Labutta was 37 years, with occupation distribution of 33% for agriculture, 38% for casual labour, 10% jobless, 7% of fishery and 12 for others. Main results are presented below:

Villagers understanding on the necessity of polder dike / embankment are given in the following graph. From this, it is observed that most villagers up to 80% to 90% have recognized basic function of polder dike such as prevention of high tide, flood and saline water.



4.3.2 On-site Seed Production Pilot Project

(1) Purpose of Pilot Project

Considerable challenges to solve problems on farming in the Project Area are explained in Chapter 3. It was difficult to try and verify all challenges mentioned in Chapter 3 in the limited period and budget of the Project. Therefore, pilot project was designed focusing mainly on high quality paddy seed production in the rural area.

Purpose of the On-Site Seed Production Pilot Project (the pilot project) is to verify, "Possibility of expanding high quality paddy seed production by the farmers to improve farming of the Project Area". The Pilot Project also aims at strengthening "Faming technique of participant farmers of the Pilot Project" and "MAS extension work" as indirect effects expressed through implementation of the Pilot Project.

Figure 4.3.2-1 shows conceptual diagram of high quality paddy seed production prepared for the Pilot Project. The diagram was prepared in compliance with MAS certified seed production system.

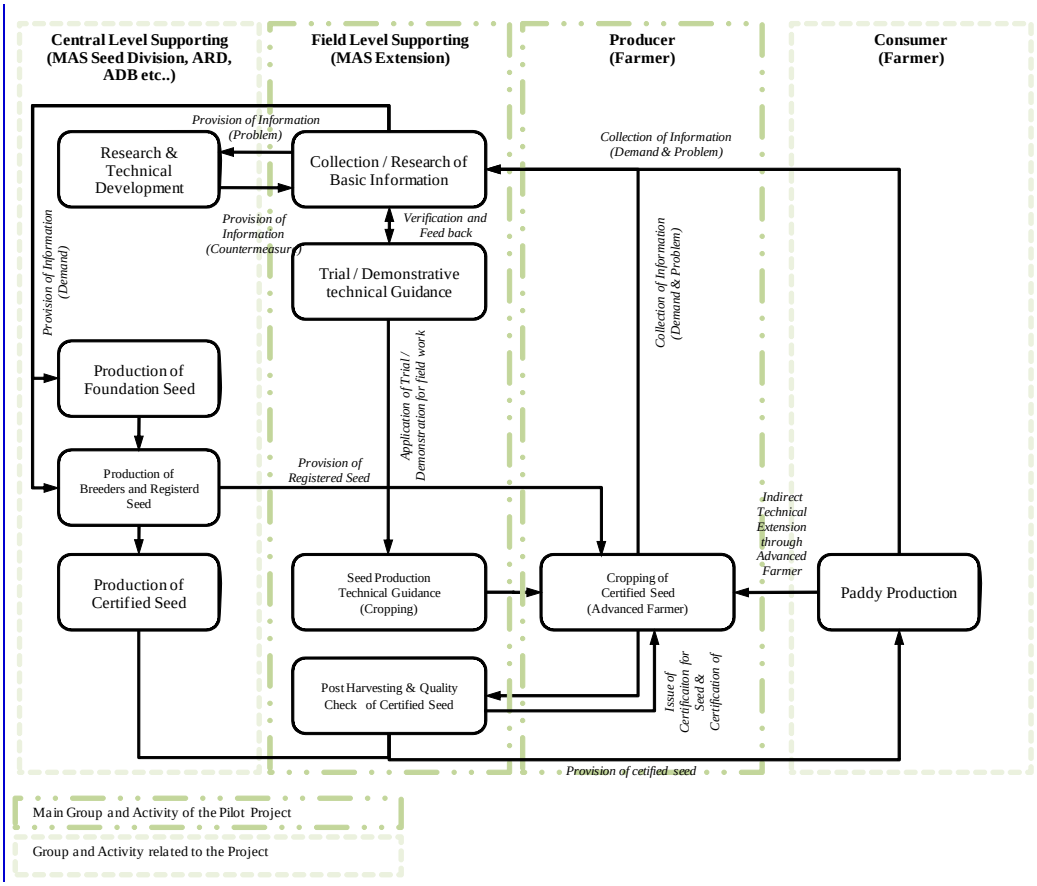


Figure 4.3.2-1 High Quality Seed Production Flow prepared for Pilot Project

Data Source : JICA project Team

(2) Implementation and Result of Pilot Project

The Pilot Project was implemented for 13 months from April 2010 to April 2011 (Phase-1 and 2 of the Project). Implementing schedule and organization for the Pilot Project are shown in **Figure 4.3.2-2** and **Table 4.3.2-1**.

Table 4.3.2-1 Schedule of On-Site Seed Production Pilot Project

Activity	2010											2011				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
	1st Phase						2nd Phase									
Avtivity 1 : Preparatory Work (Selection of Variety, Selection of Farm																
Avtivity 2 : Monitoring, Research and Survey Work																
Activity 3 : Paddy Seed Cropping Trial																
Activity 4 : Seminars																

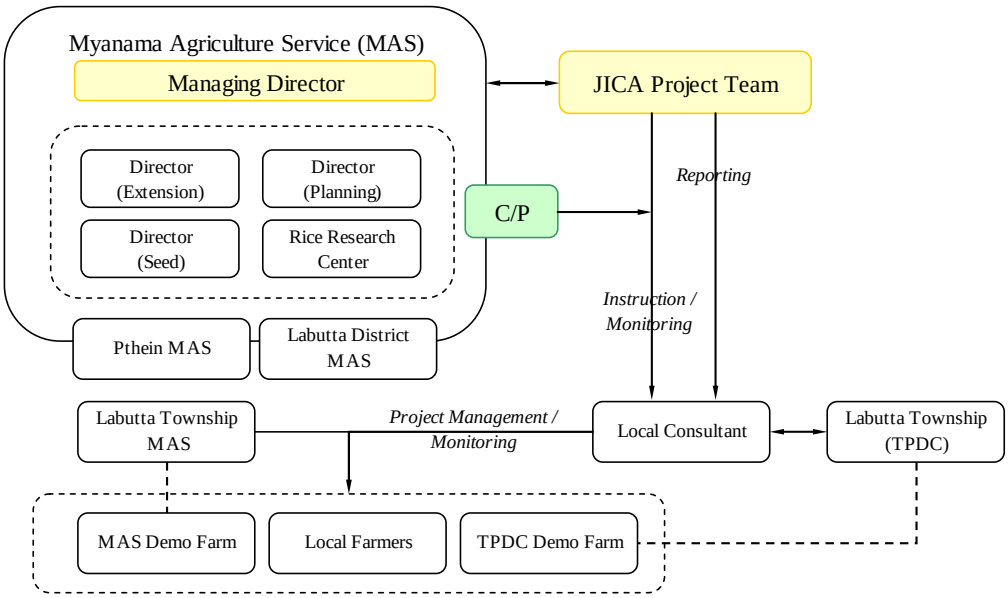


Figure 4.3.2-2 Organization for Implementation of On-site Seed Production Pilot Project

The Pilot Project was managed by sub-consultant under the JICA Project Team in cooperation mainly with MAS Labutta Township Office. Tender for the selection of the sub-consultant for 1st Phase and 2 Phase was done in March and October 2010, respectively. Golden Plain Agricultural Products Cooperative Society Ltd. was finally selected. The contract between the Project Team and the Golden Plain were concluded on 23 March and 14 October 2010. Activities and result of the Pilot Project is described below.

1) Selection of Farmers for Seed Production

Period of the Pilot Project was only one cropping season (one monsoon season). For efficient operation and maximization of effect of the Pilot Project in this limited period, participant farmers were selected based on the following criteria.

a) Farming land which has good access to MAS demonstration farm for easy project administration

b) Farming land which has good access to neighboring farmers (non-project participant farmers) for demonstration purposes.

c) Farmer with sufficient experience on paddy cultivation

As a result of discussion with MAS, 29 farmers / plots including MAS and TPDC demonstration farms were selected as the pilot project area. Total pilot project area was 50 acres (adjusted to 45.40 acres based on result of re-measurement of the area).

2) Selection of Paddy Variety

Paddy varieties to be produced by the Pilot Project were selected in consideration of a) farmers' experience, b) compatibility to the particular area, c) demand and d) availability of registered seed. Varieties shown in **Table 4.3.2-2** were selected through technical discussion with MAS and 29 farmer participants.

Table 4.3.2-2 Paddy Varieties used in Pilot Project

Name	Type	Potential Cropping Yield	Growth Period (days)	Production Area in the Pilot Project
Paw San Yin	Local	40-60 baskets / Acre (2.1-3.1 t/ha)	145	20.7 Acres
Manawthukha	HYV	100-120 baskets / Acre (5.2-6.3 t/ha)	130-135	20.2 Acres
Sin Thwe Latt	HYV	100 baskets / Acre (5.2 t/ha)	130-135	4.3 Acres
Hnangar	Local	40-60 baskets / Acre (2.1-3.1 t/ha)	145	0.2 Acres
Theehtatyin	HYV	100 baskets / Acre (5.2 t/ha)	110	

3) Quality Check of Farmers' Seed

Quality check of farmers' seed was carried out for 13 project participant farmers who kept the seed. Out of 13 sample seeds, only one seed passed seed quality standard of MAS. High content of red rice which have low cropping yield is the main problem identified of the farmers' seed. Some of samples contain 450 red seed within 1,000 seeds.

4) Soil Investigation and Fertilizer Application Method for the Pilot Project

Simple Soil investigation for 29 project participant farmers (plots) was carried out for checking soil character (ph, N and P contents). ATAGO EC, pH meters and Portable Soil Investigation kit produced by Yezin Experimental Farm of Ministry of Agriculture and Irrigation were used for the investigation.

Average pH value is 5.57, higher than 5.00 (Soil of which pH value is lower than 5.00 is classified to acidic soil in general) and, N and P contents were diagnosed as low for 41% - 48% of 29 project participant farmer.

According to abovementioned soil investigation and technical discussion with MAS, fertilizer application was set up as shown in **Table 4.3.2-3.**

Table 4.3.2-3 Fertilizer Application in Pilot Project

Fertilizer	Local Variety	HYV
N (Urea)	1.5 bag/Acre	2.0 bag/Acre
P (T-Super)	1.0 bag/Acre	1.0 bag/Acre
K (Potash)	1.0 bag/Acre	1.0 bag/Acre

5) Paddy Seed Production Trial

Paddy seed production trial was implemented between June and December 2010 (2010 monsoon season). Intensive cultivation technique such as regular row transplanting was applied for paddy seed production. Several technical seminars and field guidance were conducted during the Pilot Project. Photographs below show cropping practices applied in the Pilot Project.

1. Selection of Seed (Salt Solution)

2. Preparation of Nursery

3. Germination of Paddy Seed

		
4. Seedling	5. Growth of Seedling at the Nursery	6. Transplanting (Regular Row Planting)
		
7. Fertilization	8. Rouging (Elimination of other variety)	9. Threshing
		
10. Dry of Paddy Seed	11. Moisture Contents Check (Checked by Moisture Contents Meter prior to MAS Official Quality Check)	12. Storage of Paddy Seed (Store the Paddy Seed at Rice Mill Factory Rental Storage)

Some participant farmers had difficulty carrying out farm activities especially rouging without the close supervision and constant instruction and guidance from the Project Team. In addition, some pest and diseases affected some of the plots. However, the pest and diseases did not cause serious damage.

7) Result of the Pilot Project

Result of Paddy Seed Quality Check and Production Amount

Two times of seed quality check (Field Inspection by MAS and Seed Quality Check by MAS Laboratory) were carried out following MAS Certified Seed Production process. MAS Seed Quality Standard is shown in **Table 4.3.2-4**.

As a result of the checks, most of participant farmers were requested to re-dry paddy seed until getting optimum moisture content. As a result, 22 participant farmers (75.9%) passed the checks after re-drying of paddy seed. Seeds of the seven (7) other farmers were rejected during the field inspection a/or based on the results of the laboratory check. Production amount of paddy seed was 2,384 baskets. Result of the check and paddy seed production amount is shown in **Table 4.3.2-5**

Table 4.3.2-4 MAS Seed Standard for Certified Seed

Seed Class	Purity (%) Minimum	Germination (%) Minimum	Moisture Content (%) Maximum	Red Rice (no./500gm seeds) Maximum	Weed seed Maximum
Breeder Seed	99	90	13	0	3
Foundation Seed	98	90	13	1	5
Registered Seed	98	85	13	3	10
Certified Seed	***97***	***80***	***13***	***5***	***10***

Data Source : Seed Division MAS

Table 4.3.2-5 Result of Seed Quality Check, Production Amount and Cropping Yield

Participant No.	Variety	Area			Total Harvesting (Baskets)	Cropping Yield (Baskets / Acre)	Seed Quality Check Result
		Planed Cropping Area	Actual Cropping Area	Difference			
1							Not certified due to High Red Rice Seed Contents
2	PSY	1.00	1.04	0.04	45	43	Certified
3							Rejected by Field Inspection
4	MNTK	2.00	1.53	-0.47	96	63	Certified
5	PSY	2.00	1.58	-0.42	115	73	Certified
6	PSY	2.00	1.95	-0.05	120	62	Certified
7	MNTK	2.00	2.12	0.12	180	85	Certified
8							Rejected by Field Inspection
9	MNTK	1.00	0.80	-0.20	94	118	Certified
10	MNTK	2.00	1.94	-0.06	135	70	Certified
11							Rejected by Field Inspection
12	PSY	1.00	0.92	-0.08	46	50	Certified
13	MNTK	1.00	0.96	-0.04	70	73	Certified
14							Not certified due to High Red Rice Seed Contents
15	PSY	2.00	1.50	-0.50	96	64	Certified
16	PSY	2.00	2.22	0.22	80	36	Certified
17	MNTK	2.00	1.91	-0.09	110	58	Certified
18							Not certified due to High Red Rice Seed Contents
19	PSY	2.00	1.87	-0.13	100	53	Certified
20	MNTK	1.00	1.11	0.11	70	63	Certified
21	MNTK	1.00	1.04	0.04	110	106	Certified
22	MNTK	2.00	1.39	-0.61	95	68	Certified
23	STL	1.50	1.56	0.06	110	71	Certified
25	MNTK	2.00	1.96	-0.04	165	84	Certified
26	MNTK	2.00	2.23	0.23	140	63	Certified
27	STL	3.00	2.64	-0.36	215	81	Certified
28	PSY	2.00	2.09	0.09	112	54	Certified
29	PSY	2.00	1.80	-0.20	80	44	Certified
Total		38.50	36.16	-2.34	2,384	66	
Average							
PSY		16	14.97		794	53	
MNTK		18	16.99		1,265	74	
STL		4.5	4.2		325	77	

Result of Cropping (Yield and Paddy Seed Production Amount)

As shown in **Table 4.3.2-6**, average cropping yield is 53 baskets / acre for Paw San Yin (Local Variety), 74 baskets / acre for Manawthukha (HYV) and 77 baskets / acre for Sin Thwe Latt (HYV). These cropping yields are still low as compared with potential yield of each variety. However, the yield of the Pilot Project is approximately 30% - 50% higher than that of non-pilot project area.

Table 4.3.2-6 Comparison of Cropping Yield

(Baskets / Acre)

	Potential Cropping Yield *1	Result of the Pilot Project	Non Pilot Project Area *2
Paw San Yin	65-70	53	40
Manawthukha	100-110	74	54
Sin Thwe Latt	120-130	77	49

*1 Rice in Myanmar, MOAI *2 Harvesting survey by the Pilot Project, 2010 wet season in Labutta North Polder

Main reason of such high yield would be realized by synergy effect by 1) use of adequate amount of fertilizer, 2) intensive farming management and 3) use of high quality seed.

Result of Sale of Paddy Seed

Sale of paddy seed was difficult. In the beginning of the Pilot Project, many international organisations and NGOs signified their interest to buy high quality paddy seed to be produced by the Pilot Project. However, such interest was reduced after seeds were harvested due to reduction of aid activity for Nargis-affected area by these organisations. Therefore, participant farmers sold their seed mainly to farmers and brokers and/or share the seed with neighbor farmers. Sales progress of the paddy seed as of the end of April 2011 is 52% as is shown in **Table 4.3.2-7.**

Table 4.3.2-7 Sales Result of Paddy Seed produced by Pilot Project as of end of April

Variety	Total Amount	Seed Sales / Sharing						
		Kept for Next Season	Sold / Share to / with Neighbor Farmer	Sold to Brokers	Total		Remaining	
Paw San Yin (Local Variety)	794	128	149	437	714	90%	80	10%
Manawthukha (HYV)	1,265	180	80	50	310	25%	955	75%
Sin Thwe Latt (HYV)	325	0	0	215	215	66%	110	34%
Total	2,384	308	229	702	1,239	52%	1,145	48%

Sales price of the paddy seed is varied among participant farmers. The price ranges from 6,200 to 8,000 Kyats/ basket for local variety and 4,000 to 6,000 Kyats/ basket for HYV. Highest price of both varieties was offered by the broker. The prices are low as compared with the seed price of MAS (8,000 Kyats/ basket for local variety and 6,000 Kyats/ basket for HYV).

At the latest information, as seed demand was increased in the beginning of monsoon season of May and June, seed sales also progressed to 91% as of June 2011.

Profitability

Table 4.3.2-8 shows estimated production cost and income of the participant farmers (22 farmers who passed MAS seed quality check).

Average production cost / acre is Kyats 222,000. However, the production cost reported shows a wide difference among participant farmers with a reported production expenditure of as much as 302,000 Kyats/ acre (highest) and of 179,000 Kyats/ acre as lowest. This difference is caused mainly by difference of farming area (acreage) between the area recognized by the farmers and actual area.

As explained in Section 2.3.2, net income of grain paddy cropping is estimated at 120,000 - 140,000 Kyats/ acre. Of 22 participant farmers, 16 farmers (72.7%) gained net profit higher than the reported average income from paddy production.

Table 4.3.2-8 Estimated Production Cost and Income in Pilot Project

Participant No.	Variety	Area (Acres)			Production Cost (Kyats 1,000)				Total Harvesting (Baskets)	Sales Price (Kyat / Basket)		Gross Income (Kyats 1,000)	Net Income (Kyats 1,000)	Net Income / Acre (Kyats 1,000)
		Planed Cropping Area	Actual Cropping Area	Difference	By Farmer	By Project	Total	Cost / acre						
		a)	b)	c)= b)-a)	d)	e)	f)= d)+e)	g)= f)/b)	h)	i)		j)= h)*i)	k)= j)-f)	l)= k)/b)
2	PSY	1.00	1.04	0.04	126	90	216	208	45	7,500	Actual	338	122	117
4	MNTK	2.00	1.53	-0.47	220	180	400	261	96	7,500	Actual	720	321	209
5	PSY	2.00	1.58	-0.42	224	180	404	255	115	6,500	Actual	748	344	218
6	PSY	2.00	1.95	-0.05	239	180	419	215	120	8,000	Actual	960	541	278
7	MNTK	2.00	2.12	0.12	245	192	437	206	180	5,750	Estimate	1,035	598	282
9	MNTK	1.00	0.80	-0.20	146	96	242	302	94	5,750	Estimate	541	299	374
10	MNTK	2.00	1.94	-0.06	256	192	448	231	135	5,750	Estimate	776	329	169
12	PSY	1.00	0.92	-0.08	130	90	220	239	46	7,500	Actual	345	125	136
13	MNTK	1.00	0.96	-0.04	129	96	225	234	70	5,750	Estimate	403	178	185
15	PSY	2.00	1.50	-0.50	192	180	372	248	96	7,000	Actual	672	300	200
16	PSY	2.00	2.22	0.22	216	180	396	179	80	7,113	Share / Estimate	569	173	78
17	MNTK	2.00	1.91	-0.09	256	192	448	235	110	5,750	Estimate	633	184	97
19	PSY	2.00	1.87	-0.13	219	180	399	213	100	8,000	Actual	800	401	214
20	MNTK	1.00	1.11	0.11	127	96	223	201	70	4,000	Actual	280	57	51
21	MNTK	1.00	1.04	0.04	145	96	241	232	110	5,750	Share / Estimate	633	391	376
22	MNTK	2.00	1.39	-0.61	151	192	343	247	95	5,750	Share / Estimate	546	203	146
23	STL	1.50	1.56	0.06	198	144	342	219	110	6,000	Estimate	660	318	204
25	MNTK	2.00	1.96	-0.04	215	192	407	208	165	5,750	Estimate	949	542	276
26	MNTK	2.00	2.23	0.23	249	192	441	198	140	5,750	Share / Estimate	805	364	163
27	STL	3.00	2.64	-0.36	331	288	619	235	215	6,000	Actual	1,290	671	254
28	PSY	2.00	2.09	0.09	203	180	383	183	112	6,200	Actual	694	312	149
29	PSY	2.00	1.80	-0.20	238	180	418	232	80	6,200	Actual	496	78	43
Total		38.50	36.16	-2.34			8,042	222	2,384			14,891	6,849	189
Paw San Yin		16.0	14.97				794	216	794			5,621	2,395	160
Manawthukha		18.0	16.99				1,265	227	1,265			7,319	3,464	204
Sin Thwe Latt		4.5	4.2				325	229	325			1,950	989	236

Remark : Estimated / Share (Participant farmers who share the seed with neighbor farmers)
Estimated (Participant farmers who have not yet sold the seed)
* Average price of sold seed is applied for Estimated / Share and Estimated

(3) Training and Workshop

In total, 12 workshops and seminars were carried out under the pilot project. General description of the workshops and seminars are shown in the table below.

1) Introductory Meeting

Data and Time	30 March 2010
Venue	TPDC Office, Labutta Township
Participants	TPDC (1 person), MAS (7 persons), ID (1 person), FD (1 person), SLRD (2 persons)
Purpose	- Explanation of plan of the pilot project

2) 1st Workshop (Orientation)

Data and Time	07 April 2010
Venue	MAS Labutta Township Office,
Participants	TPDC (1), MAS (9)
Purpose	- Selection of Participant Farmers - Explanation of Importance of High Quality Seed - Explanation and discussion on implementation plan of the Pilot Project

3) 2nd Workshop (Technical Training)

Data and Time	05-07 May 2010
Venue	TCG (Tripartite Core Group) Hole, Labutta
Participants	TPDC (3), TPDC (3), Participant Farmers (27)
Purpose	- Explanation about importance of high quality seed and present situation of seed in rural area - Technical Training on preparation of seed selection by salt solution, seed quality check, preparation of organic fertilizer - Preparation of mutual agreement about the Pilot Project

4) 3rd Workshop (Technical Training)

Data and Time	01-02 June 2010
Venue	TCG Hole, Labutta
Participants	TPDC (1), MAS (4), Participant Farmers (28)
Purpose	- Explanation of implementation plan of the Pilot Project - General technical training on paddy cropping and preparation of cropping plan of the participant farmers

5) 4th Workshop (Technical Training)

Data and Time	09 July 2010
Venue	TCG Hole, Labutta
Participants	TPDC (1), MAS (3), Participant Farmers (21)
Purpose	- Discussion on progress of cropping and difficulties encountered - Technical training on transplanting and others

6) 5th Workshop (Technical Training)

Data and Time	27 October 2010
Venue	TCG Hole, Labutta
Participants	TPDC (2), MAS (4), Participant Farmers (24)
Purpose	- Discussion on progress of cropping and difficulties encountered - Technical training on harvesting and post harvesting

7) 1st External Workshop (Seed Promotion)

Data and Time	02 December 2010
Venue	TCG Hole, Labutta
Participants	TPDC (2), MAS (4), Participant Farmers (26), International Organization / NGO/Others (9)
Purpose	- Explanation of importance of high quality seed - Explanation of outline and progress of high quality seed - Promotion of high quality seed production

8) 6th Workshop (Technical Training)

Data and Time	21 December 2010
Venue	TCG Hole, Labutta
Participants	TPDC (2), MAS (4), Participant Farmers (21)
Purpose	- Discussion on progress of cropping and difficulties encountered - Confirmation of seed quality check process

	- Analysis and discussion on harvested amount and production cost

9) 2nd External Workshop (Seed Promotion)

Data and Time	27 December 2010
Venue	TCG Hole, Labutta
Participants	MAS (1), Participant Farmers (25), International Organization / NGO/Others (4)
Purpose	- Explanation of importance of high quality seed and establishment of seed law - Explanation of outline and progress of high quality seed Promotion of high quality seed production

10) 7th Workshop (Technical Training)

Data and Time	28 February 2011
Venue	TCG Hole, Labutta
Participants	MAS (1), Participant Farmers (18)
Purpose	- Confirmation of result of seed quality check - Analysis and discussion on production cost and benefit

11) Evaluation Workshop

Data and Time	18 March 2011
Venue	Demonstration Farm of MAS Labutta Township Office, Labutta
Participants	MAS (2), Participant Farmers (20)
Purpose	- Self evaluation of result of the Pilot Project (SWOT Analysis) - Explanation of result of the Pilot Project analyzed by the Project Team

12) Extension Workshop

Data and Time	05 April 2011
Venue	Lay Htet Monastery, Labutta
Participants	MAS (3), Participant Farmers (20), International Organization / NGO/Others (9)
Purpose	- Explanation of Importance of high quality seed and present situation of seed in rural area (results of survey conducted by the Pilot Project) - Explanation of result of the Pilot Project - Presentation about contract farming for high quality seed production (presented by private company)

(4) Evaluation and Lessons from the Pilot Project

1) Evaluation

Evaluation of result of the Pilot Project was carried out by the JICA Project Team and the participant farmers. Evaluation results are summarized as follows.

General Aspects

- All the planned activities of the Pilot Project were carried out without particular problems. Contract of sub-consultant did not cover all of the paddy seed production period/cropping season (covered only seedling, transplanting and harvesting seasons) activities. However, technical support to farmers and monitoring of the Pilot Project during the absence of the sub-consultant (middle of July to middle of October 2010) were carried out properly by the counterpart from MAS and MAS Labutta Township Office.

Technical Aspects

- All the participant farmers have long experience of paddy production. Therefore, the farmers could apply seed production technique relatively easy with appropriate technical guidance. Regarding to drying seed paddy, re-dry was needed due to high moisture content. However, moisture contents could be reduced sufficiently by conventional method (solar drying) adding 1-2 days of additional drying period.

- According to the participant farmers, there is limited number of casual labor familiar with advanced cropping technology such as regular row transplanting. The labors employed by the participant farmers experienced advanced cropping technology through the pilot project. Therefore, securing these labor is important for continuous paddy seed production
- A total of 22 (75.9%) out of total 29 participant farmers can produce high quality paddy seed (MAS certified seed). Therefore, it was generally verified that the farmers can produce high quality paddy seed with adequate technical support.

Other Aspects

- Access to MAS registered seed and MAS seed quality test are insufficient in the pilot project area. These insufficiencies would be one of the main reasons of delay of dissemination of certified seed production. It is necessary to expand MAS supporting system for high quality paddy seed production.
- Sales of the paddy seed were not satisfactory. Sales progress of paddy seed will ultimately depend on the ability of individual farmers. However, it is fact that there are marketing constraints which can not be changed easily by participant farmers themselves e.g. “farmer’s low understanding about advantage of high quality seed and meaning of certified seed”, “unstable price of paddy seed”, “lack of communication method for promoting the paddy seed” etc. Such constraints reduce the value of the paddy seed and, cause unreasonable paddy seed price fluctuation which links with price with grain paddy. Therefore, extension activity of MAS should not be limited only for production technique but should also include overcoming abovementioned marketing constraints to expand high quality paddy seed production.

2) Lessons Learned

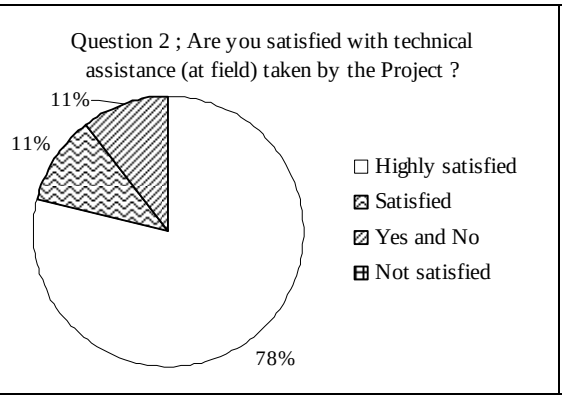
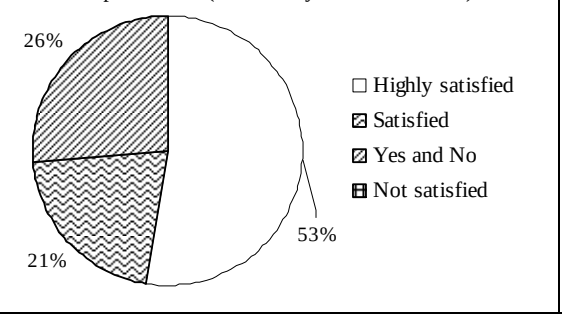
Lessons learned from the Pilot Project are summarized as follows.

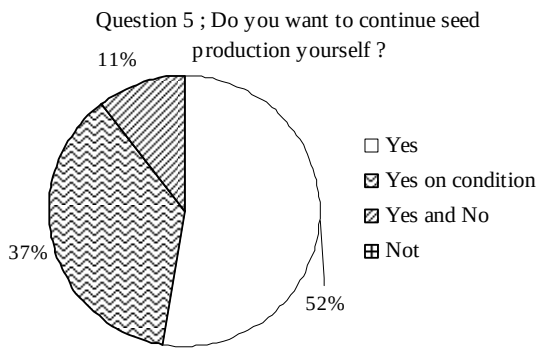
- Willingness and interest on farm management varies widely by farmer’s individual character. There were two types of the participant farmers in the Pilot Project. Some farmers could practice adequate farming management only with verbal instruction / explanation. On the other hand, some farmers needed several times of instruction at the field. Therefore, it is important to select seed production farmers in accordance with level of their willingness and interest on farm management.
- Most of farmers use private agricultural loan with very high interest rate. Therefore, the farmers usually sell the paddy immediately after harvest for repayment of the loan. On the other hand, demand of paddy seed is usually increased after 5-6 months from harvest. Therefore, it is important to “select the seed production farmer and/or to set up seed production area in accordance with their economic potential (availability of farming budget)”.
- Some of the participant farmers do not own storage or if available, storage capacity is not sufficient. As mentioned above, 5-6 months of storage of paddy seed is required. Therefore, it is important to “select the seed production farmer with sufficient storage and/or to set up seed production area in accordance with storage availability.
- A private agricultural company participated in the extension workshop held on 5th April 2011. The company is now seeking possibility to start high quality paddy seed business in the form of contract farming. The contract farming is a way to minimize the constraint on farming budget and storage for paddy seed production. Therefore, it is important to share information about advanced farmers between MAS and private company to accelerate high quality paddy seed production by contract farming.
- Local variety sill has high demand in the Project Area (3 districts where 34 polders are located). Good progress of paddy seed sales of the local variety in the Pilot Project also implies the high

demand. Seed renovation is important for improved variety than local variety because of difference of genetic stability. However, seed renovation of local variety is important taking physical seed problem (mixture of other variety / red seed) into account.

(5) Farmer Satisfaction Survey

Satisfaction of the Pilot Project of the participant farmers was confirmed through questionnaire survey on Evaluation Workshop held on 18 March 2011. **Figure 4.3.2-3** shows result of the survey and analysis of survey result.

<table>
<tr>
<td> 
</td>
<td>Reason
1. Highly satisfied
- Simple and improved technologies (7)
- Timely support on farming technology in the field (2)
- *Reason unclear (7)
2. Satisfied
- Technologies (*unclear answer)(3)
3. Yes and No
- Support against farming weakness (1)</td>
</tr>
<tr>
<td colspan="2">Analysis
Counterpart from MAS provided field technical guidance continuously through out the Pilot Project including absence period of the sub-consultant. Opportunity of receiving such continuous support is really limited for the participant farmers. In addition, guided techniques are acceptable not only for paddy seed production and also grain paddy production. Therefore, technical guidance was considered as very useful to the farmers.</td>
</tr>
<tr>
<td> 
</td>
<td>Reason
1. Highly Satisfied
- Learning & understanding on characteristics of quality seeds (8)
- Improvement of yield, quality and profit (2)
2. Satisfied
- Improvement of quality but fairly profitable (* Paddy Quality was improved. However, no significant increase of profit) (4)
3. Yes and No
- Not much profitable on sales of seeds (5)</td>
</tr>
<tr>
<td colspan="2">Analysis
Cropping yield was significantly increased by the Pilot Project. On the other hand, profitability was not increased satisfactory due to delay of sale of paddy seed and its' low price for some farmers.</td>
</tr>
</table>



Reason

1. Yes
- Willing to continue seed paddy production because of good quality (6)
- Willing to continue seed paddy production with better support (3)
- *Reason unclear (1)

2. Yes on Condition
- If, favorable seed market is available (5)
- Continue small scale paddy seed production (2)

3. Yes and No
- Seed market is not available (2)

Analysis

Participant farmers who clearly expressed intention of continuing high quality paddy seed production was only 52%. It is conceivable that this percentage reflects more accurately the satisfaction of the participant farmers. Main reason of unclear intention of continuing the seed production would be difficulty on marketing and procurement of inputs for paddy seed production.

Figure 4.3.2-3 Result of Farmer Satisfaction Survey in Pilot Project

4.3.3 Income Generation Pilot Project

(1) Purpose of the Pilot Project

The pilot project of income generation is aimed at examining the possibility that participant households would get substantial and higher income from vegetable production. The result of this pilot project will be used to finalize the income generation plan.

(2) Implementation and Result of the Pilot Project

1) Overview of the pilot project implementation

(i) Income generation pilot project was not the extension of production to the public but a trial for i) understanding problems and possibility in terms of land availability, cultivation technique and fund management, ii) examination of feasibility as income generation, and iii) experiences of good and bad practices to make an appropriate master plan.

(ii) In the pilot project, JICA study team executed: i) preparation of the framework for landless household to start vegetables production (land use, technical transfer), ii) support in vegetables production and marketing to participating households, and iii) establishment of sustainable production framework.

(iii) This project aimed at income generation by own effort of project participants. They made a contract with JICA study team and did necessary works related to the pilot project such as attending to workshops, doing cultivation, recording and reporting of their production activities.

(iv) From the viewpoint of inhabitant's sustainability, this project chose crops that required neither new farm exploitation nor expensive input. Basically, it used means of production that they used for vegetables production (land, water and so on).

(v) Easy growing crops were selected for beginners and people having little production skill which will enable them get income easily. Five crops were chosen based on the intention of inhabitants in Labutta North polder and advise of MAS (Vegetable and Fruit Research and Development Centre = VFRDC): cucumber, okra, water cress, roselle (leaf crop used for soup), and yard long bean.

(vi) Paddy field after harvest was borrowed for the pilot project without payment. In consideration

of work burden of participants, especially watering by women, and of easiness of monitoring, farm size was set at 0.15 acre (607 m^2) for each participant.

(vii) Two pilot sites were selected for each of two markets actually existing in Labutta North polder: Labutta market and New Town temporary market.

(viii) JICA study team and MAS supervised the supporting activity in collaboration with TPDC and VPDC and field work was executed by a subcontracted Myanmar consultant.

2) Activities

The income generation pilot project composed of three activities: (i) preparatory works, (ii) vegetable production and marketing, and (iii) establishment of sustainable production framework, items of each activity. The project was planned that the JICA study team provided vegetables seeds and fertilizer ~~of~~ for one cultivation cycle and gave training on cultivation and management (including financial management).

3) Role Sharing among Stakeholders

JICA study team expected landless households to continue vegetables cultivation with sustainable process using experiences in the pilot project after termination. To fulfill this expectation, inhabitant's efforts as well as support of institutions are necessary.

- Participants received training, cultivated vegetables themselves on the paddy field after harvest that they borrowed from land right holders free of charge and got profit, they kept records of cultivation and sale.
- VPDC intermediated and guaranteed land use and took measures against problems that may occur.
- TPDC managed overall project procedure.
- MAS gave technical comments to the cultivation.
- JICA study team managed all the procedure.

4) Selected Villages

a) Social condition

Thet Yat Kone and Pharar Gyi Kone are located along the road connecting Labutta town and western part of the Labutta North polder. Distance to the Labutta market is 5 to 6 km and villagers frequently go there on foot and by *trailorji* (tractor cart). Thet Yat Kone is the centre of Labutta South VT where there is a school, some shops and video houses. Phayar Gyi Kone is a village located eastward of Thet Yat Kone. There are some small shops and a monastery.

Thet Yat Kone spreads approximately 1 to 3 km west from Labutta New Town being under construction at the study period. Damage of Nargis was greater here than other candidate villages in terms of the number of collapsed houses. Comparing with other candidate villages, paddy harvest per acre is much lower and MAS staff cited low altitude and bad water drainage as reasons for low production. A lot of landless people are working as construction workers during the dry season, but they said that wage labour is not stable as they do not have the chance to work all days of the month and they are worried about the day after construction work terminates.

b) Actual situation of vegetables cultivation in the target villages

In the villages of Labutta Loke south, water of the creek east of the Labutta Loke sluice has of low salinity and inhabitants did vegetable cultivation using this water. Also, a great ditch in the south of the village was full of rain water till February or March and used for vegetables cultivation. About 45 landless households in Thet Yat Kone and at least ten households in Phayar Gyi Kone had been producing vegetables for several years, especially cucumber and water cress, in their yard, river bank and paddy field after harvest. The households had no formal training on

vegetable production but have relied on information from others Vegetables that they strongly wanted to produce were cucumber, yard long bean and water cress. For the present vegetable cultivators, vegetable cultivation problems identified are vegetable diseases and they wanted to learn the measures against this disease infection.

In Tha Yet Kone, Kyauk Hmaw VT, around 80 landless households had experience of vegetables cultivation on the creek bank and paddy field after harvest. They have indicated that vegetable cultivation is their second income source before the New Town construction started. However, like Labuta Loke South villages, they have no formal training on vegetable cultivation and get their know-how from other villages like Myaungmya. For the inhabitants who showed interest to participate, vegetables they wanted to cultivate first was water cress, next comes roselle, and the third was okra[2]. The subject that they wanted to learn was, at first, disease prevention, the second was prevention of harmful insects and the third was appropriate way of fertilizer application.

Result of Baseline Survey shows that all participants have experience on vegetables cultivation in the paddy field after harvest on a small scale basis. A third of the participants started vegetable cultivation after 2000 while more than half of participant households started before 2000 in Kyauk Hmaw. They learnt technical know-how mainly from other growers in and nearby villages, but they did not get training on systematical cultivation technique.

Area for vegetable cultivation was set at 0.15 acre / HH that became 9 acre (= 3.645 ha) in total for the Pilot Project at two sites.

Table 4.3.3-1 Summary of Social Condition of Target Villages

Village tract		Labutta Loke South		Kyauk Hmau
Village		Thet Yat Kone	Phayar Gyi Kone	Tha Yet Kone
Population		853	526	641
Households	All households	214	120	142
	Land right holder	39	12	38
	Landless households	175	108	104
	Paddy worker	*145*	*85*	*99*
	Small fishery	*5*	*13*	*5*
	Other casual works	*25*	*10*	*(construction work is important income source)*
Social infrastructure	Primary school	1	0	1
	Drinking water source	Wells (68)	Open wells, ponds	Open well (1), Pond (1)
Paddy production	Registered paddy field (ac)	571.73	144.34	550
	Paddy harvest 2008/2009	35 basket/ac	35 basket/ac	20 basket/ac
	Paddy harvest 2009/2010	35 basket/ac	35 basket/ac	18 basket/ac
Damage by Nargis	Human death (person)[3]	7	6	3
	Collapse of house	44	9	99
	Half collapse of house	113	66	30
	Damaged social facilities	School, Library	Pagoda, Monastery	Primary school, monastery, church

5) Implementation process

The Pilot Project was implemented in the following process.

[2] Interview of all candidate villages except Nyaung Lein with interest to cultivate high value crops. Cucumber, long bean, okra, roselle and watercress are the identified top five vegetables the villagers want to cultivate.

[3] Villagers died of Nargis in the southern part of Ayeyawady delta when they worked for fishery and crab catching.

a) Work of Activity 1 (establishment of implementation body, selection of participants, and confirmation of land use, preparatory workshop and baseline survey) were done from the end of October 2010 to the end of November 2010.

b) Vegetables cultivation and marketing (technical workshop, distribution of input, cultivation and sale by participants, recording, on site training) were executed form the beginning of December 2010 to the end of March 2011.

c) Establishment of sustainable production framework consists of evaluation workshop, extension workshop, manual making, and satisfaction survey were done in April 2011 and the draft D/P was formulated.

6) Result of the pilot project

- Of the sixty selected households, 28 households in Thayetgone & Phayagyigone villages in Labutta Loke South Village-tract (LLS) and 29 Thayetgone villages in Kyauk Hmaw village-tract (KH) started cultivation, but three households, all in LLS, stopped due to illness, starting other job and moving to other place.
- More than 80% of the participants harvested cucumber, roselle and water cress while harvest rate was low in okra and especially yard long bean. Among 54 remaining participants, 52 were able to harvest at least one crop. The remaining two households started too late due to agricultural labour and illness and are expected to harvest in April.
- A problem for verification of income generation was found that the volume of selling unit (bundle/bunch) was not regularly fixed in size, and villagers made bundles/bunches according to market trend and their instinct. Measured weight on site was applied and average weight per acre was calculated.
- Comparing the yield from the pilot project and that of the median yield of MAS manual[4], yield of cucumber and yard long bean was much lower than the MAS median yield, that of okra was almost same, and yield of roselle and water cress was higher than the median. Some participants regarded roselle and water cress as 'low risk-low return crops' and were not eager to plant at the beginning, but gross return of these two vegetables were higher than those of other vegetables.
- Cultivation in the pilot project revealed that rural, non-skilled people could produce low-risk crops but difficult to produce relatively high risk and highly technical crops, especially in the year of unusual weather. But to get sufficient income, they need to become familiar with these difficult vegetables, and effective support is needed for them.
- Almost all participants expressed to continue cultivation after the termination of the pilot project till the beginning of May when the rainy season starts. For such circumstances, sales proceeds till the beginning of May were estimated in the condition that production quantity decreased gradually.
- As a result, average gross benefit was 49,300 Kyats per participant and that of net return was negative when production cost of 49,401 Kyats was considered[5]. About 30% of participants got positive net return. However, some participants who started later continue cultivation till May and this figure will become better a bit.
- The percentage of participants who succeeded (got harvest) one crop was higher in KH than in LLK. However, participants in LLS got 1.4 times gross benefit as much as those in KH and net

[4] MAS Manual-2000 (4th version)

[5] Participants did not really feel they lost investment, as JICA study team provided seeds, fertilizer and chemicals.

return of KH was negative while that in LLS was positive.

- A remarkable difference was observed between KH and LLS in understanding and practice of new technique. Also, KH was located in the remoter area than LLS till the time when the construction of the new district center was started and difficult to communicate with other villages. For generating income in future, more support shall be given to the more vulnerable villages where inhabitants are not accustomed to learn new matters.

Table 4.3.3-2 Result of Vegetables Production in Pilot Project

Item	Unit	Cucumber	long bean	okra	roselle	water-cress	Per HH
Successful participants	HH	44	20	40	49	47	(total 52)
% of continuing participants		84.6%	38.5%	76.9%	94.2%	90.4%	-
Gross profit/ participant	Kyat	9,674	12,872	8,356	19,944	12,107	49,300
Production cost Kyat	Kyat	16,859	12,019	6,784	6,888	6,850	49,401
Net return Kyat/participant	Kyat	-7,185	852	1,572	13,056	5,257	-2,790

7) Price fluctuation

- Selling unit price fluctuated widely according to the selling period and place. If the participants sell the produces directly to consumers in and near villages, unit price is high but the selling amount is not so large.
- Almost all participants sold their produce at Labutta Konelay 'no tax' market that is open only during night time. A new market was planned to be constructed in the new district center near the KH site in 2010-2011 dry season, but it has not yet materialized.
- Generally, selling unit price went down from February to March for cucumber, roselle, and water cress while there is no change in the price for yard long bean and okra.
- During the pilot project period, market price of target vegetables was surveyed at Labutta Konelay market (night market without tax) and Labutta Ywainadi market (official market) every two weeks. The result indicates that unit price of all vegetables except roselle was decreasing form December to March. It means that landless households should start vegetable cultivation as early as possible to get higher profit if the yield is same. However, it was also found that they are forced to start only after the completion of agriculture labour work (which sometimes continues till the end of January).

(3) Training and Workshop

Nine workshops were held during the income generation pilot project from preparation to extension as summarized in **Table 4.3.3-3**.

Table 4.3.3-3 Trainings and Workshops for Income Generation Pilot Project

Workshop	Date	Subject	Attendant
1) Preparation Workshop (at LLS)	24/11/2010	- Explanation of the pilot project - Confirmation of intension of participation - Agreements between participants and JICA study team, participants and land right holders	Participants, MAS, PDC
2) Preparation Workshop (at KH)	25/11/2010		
3) 1st Workshop (Technical training at LLS)	9-10/12/ 2010	- Training on improved cultivation method and book keeping	Participants, MAS
4) 1st Workshop (Technical training at KH)	11-12/12/ 2010		
5) 2nd Workshop (Technical training at LLS)	25/2/2011	- Instruction of proper chemical use	Participants, MAS, PDC
6) 2nd Workshop (Technical training at KH)	26/2/2011		

7) Evaluation Workshop (at KH)	28/3/2011	- Confirmation and sharing of the outputs of the pilot project among stakeholders - SWOT analysis	Participants, MAS, PDC
8) Evaluation Workshop (LLS)	29/3/2011		
9) Extension Seminar	5/4/2011	- Information sharing about the result of the pilot project among participants, government staff, and NGOs	Participants, MAS, NGO, government staff

Note: LLS = Labutta Loke South, KH = Kyauk Hmaw

(4) Evaluation and Lessons from Pilot Project

1) Self evaluation by participants

As mentioned in the previous section, net return was negative. Participants evaluated their activities by applying SWOT analysis at the evaluation workshop. Though they were not accustomed to present own opinion to others and to analyze reasons of good or worse production result, following strengths (strong points and positive factors internal/ own to the participants or village), weakness (negative factors internal/own to the participant or village), opportunities (positive factors external/ outside to the participants and outside the village) and threats (negative factors external/outside to the participants and outside the village) were extracted from the participants during the session..

As the result, labour force availability, location of cultivation plot, experience, and knowledge and technique were regarded important as internal factors. Free land use, work schedule of rice production, and natural (soil, water) condition were found important as external factors.

2) Lessons learnt from pilot project for sustainable vegetables cultivation

From the result of SWOT and monitoring by the JICA study team, the following lessons were extracted as internal factors.

(i) Balance of labour force and cultivation area is an important key for success. 0.1 acre is suitable for two persons while 0.2 acre is possible for four person work force.

(ii) Distance of cultivation plot and water source should be less than 100 feet (at farthest point) to avoid watering burden.

(iii) Distance of cultivation plot and house is important for avoiding cattle penetration and thieves. The distance that the participants can watch from the house is ideal.

(iv) Rural people understand they need knowledge and experience of improved cultivation method, fertilizer and chemical application for generate income. However, it was difficult for many participants to achieve it while a few of them could. They were too low-educated to understand new technique (especially in KH) and not familiar to this type of learning experience. They were cautious to accept new knowledge unless they are very sure of a positive outcome. Thus, longer time training (1 week), understandable approach and manual, model farm that shows precise production method and profitability are indispensable.

(v) Starting time is important. Early start brings more profit. However, many landless households are agricultural labour and for this reason, it is not easy to start early and thus sometimes they miss high market price time. It is a constraint to generate good income through vegetables cultivation particular for landless households. Thus, if a landless household want to start vegetables cultivation, he/she needs to manage own rice production work.

These are internal factors that the cultivators should overcome. When landless households start vegetables cultivation to get more income, they need to consider these matters. Guidance and

assistance of the government organization (MAS, local government) are needed to provide cultivators to get a stable income.

Lessons learnt as external factors are as follows.

(i) Land use must be guaranteed for sustainable vegetables cultivation by landless households.

(ii) Soil and water condition must be checked before cultivation.

Cultivators cannot deal with these issues though they are key points for sustainable vegetables cultivation by landless households living in remote areas. Organizations in charge (MAS and local government) are proposed to be responsible for dealing with these issues.

In addition, many participants, especially low-educated ones, are not easily prone to accepting immediately new ideas and technology. Supporting system must be carefully prepared to meet this demand when the project of income generation through vegetables cultivation starts.

3) Effect on household economy

a) Family budget of the participant households

Result of Baseline Survey shows that main income sources of the participant households are vegetables cultivation, casual labour, agriculture labour, poultry and pig raising, and fishery in this order. But the biggest contribution to the family budget is income from casual labour (more than 80% of casual labour households, it is the first income source) and in agricultural labour (for two- thirds of agriculture labour households, it is the first income source). Vegetables cultivation is the most common income source in the project site, but it plays a rather low important role; for more than 55% of vegetables cultivation households, it is the second or lower income source.

There are many factors to consider in understanding household income. One is that the income from vegetables cultivation and sale is not clear because the growers do not have an idea the concept of net return. Declared income from vegetables seemed too high when the result of the pilot project, productivity and market price are considered. Also, even for agriculture labour, participants could not know clearly declare their income because they get labour fee both in cash and in-kind (paddy, rice) and price of paddy and rice fluctuates widely. In this report, household income was estimated based on the following procedure. (i) For the case of the in-kind income, a basket of paddy is set at 4,000 Kyats and a basket of rice is set at 10,000 Kyats[6], and (ii) declared vegetables sale is divided into 30% consistent to the result of the pilot project. The result of estimate is shown in **Table 4.3.3-4** and used for the analysis of effect of pilot project, but to get more accurate information on income of rural households, there is a need to undertake a more precise survey.

Table 4.3.3-4 Estimated Annual Household Income

Village Tract	Income maximum Kyat/year	Income minimum Kyat/year	Income median Kyat/year
Kyauk Hmaw	2,275,000	50,000	535,000
Labutta Loke South	1,030,000	45,000	357,500

b) Effect on household economy

As mentioned above, net return of sales of five vegetable participants was negative in KH (when input cost was considered) and average percent of the net return to the household annual income was -2.9% on the average. However, net return is expected to be positive if the lessons learnt from the pilot project are carefully followed.

[6] As large portion of in-kind income is consumed at home, market price (gate price) was applied expediently for the estimate.

Other works for participants to do during the pilot project period was examined (this is other reason of low harvest adding to above mentioned issues). It was found that two reasons/causes possibly affected their vegetables cultivation. A participant could not harvest till the beginning of April due to his labour work for the landowner (repayment of debt by labour). Another participant preferred to undertake labour work due to low vegetable production. They regarded labour work for debt repayment as more urgent activity than getting another income from vegetables cultivation. Also, payment for labour in the fishery sector was higher. Households who got chance to work as temporary construction worker stopped vegetables cultivation. On the other hand, interview result said that some income opportunities were lost by participation in the pilot project. Vegetables cultivation is not as competitive as construction works and labour in terms of income due to socio-economic aspect in the Project Area.

Table 4.3.3-5 Estimate Income Increment in Vegetable Cultivation Pilot Project

Village Tract	Average Net return from pilot project Kyat	Average % of the net return to the estimated household annual income
Kyauk Hmaw	-7,606	-4.0%
Labutta Loke South	9,363	-1.4%
Two sites	-101	-2.9%

4.3.4 Mangrove Windbreak Rehabilitation Pilot Project

(1) Purpose of Pilot project

Objective of the pilot project for the rehabilitation of mangrove windbreak trees is to obtain data and information regarding mangrove reforestation to be undertaken along the dike embankment. The mangrove windbreak trees are commonly seen along polder dike embankment at river side as natural vegetation, with the function to protect embankment from direct attack of tidal wave and storms. Result will be used for the formulation of the D/P for the rehabilitation of mangrove windbreak to cover other polders and embankments in the Project Area in the Ayeyawady Delta.

(2) Implementation and Result of Pilot Project

1) Site selection for pilot project

From result of site selection investigation on February of 2010, the river bank in front of Damin Chaungalay village was selected as site of pilot project. Damin Chaungalay village is located in the North-western part of Labutta North Polder, which faces Thet Ke Thaung River.

2) Planted mangrove species

Three mangrove species, namely *Sonneratia apetala* (Sa, local name is Kanbala), *Nipa fruticans* (Nf, local name is Dani) and *Avicennia officinalis* (Ao, local name is Thame Gyi), were selected as species for the project site. Sa was planted in most of the river side, Nf was planted in the middle and Ao was planted in the land side. Planting width of Sa and Nf was 30 m each and planting width of Ao was 40 m to made 100 m in total planting width. Planting length was 500 m along dike embankment and planting spacing was 2 m x 2 m.

3) Procurement of seeds and seedlings, installing of temporary nursery

Seedlings of Sa and Ao were obtained from Thar Kone nursery which is managed by FD. NF seeds also are prepared by FD. However seedling breeding of Nf was carried out by local villagers in Damin Chaungalay. For the seedling breeding of Nf, temporary nursery for Nf was prepared at planting site.

4) Fencing

Bamboo fence, which was made by knitting a bamboo in the pin grid array format, was installed around the plantation. The bamboo fence surrounding the plantation also prevented the invasion by animals.

5) Implementing body

Figure 4.3.4-1 shows structure of implementation for the pilot project. Pilot project was implemented by local villagers of Damin Chaungalay village through management by Myanmar local consultant which was contracted by JICA Study Team. The study team supervised the Myanmar local consultant and the overall pilot project activities. FD Labutta office supported technical aspects regarding planting of mangrove tree species.

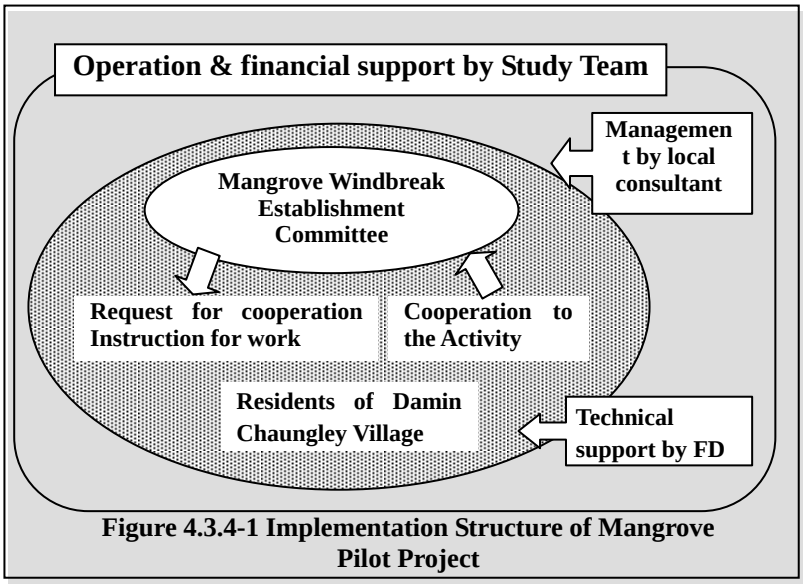


Figure 4.3.4-1 Implementation Structure of Mangrove Pilot Project

Local consultant hosted workshop for explanation of pilot project. The consultant established the local villagers group, which was called "Mangrove Windbreak Establishment Committee" for implementing mangrove tree planting. This committee became the core implementing body of the pilot project operation, the villagers of Damin Chaungaley village gather to the committee and the pilot project was implemented.

6) Result of Implementation

The mangrove windbreak with planted area of about 5 ha was established along the polder dike in Damin Chaungalay village through the implementation of the mangrove windbreak rehabilitation pilot project (See **Figure 4.3.4-2**).

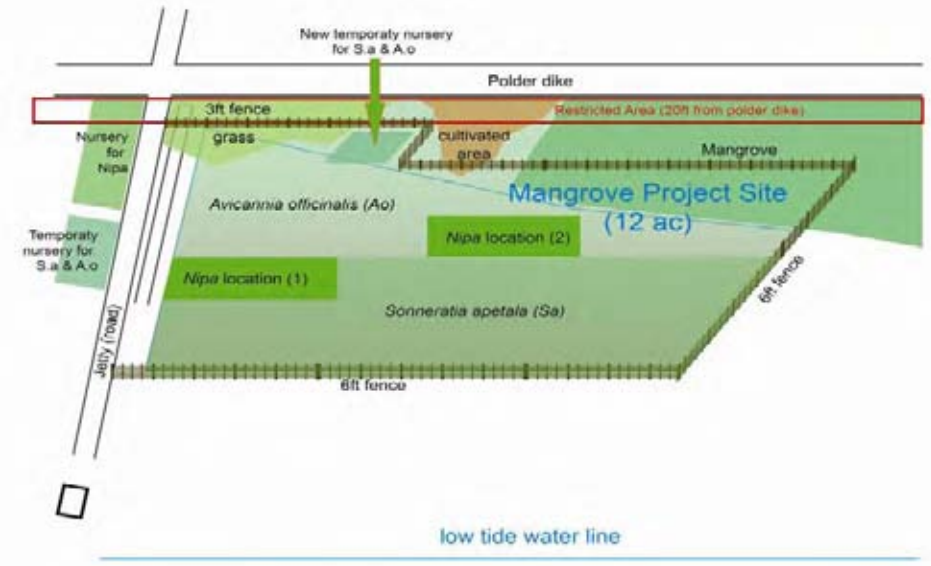


Figure 4.3.4-2 Site Arrangement of Mangrove Windbreak Rehabilitation Pilot Project

Table 4.3.4-1 Implementation Process of Mangrove Windbreak Rehabilitation Pilot Project

Activity	Timing	Contents	Man/day	Material cost (Kyat)
Land survey	April, 2010	・Measurement of boundary ・Location fixing for temporary nursery and fence ・Implementing by local consultants	—	—
Temporary nursery	May, 2010	・Material procurement by project ・Implementing by residents with payment	4.5	29,760
Procurement of Nf seeds	May, 2010	・Procurement of Nf seed from FD nursery by project ・Transportation of Nf seed by boat which prepare by project ・Unloading of Nf seed from boat by residents without payment	—	367,500
Breeding of Nf	May–July, 2010	・Patrol at the nursery ・Implementing by residents without payment	—	—
Fencing	May–June, 2010	・Installing at surround of planting site ・Material procurement by project ・Implementing by residents with payment	215	2,150,700
Marking for planting place	May–June, 2010	・Bamboo stick for marking and support of seedling ・Material procurement by project ・Implementing by residents with payment	131	62,500
Procurement of Ao and Sa seedlings	June, 2010	・Procurement of Ao and Sa seedlings from FD nursery by project ・Transportation of seedlings by boat which prepare by project ・Implementing by residents with payment	22.5	1,175,000
Planting	June–July, 2010	・8000 seedlings of Ao ,5000 seedlings of Sa and 920 seedlings of Nf were planted ・Implementing by residents with payment	163	84,740
Grass weeding	September, 2010	・Grass weeding was conducted along the planted row ・Implementing by residents with payment	—	—
Monitoring	October, 2010	・Implementing by local consultants	—	—
Supplemental planting	October, 2010, January, 2011	・8000 seedlings of Ao ,5000 seedlings of Sa and 920 seedlings of Nf were planted ・Procurement of seedlings from FD nursery by project ・Implementing by residents with payment	—	176,000
		Total	536	4,046,200

i) Land measurement for planting site

Measurements of planting are along the river bank of the Thet Ke Thaung River and conducted by local consultants together with the local villagers. As a result of area measurement, planting place was fixed to be 12 acres (about 4.8 ha). At the same time, location for fencing to surround the planting site and temporary nursery for Nf seedling was selected.

ii) Establishment of temporary nursery and transportation of Nf seeds

Temporary nursery for breeding of Nf seedling was established on the first week of May 2010. After establishment of the nursery, Nf seeds was transported from FD Thar Kone nursery to the plantation site on 8 May 2010. Nf seed from FD nursery had relatively low germination rate as

only 920 seeds was germinated. It has only a 15% germination rate.

iii) Installation of fence and marking for planting location

The installation of the fence around the pilot project site was undertaken from the last ten days in May, 2010 to the first ten days in June. The bamboo used as the material of the fence was procured from the Damin Chaungalay village suburbs. A 6 feet fence was installed at the riverside to prevent tidal intrusion and 3 feet at the inland side to prevent the entry of livestock Bamboo stakes were placed to mark planting location which shows a 2 m interval.

iv) Planting

The seedling of Ao and Sa was carried in from FD Thar Kone nursery on the last ten days in June, 2010 and planting activity was implemented by the end of June, 2010. Nf was also planted on first week of July 2010. About 8,000 seedlings of Ao, 5,000 seedlings of Sa and 920 seedlings Nf, were planted at that time.

v) Grass weeding and monitoring

Grass weeding of pilot project site was conducted on September. Monitoring of survival rate for planting tree also was conducted at the same time.

vi) Supplemental planting

In Accordance with the result of monitoring, supplemental planting of Nf was conducted on October. 2010. About 1,950 seedlings of Nf were planted at that time. Also, 500 seedlings of Ao and 300 seedlings of Sa were planted on January, 2011. Ao and Sa seedlings were also procured from the FD nursery.

As presented in **Table 4.3.4-1**, implementation of the mangrove windbreak rehabilitation pilot project required a total of 536 man-day labours and 4,046,200 Kyats for materials to establish the pilot project site. Most complex work was the installation of the fence, as it needed 215 man-day labour forces. Second most complex work was planting, as it needed 163 man-day labour forces. Most costly work was the installation of fence, as it needed 2,150,700 Kyats. Second most complex work also was planting, as it needed 1,175,000 Kyats.

7) Cost-Benefit Analysis of Mangrove Windbreak Pilot Project

A cost-benefit estimate of the mangrove windbreak pilot project was prepared and is presented in **Table 4.3.4-2.**

Table 4.3.4-2 Cost-Benefit Analysis of Mangrove Windbreak Pilot Project

Species	Products	Lotation	Products volume	Anuual income (1000Kyat/ha)	Annual expence (1000Kyat/ha)	Annual profit (1000Kyat/ha)
Sonneratia apetala (Sa)	Constluction materials	Every 5 years	After 5 years 375logs/ha After 10 years 188logs/ha After 5 years 187logs/ha	877	43	834
Nipa fruticans (Nf)	Roofing	Every year	750sheets/ha	188	9	179
Avicennia officinalis (Ao)	Fire wood	Every 5 years	After 5 years 43,000bandles/ha After 10 years 40,000bandles/ha After 15 years 58,000bandles/ha	502	57	445
			Total(1000Kyat)	1567	109	1458

Villages can get fire wood from Ao, construction material from Sa, roofing materials from Nf. Nf can produce 750 sheets of roof material per ha every year, 3 years after planting. With the production of the material of this roof thatching, the profit of 188,000 Kyats/ha is expected every year. On the other hand, annual expense of Nf management is only 9,000 Kyats/ha, hence, the annual net profit of Nf becomes 179,000 Kyats/ha. Annual profit of Sa is 877,000 Kyats/ha, while the annual expense is 43,000 Kyats/ha, hence an annual net profit of 834,000 Kyats/ha. The annual profit of Ao is 502,000

Kyats/ha, and with the annual expense is 57,000 Kyats/ha, the annual net profit becomes 445,000 Kyats/ha. The annual profit of the 3 tree species in total is 1,567,000 Kyats/ha, the annual fee is 109,000 Kyats/ha and the annual net profit is 1,458,000 Kyats/ha. Because the pilot project site has about 5 ha area, the annual net profit of is expected to be about 7,290,000 Kyats from the pilot project site.

(3) Training and Workshop

Several training and workshops were conducted during the implementation of the pilot project as described below:

i) Introductory Meeting

Date	29 March 2010
Place	TPDC office, Labutta
Attendants	TPDC chairman, officer of FD, MAS, SLRD, ID（Total 13 persons）
Objective	− To know the objectives and contents of the pilot projects to be carried out in Labutta township. − To know the overall schedule and project scheme of the pilot project implementation. − To have common understanding on the project and promote close relationship between the personnel of different organizations representing the pilot projects.

ii) First Workshop (Orientation)

Date	4 April 2010
Place	Damin Chaungalay
Attendants	VPDC chairman、Villagers of Damin Chaungalay（Total 13 persons）
Objective	− To know the objectives, planned activities and expected results of the pilot projects by all the beneficiaries and relevant local authorities in Damin Chaungalay village, Laputtaloke VT. − To understand the overall schedule and methods of operations of the pilot project activities. − To improve knowledge and awareness of local people on advantages of the presence of mangrove trees and disadvantages of it's' absence in the coastal region. − To understand potential problems and difficulties that will be encountered during implementation, and to find possible solution. − To agree to a common direction that would lead to the smooth implementation of the pilot project.

iii) Second Workshop (Technical Training)

Date	12 May 2010
Place	Damin Chaungalay
Attendants	VPDC members、Villagers of Damin Chaungalay（Total 29 persons）
Objective	− To provide updated information on changes made in the planned activities. − To promote better understanding and close relationship between the villagers and the personnel representing to the pilot projects. − To understand potential problems and difficulties which may have been encountered during implementation, and find appropriate solutions to identified problems. − To agree on specific tasks, time schedule, roles and responsibilities of each personnel in future project activities.

iv) Third Workshop (Technical Training)

Date	17-18 May 2010
Place	Damin Chaungalay
Attendants	Villagers of Damin Chaungalay（Total 54 persons）
Objective	− To enhance technical skills and knowledge of the local community on the rehabilitation of mangroves. − To understand more in detail about the nature of mangroves.

	− To improve capacity of the local community in maintaining mangroves. − To achieve effective and efficient cooperation of the local community in project activities. − To improve close relationship between the local villagers and Mangrove Management Committee of Damin Chaunglay village.

v) Picture Competition by School Students

Date	28 January 2011
Place	Damin Chaungalay
Attendants	Students of primary school in Damin Chaungalay（Total 40 persons）
Objective	− To understand the importance of the mangrove windbreak through the picture contest.

vi) Fourth Workshop (Technical Training)

Date	1 March 2011
Place	Damin Chaungalay
Attendants	Villagers of Damin Chaungalay（Total 69 persons）
Objective	− To acquire technique for maintenance of mangrove windbreak

vii) Fifth Workshop (Technical Training)

Date	17 March 2011
Place	Damin Chaungalay
Attendants	Villagers of Damin Chaungalay（85 adults and 110 children）
Objective	− To improve awareness and knowledge to more villagers regarding the proper maintenance and conservation of mangrove plantation in local region. − To understand sustainable management of mangrove windbreak which has the function against disaster − Motivating children and their parents by giving awards to the winners of picture competition

viii) Evaluation Workshop

Date	31 March 2011
Place	Damin Chaungalay
Attendants	Villagers of Damin Chaungalay（Total 72 persons）
Objective	− To understand the real situation (strengths/ weaknesses) of the project activities − To learn lessons and take necessary actions based on the evaluation results − To be able to maintain windbreak mangrove plantation systematically.

(4) Evaluation and Lessons from Pilot Project

Table 4.3.4-3 gives the way of villager's participation in the work and the manner of procurement of materials and equipment required for the work.

Table 4.3.4-3 Villagers' Participation in Pilot Project Activity

Activities	With-pay	Without-pay	Procurement from outside	Procurement by own
Temporary nursery	O		O	
Procurement of seed &	O		O	
Breeding		O	—	—
Fencing	O		O	
Marking	O		O	
Planting	O		—	—
Grass weeding		O		O

i) Establishment of temporary nursery and installation of fence

The establishment of temporary nursery and the installation of the fence were conducted by

villager's work with wage payment. Labor force from outside for the activity was not required. Materials and equipment were procured by the project side.

ii) Procurement of seedling and breeding of Nf seed

Ao and Sa seedling and seed of Nf were procured by the project from FD nursery and private nursery. Quality of Ao and Sa seedlings were good. Unloading from boat was carried out by villager's work with wage payment. On the other hand, Activity of Nf breeding was conducted without wage payment. Seed from FD nursery had low germination rate, so number of seedling obtain was relatively low quantity.

iii) Marking

Marking of planting location was done by villagers with pay. Therefore outside labor force was not required. Marking stakes which were made from bamboo was procured by the project side.

iv) Planting

Planting was conducted by villager's work with wage payment. Labor force from outside for the activity was not necessary. Planting activity did not need any materials and equipment.

v) Grass weeding

Grass weeding was conducted by villager's work without wage payment. Labor force from outside for the activity was not required. Bush cutter was prepared by villager.

Evaluation of technical aspects for the Pilot Project is presented below.

i) Planting species

From the result of monitoring, which was carried out four (4) month after the planting activity, mortality rate of Ao seedling was 17%, Sa was 12% and Nf was 15%. According to U Win Naing, former chief officer of Labutta FD office, this mortality rate was relatively low compared with other mangrove plantation work in Myanmar. Also tree growth monitoring, which was carried out eight (8) months after planting, showed good growth of three mangrove species. For instance, Ao became 45 cm, Sa became 69 cm and Nf became 96 cm (See **Figure 4.3.4-3**). This result shows that three mangrove species used are suitable for mangrove windbreak rehabilitation.

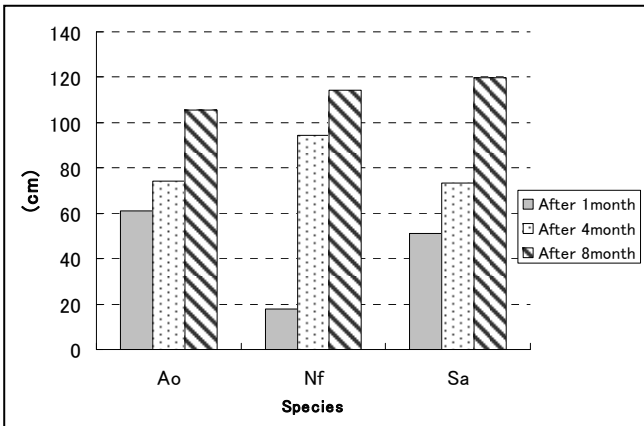


Figure 4.3.4-3 Mangrove Height Monitoring after Planting

ii) Fencing

The fence was installed surrounding the planting site. Functions of the fence are; (i) To reduce power of strong wave, (ii) To protect entering trash and water lily from outside into planting site, and (iii) To avoid entering of boat.

iii) Implementation body

The pilot project activity was conducted smoothly within the original schedule. So, it was understood that implementation plan for the pilot project is suitable. When the evaluation workshop was held, Mangrove Management committee which is the body for maintenance of mangrove windbreak was established. Mangrove Management committee is composed of 11

members of villagers. The committee identified the roles of the villagers in the maintenance and utilization of mangrove wind break.

Lessons obtained from the Pilot Project implementation are explained as follows;

1) The materials and equipment which the villagers can procure personally are extremely limited. Outside investment is indispensable for the procurement of materials and equipment.
2) Establishment of mangrove windbreak can be conducted by labor force of villagers only. However, volunteer work was limited, almost work needs payment for villagers.
3) Ao and Sa seedling are available from FD nursery, Nf seed also available from FD nursery and private nursery in the Ayeyawady Delta. These three are very common mangrove species in Ayeyawady Delta, and nursery activity of these species is relatively easy. Therefore these 3 species are suitable for the rehabilitation of mangrove windbreak in this area.
4) Due to obtain good result for Nf breeding, mature Nf seed should be used for planting.
5) Although installation of fence required much labor force, equipment and materials, the function of protection of the planting site is very effective.

(5) Villager Impact Survey

An evaluation workshop about the mangrove windbreak rehabilitation pilot project was undertaken in the Damin Chaungalay village on March 31st in 2011. Attendants of the evaluation workshop were 69 villagers. They expressed many opinions regarding mangrove windbreak rehabilitation project as presented in **Table 4.3.4-4** below.

Table 4.3.4-4 Villagers' Response in Evaluation Workshop on Mangrove Pilot Project

Questions	Answers	Number of Respondent
The number of times participated n the mangrove technology transfer seminar	One time	21
	Two times	23
	More than Three times	25
Understanding the meaning of windbreak mangroves establishment	Well	14
	Moderate	54
	Not well	1
Understanding the technology transfer of windbreak mangroves	Well	40
	Moderate	28
	Not well	1
The activity which is possible do ourselves	Nursery	0
	Fencing	0
	Planting	51
	Grass Weeding	31
The windbreak establishment activity	Good activity	69
	Not good activity	0

Answers from the attendants are summarized as follows;

1) All attendants of evaluation workshop joined at least one technical transfer workshop. 68 numbers of attendants could understand contents of technical transfer workshop.
2) The Villagers cannot provide by themselves the material and equipment for temporary nursery, and material and equipment for fencing. However, 51 participants indicated their capacity to provide labor force for planting, and 31 for grass weeding.
3) All participants of evaluation workshop understood that mangrove windbreak rehabilitation

activity is very good activity.

Lessons obtained from the above result are as follows;

1) Villagers could get knowledge and information about the mangrove rehabilitation at the technology transfer workshop. In case of rehabilitation of the mangrove windbreak, the preliminary technology transfer and the orientation activities are indispensable.
2) To recognize that it is difficult for the villagers themselves to procure the seedling, materials and equipment in the implementation of similar projects in the future. The seedling, materials and equipment should be sourced out outside assistance in case of rehabilitation of the mangrove windbreak.
3) From the implementation result of the mangrove windbreak pilot project, villagers could understand that mangrove rehabilitation work is a good and effective project in their area. Villagers recognize that mangrove rehabilitation is good activity for the villagers. Villagers have big potential for implementing mangrove windbreak rehabilitation by themselves.

4.4 Initial Environmental Examination (IEE)

The components of the Pilot Project are 1) Dike embankment and sluice rehabilitation, 2) On-site seed production, 3) Income generation and 4) Mangrove windbreak rehabilitation. The impact of the hereinto pilot project components are discussed below.

(1) Social Impacts

1) Expected social impacts by the embankment works and countermeasures against them

The expected impacts by the polder embankment widening are resettlement and land acquisition. Proposed necessary width including borrow pits for the rehabilitation is around 70 feet from the toe of existing dikes. According to the customary rule described in Chapter 4.3, it is allowed for people to use land outside 50 feet from the toe of dike, for residential purpose or farming activities and actually the people got used to cultivating the land. However, due to the widening of embankment, a part of farmlands, from 50 feet to 70 feet should have been acquired. In addition to that, there are about 10 huts along the dike that are considered as illegal.

Since there is no specific standard related to polder dike slope in Myanmar, application of the Japanese standard for the slope (1:2 to 1:3) was examined. If the slope is designed at 1:2 or 1:3, the necessary land to be acquired can be wide. Therefore, the proposed slope was set at 1:1.5 to minimize the land acquisition. It would not cause any problem in terms of safety, since the height of embankment is 7 to 8 feet (= 2.1 to 2.4 m) from the ground level, which is not very high. This was the environmental consideration taken at the design level.

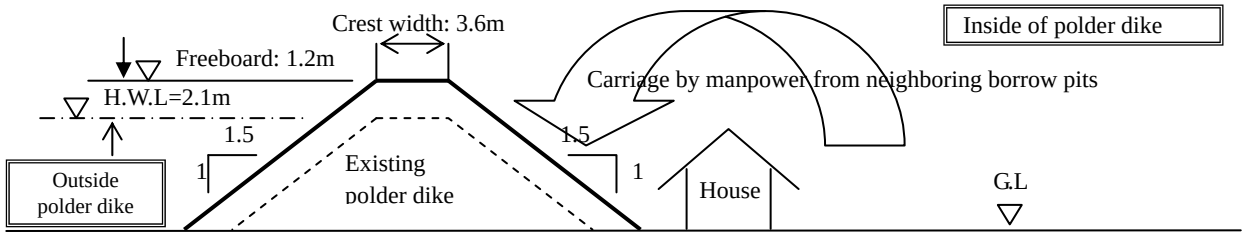
At the construction stage, if houses were situated close to polder dikes, soil was carried manually, which did not require the area for temporary stockpile for drying soils (refer to **Figure 4.4-1,** Method-1). Further measure to minimize the disturbance of existing huts / houses was to obtain embankment soils from the area nearby but not from the hut lot (refer to **Figure 4.4-1**, Method-2). It is noted that ordinal construction method, namely, use of machines e.g. bulldozers and set of borrow pit along the dike, which requires temporary dike, was applied if there were no houses, since it is cost-effective and possible to save time. Taking consideration into the site conditions, the method to be applied was determined.

If standing crops are damaged by the works, there is a need to provide compensation. At the Pilot Project, no standing crops were observed along the polder embankment. Therefore, it was not necessary to consider this matter.

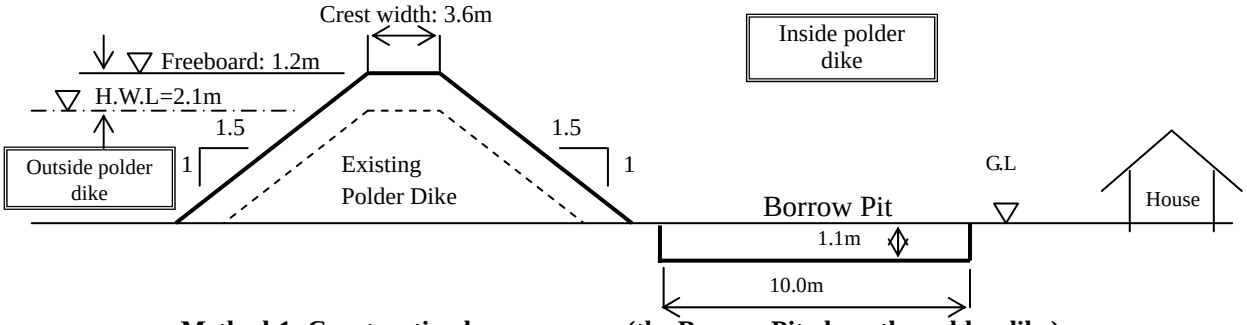
2) Social impacts by other components

Concerning other pilot project components, namely, On-site Seed Production and Income Generation,

the former aimed to improve present farming and targeted farmers who have cultivation right and the latter targeted landless people, who are called casual labor. Therefore, both groups were covered by the Pilot Project, which means people in various conditions could access to good opportunities. In addition to that, another component, namely, Windbreak Mangrove Rehabilitation can prevent their lives from disasters and contribute to fish resource increase by bio-diversification, which leads to income increase for the people. Therefore, it can be said that the impacts by those components were not negative.



Method -2: Construction by manpower (the soil materials are carried from neighboring Borrow Pits)



Method-1: Construction by manpower (the Borrow Pit along the polder dike)

Figure 4.4-1 Cross Sections of Construction Method to Minimize Resettlement

(2) Natural Impact

In general, there were no negative impacts caused by the Pilot Project, since the projects considered only the rehabilitation the original situations. There are no sanctuaries, special landscapes and other valuable places in terms of flora and fauna along the embankment which was affected by the project. Regarding mangrove windbreak rehabilitation, three main local mangrove species, namely, Sonneratia apetala (Sa, local name: Kanbala) for river ward zone, Avicennia officinalis (Ao, local name: Thame Gyi) for middle portion and Nypa fruticans (Nf, local name: Dani) for land ward zone were planted. They are suitable for the natural conditions in the Pilot Project site. This work was implemented without mechanical equipment, chemicals and fertilizers, and in an environment-friendly manner. Generally, mangrove forest plays a role as shelter in case of natural disasters and can contribute to bio-diversification. Moreover, these Pilot Project components were small-scale which could cause little adverse effect. Therefore, it can be said that the adverse natural impacts by Pilot Project are negligible.

(3) Pollution

The main anticipated pollutions were air pollution, water deterioration, waste, noise and vibration and so on. The pollutions mentioned were tentative and the period was limited to the construction stage only. Concerning dust generation by the embankment works, the soil in the field is relatively wet and there was low possibility that the works generated dust and it was not needed to spray water at the construction sites. In and around the residential area, manual embankment was applied, which made it possible to suppress dust generation. The number of houses in the sites, where machinery works were

implemented, was limited.

(4) Orientation of the Pilot Project

Prior to the Pilot Project implementation, a series of consultations were held targeting the people. Concerning the dike embankment and sluice rehabilitation, ID requested and informed Labutta TPDC implementing scheme of Pilot Project. In general, TPDCs are the responsible organization for such project to send notice to people through VPDC. Labutta TPDC provided information on the rehabilitation of embankment and sluice to VPDCs on March 2010, and sent notice of land acquisition and resettlement in December 2010 to VPDCs during the regular monthly meeting. There was no comment on the explanation of TPDC at the meeting. On the other hand, regarding other components, namely, on-site seed production, income generation and mangrove windbreak rehabilitation, workshops to introduce these components to the people were organized. The series of notifications were made as follows:

Table 4.4-1 Notification of Pilot Project to the People

Dike embankment and sluice rehabilitation

Date and Venue	Subjects of explanation	Organizer	Targets
March 2010 at the Labutta Township office	- Test embankment - Rehabilitation of whole embankment	Labutta TPDC	VPDC members
1st December, 2010 at the Labutta Township office	- Necessity of resettlement and land acquisition *No comment from the VPDC*	Labutta TPDC	VPDC members

On-site seed production

Date and Venue	Agenda	Organizers	Targets
7th April, 2010 at the Labutta Township office of MAS	- Objectives of the pilot project - Expected outcomes - Identification of problems regarding farming - Responsibilities of each stakeholder such as farmers, JICA Team and MAS - Agreement on the pilot project between the project and the villages	TPDC Labutta, MAS, Golden Plain and JICA Team staff	Farmers representatives from the 3 target Pilot Project sites

Income generation

Date and Venue	Agenda	Organizers	Targets
20th to 25th May, 2010 at the 5 villages tract assembly room	- Introduction of the pilot project objectives and components - Number of people who are interested - Confirmation of available land - Confirmation of current technical level - Market - Women's participation in vegetable cultivation *Based on the acquired data, 2 villages out of 5 were selected as Pilot Project sites by the JICA Team*	MAS and JICA Team	VPDC members and 40 to 70 people per village , who are interested (main target are landless, and some land owner also joined)
16th to 18th June, 2010 in the 2 selected villages	- Result presentation of the sites selection - Schedule of the Pilot Project - Social condition survey on the village population (ratio of landless people, main income sources etc.)	JICA Team and MAS, VPDC members	Villagers who are interested
Mid of June, 2010	- Notice of the selection results to the 3 not-selected VT PDCs	JICA Team and MAS	VPDCs members of Not-selected VT
		VPDC members	Villagers in not-selected

Mangrove windbreak rehabilitation

Date and Venue	Agenda	Organizers	Targets
4th April, 2010 at the temple of Damin Chaungalay village	- Introduction of the pilot project objectives and components - Schedule of the Pilot Project - Discussion to enhance awareness of mangrove forest functions and conservation *As a result of 1st workshop, "Mangrove Management Committee" consisting of 13 villagers was established.*	VPDC members and Golden Plain	11 Villagers
12th May, 2010 at one residence' compound of Damin Chaungalay village	- Updating schedule, plan, schedule and activities of the Pilot Project - Explanation about commitment & participation by villagers - Identification of problems - Discussion on how to overcome the expected difficulties during the Pilot Project	VPDC members, Golden Plain and JICA team member	34 villagers

(5) Attitude of People toward the Embankment Works

According to VPDCs within the Labutta North Polder, a total of 96 household lost some parts of their farmland by the embankment works. Taking consideration into that the embankment works gave some adverse impacts on the surrounding people, an attitude survey targeting the affected people was implemented in March 2011. The target was 86 households within the Labutta North Polder, which corresponds to 90% of total. In addition interview to the resettled households was also implemented in March 2011. The survey results are shown below.

1) Notice to the affected people

Labutta TPDC provided information on the resettlement and land acquisition to the VPDC concerned in December 2010 during the monthly meeting. However the information was not transmitted to the individuals in the villages sufficiently. Only 31 (36%) out of the 86 interviewed got the information in advance (refer to **Figure 4.4-2**). In the Dami Chaunglay village, the people were familiar with the embankment works very well, since they were informed of this matter at the orientation workshop of mangrove windbreak rehabilitation. Also, the household that will be resettled did not receive official notice about the need of resettlement. They came to know about the situation through observation of the survey by ID staff around the polder embankment.

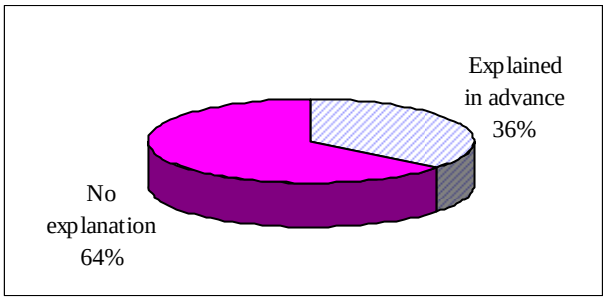


Figure 4.4-2 Prior Explanation about Land Acquisition to affected Farmers

2) Land Acquisition

As mentioned above, the questionnaire survey targeting 86 households (= 90% of total) was undertaken for the purpose of identification of their notion about land acquisition. According to the results, the mean farmland per households is 19.3 acres, and 2.1 acres on the average, which corresponds to 11% of their whole farmland, were acquired without compensation. However, there is a high possibility that people regard a part of ROW also as their farmland, given that total acquired area in the Pilot Project area is calculated at 183 acres, which is much larger than roughly estimated legal acquired area, namely, around 60 acres (=20 feet times 39 km). It is a fact that 36% of the affected people responded that they did not know the area of ROW.

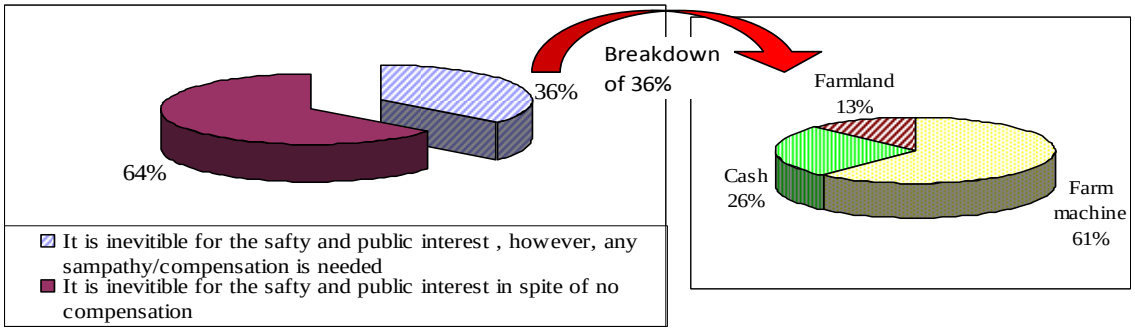


Figure 4.4-3 Farmers Attitude on Embankment Work and Land Acquisition

In general, people think that land acquisition for the embankment works is inevitable for security and the public interest. 64% of respondents accepted the land acquisition without compensation. Still, 36% of those responded that some supports, e.g. provision of farm machine (water pump) were needed as shown in **Figure 4.4-3**. In practice, compensation for the land acquisition would not be provided, following the regulation in Myanmar that all farmlands are owned by the State.

3) Resettlement

The measures and efforts to minimize resettlement of existing huts along the embankment were taken as planned. Still, it was observed that 5 huts stayed on the crest of embankment and 3 huts were located just beside of the embankment, therefore, 8 huts in total, which were illegal, relocated their huts to other places. The resettlement of those huts had already been completed without compensation in early December 2010 with little grievance from the persons involved. The interview results regarding the resettlement situations are shown in the following table.

Table 4.4-2 Situations of Resettlement

Resettled	No.1	No.2	No.3	No.4	No.5	No.6	No.7	No.8
Permanent or temporary	Permanent hut	Permanent hut	Permanent hut	Permanent hut	Permanent hut	Permanent hut	Temporary hut	Temporary hut
Occupation	Fishery	Fishery	Fishery	Casual labor	Casual labor	Farming	Casual labor	Casual labor
Cost for relocation shouldered by owners	Kyats 5,000	Kyats 10,000	Kyats 5,000	Kyats 5,000	Kyats 5,000	Kyats 5,000	Not confirmed	Not confirmed
Period for hut resettlement	3 days	Yet to be reconstructed	3 days	1 week	1 week	1 month	2 days by VPDC	2 days by village head

Note: Hut owners of No7 and No.8 have gone to outside of the Labutta North polder before the embankment works, hence, they were not anymore personally interviewed and their huts were moved by the VPDC members and village head.

Two casual labor households out of the eight households were temporary emigrants came from outside the polder and their shelters were just temporary in Labutta. When ID officers commenced initial survey along the polder dike, they went back to their hometowns. On the other hand, remaining six households originally had resided at landside or riverside of the dike nearby before Nargis, however they moved their shelter to the crest or just beside the embankment due to the damage from Nargis. Among them, three households being engaged in fishery went back to their original places nearby and they have just kept their work in fishery. Other two households, who work as a casual labor, have already moved near the sluice gate to find a job after the resettlement for the work. They used to move from place to place for the job opportunity. The last one makes a living by farming and the family also has a plan to move to another place again after the replacement for the embankment works.

After the relocation, their living conditions are not changed very much, since their living places are almost the same, at most, there are only several hundreds meters between the original and new locations, and their livelihood is the same as before. The paid amounts for the resettlement shouldered by the owners were 5,000 or 10,000 Kyats/household for rental of boat and house construction

materials. Given that their daily labor cost is 2,000-4,000 Kyats/day, the replacement cost mentioned above is not significant for their household account. Therefore, it can be judged that those resettlements are not involuntary. The detailed information of relocation by household is described in Appendix 10-3.

(6) Support to the People at the Construction Sites

In addition to the planned components of Pilot Project, some supports to the people were implemented at the construction site. One is water pond construction by modification of borrow pits. Based on the request by the people, some water ponds for school use and villages use were prepared. After the on set of rainy season, these ponds will be very useful for their lives. Furthermore, since a part of polder embankment was paved with stones, which people had collected with difficulty in the past, these stones were reused for the rehabilitated embankment based on people's request.

(7) Scoping Checklist

A scoping checklist describing environmental impacts by the Pilot Project is given below:

Table 4.4-3 Scoping Checklist for Pilot Project

No.	Impacts	Rating	A Brief Description
Social Environment: *Regarding the impacts on "Gender" and "Children's Right", might be related to all criteria of Social Environment.			
1	Involuntary Resettlement	B	Some efforts to minimize the resettlement were implemented. Still, there were 8 illegal huts, their resettlement was already completed with little grievance. They did not have to purchase lands for their new residence.
2	Local economy such as employment and livelihood, etc.	D	The rehabilitation works generated employment opportunity to local people.
3	Land use and utilization of local resources	B	Due to the widening of ROW under the control by ID, namely, from 50 feet to 70 feet from the toe of dike, parts of farmland, which had been cultivated by 96 farmers, were acquired. Since crop was not planted, there was no crop damage.
4	Social institutions such as social infrastructure and local decision-making institutions	D	The activities implemented under the project did not influence directly social infrastructure and local decision-making institutions.
5	Existing social infrastructures and services	D	The activities implemented under the project did not influence adversely on the social infrastructure and local decision-making institutions.
6	The poor, indigenous and ethnic people	B	In general, majority in the Pilot Project Area is Burmese with few minorities. These people are new residents due to new setting history of Ayeyawady Delta, indigenous people are not observed. Landless people who resided on and around the polder, who are illegal residents, moved to other places for the embankment works.
7	Misdistribution of benefit and damage	D	The project can contribute to protection of people's lives and farmland equally.
8	Cultural heritage	D	Important cultural heritages such as temples are not located near polder dikes.
9	Local conflict of interests	D	No severe conflict over the job opportunities was observed.
10	Water Usage or Water Rights and Rights of Common	D	Saline water from outside can be prevented through the rehabilitation works, which leads to improvement of water quality.
11	Sanitation	D	The rehabilitation works can prevent flood, which deteriorates sanitation.

No.	Impacts	Rating	A Brief Description
12	Hazards (Risk), Infectious diseases such as HIV/AIDS	D	Those who worked as labors were recruited from the neighboring villages, which led to very low risk of infectious diseases.
Natural Environment			
13	Topography and Geographical features	D	The structural measures were of small-scale such as repair works to cause any significant effects on these features.
14	Soil Erosion	D	The slope of embankment was determined considering safety. For manual embankment, sand bags made from jute were utilized, which is eco-friendly, and vegetation on the embankment slope is expected in near future.
15	Groundwater	D	All project activities did not extract groundwater and have no significant effect on groundwater or its quality.
16	Hydrological Situation	D	The sluice repair works enables to drain saline water from the polder effectively and it is expected not to cause negative impacts on hydrological situation.
17	Coastal Zone (Mangroves, Coral reefs, Tidal flats, etc.)	D	Rehabilitation of windbreak mangrove is effective for the coastal zone protection.
18	Flora, Fauna and Biodiversity	D	Since new civil engineering facilities were not constructed, no significant impact on biodiversity was generated.
19	Meteorology	D	There were no activities that affected the meteorology.
20	Landscape	D	The civil engineering works were mainly rehabilitation and too small-scale to cause any significant adverse effects including visual impact on landscape.
21	Global Warming	D	There are no activities with constant emission of green house substances.
Pollution			
22	Air Pollution	B	The construction vehicles could increase exhaust gas and rehabilitation works could generate dust, however, these situations was temporary. Moreover, manual works around the residential area were useful to suppress dust generation.
23	Water Pollution	B	Construction works along rivers could cause short-term deterioration in water quality due to increased turbidity, however, it was just tentative.
24	Soil Contamination	D	There were no activities promoting the use of toxic materials that may lead to soil contamination.
25	Waste	B	Construction wastes generated were managed appropriately focused on reuse of the wastes as much as possible.
26	Noise and Vibration	B	Construction works generated short-term noise and vibration. However, machinery works were implemented in non-residential area. Manual works near residential areas could suppress noise and vibration to some extent.
27	Ground Subsidence	D	There was no extraction of groundwater which leads to ground subsidence.
28	Offensive Odor	D	Temporary offensive odor was expected due to exhausted gas from the construction vehicles and machine only during construction period, at low level and at non-residential area.
29	Bottom sediment	D	Dispose of harmful substances such as heavy metals or organic chlorine compounds to river/sea was not implemented.
30	Accidents	D	With the greatest care, embankment works were implemented and no accidents were reported.

Rating: A:Serious impacts are expected. B: Some impacts are expected.
C: Extent of impact is unknown D: No or negligible impacts including positive impact are expected.

CHAPTER 5 DEVELOPMENT PLAN FOR PRESERVATION OF FARMING AREA

5.1 Basic Policy for Formulation of Development Plan

5.1.1 Basic Policy for Preservation of Farming Area

The objective of the Project is to formulate the "Development Plan (D/P) for Preservation of Farming Area for Urgent Rehabilitation of Agricultural Production and Rural Life" in the Ayeyawady Delta. In order to formulate the D/P, the work shall be made through appropriate procedures, i.e. i) survey and confirmation of present situation, ii) identification and clarification of current problems and challenges, and iii) planning of possible solutions / measures. As a result of the work through such procedures, realistic and implementable D/P can be formulated.

The Ayeyawady Delta where rich river deposit soils are widespread is the largest rice production and the most important food supply area in Myanmar. Therefore, it has been an important policy to maintain and increase rice production in this area from the food security viewpoint. Before Nargis attack, farming area had been preserved with construction and maintenance of polder dikes, embankments and sluices and rice production had been maintained. However, rice production declined remarkably due the serious damages of these infrastructures and farming area due to the Cyclone Nargis attacked in 2008.

With above-mentioned circumstances, discussions were presented in Chapter 2 and Chapter 3 on the confirmation and identification of current problems in the Project Area, challenges and improvement measures. As a result, two aspects were prioritized for the urgent preservation of farming area and the rehabilitation of crop production and rural life. They were; 1) rehabilitation of polder dikes, embankments and sluices as well as mangrove windbreak for the preservation of farming area, 2) improvement of farming and income generation for the rehabilitation of crop production and rural life.

In order to formulate the D/P for the preservation of farming area and crop production it is required to clarify natural condition from the viewpoint of meteorology, hydrology and topography which seems to be very severe and critical to preserve farmland and to practice farming in this area. The following are the overview of natural condition in this area.

The Project Area is situated in the coast of the Ayeyawady Delta where due to severe natural condition only limited people are inclined to reside and develop their farming for a long time. The principle of such severe natural condition is the lowland polder area, where people reside and agriculture is practiced, as it is surrounded with saline river water due to sea water penetration up to 40 to 80 km upstream of the rivers from the coastline. In fact, it is observed that at the Labutta North Polder, situated 30 km inland from the coastline, the river water levels are much higher than the farmland level during high tide. From this, it is understood that polder dikes which separate farmland from the river shall be the key to the preservation of the farmland. Heavy rainfall is another critical natural factor that the delta area is receiving annually with a rainfall of more than 3,000 mm during the monsoon season. It causes floods and inundation to farmland, seriously damaging monsoon paddy and other crops.

However, the greater risk for the people in this area will be generated by a big cyclone like that of Cyclone Nargis that actually occurred in May 2008. It claimed 140,000 lives and damaged polder dikes causing saline water intrusion to farmlands damaging crops.

In the Project Area, therefore, it is primarily necessary to rehabilitate polder dikes, embankments, sluices and mangrove windbreak to prevent damages to farmland through river water overtopping and salt water intrusion and to preserve farming area.

On the other hand, since agriculture is the most basic industry in the polder area as well as the most important income source for the residents, there are several urgent issues that has to be solved including low productivity of rice that was observed clearly after Nargis damage, lack of farm inputs such as fertilizer and seed in both quantity and quality, and insufficient agricultural extension services by government. For the issue particularly on rice seed as a farm input, improvement has not been observed due to interaction between poor cropping technique by farmers and lack of government support. In such circumstances, it is strongly required to work in cooperation between government extension services to be strengthened and farmer level self-improvement in farm inputs and cropping technique to be improved in order to restore and increase agricultural production.

From the above, it can be stated that urgent development for the preservation of farming area and agricultural rehabilitation in the Project Area shall focused on the establishment of firm agricultural infrastructure against severe natural condition as well as on the restoration and increase of agricultural production. Basic policy for the preservation of farming area in the Project shall be set as follows:

1) To preserve farming area through establishment of safe and stable infrastructure: This is essential and urgent for the preservation of farming area in the polders that were seriously damaged by Cyclone Nargis. Farmland in the Project Area can be preserved through physical rehabilitation of related infrastructure particularly polder dikes and sluices as key facility. In addition to that, rehabilitation of mangrove trees, which function as windbreak for the protection of dikes and embankment from erosion caused by tidal surge, are also included as important facility.
2) To restore and increase agricultural production and reconstruct rural life at preserved farming area: Agriculture is the most important subject in this agro-based rural area to rehabilitate and develop and its development shall focus on the improvement of farm management for rice cropping and agriculture-related activities. As to farm improvement, focus is given to the improvement of farm inputs on rice cropping and strengthening of MAS extension services. For agriculture-related activity, on the other hand, income generation plan with focus on vegetables and livestock by landless people shall be formulated in the D/P.

5.1.2 Basic Concept for Formulation of Development Plan on Preservation of Farming Area

According to the discussion made above, development subject is set as; 1) rehabilitation of polder dike and sluices as well as mangrove windbreak trees to preserve farmland inside the polder, and 2) improvement of farm management and income generation as agriculture-related field to increase agricultural production. Based on this, basic concept and framework of the D/P are discussed below;

a) As to agricultural and rural infrastructure, polder dikes and sluices shall be the major targets for urgent rehabilitation according to the survey on Nargis damage. In the design of dike, embankment height as the most important factor in view of disaster prevention shall be determined through appropriate meteorological and hydrological analysis. Mangrove trees naturally seen along the polder dike have functioned as very effective windbreak to reduce tidal surge and storms for the protection of polder dikes. At the time of Nargis, many mangrove trees were destroyed and therefore it is vital and urgent to replant for future.

b) Agriculture and agriculture-related fields to be promoted in the D/P will be two subjects, namely farm management, and income generation. Farm management is the most essential to increase agricultural production particularly rice in the Project Area, which was seriously damaged by Nargis. It is urgent and high necessity to strengthen the quality rice seed production by farmers and MAS extension capacity and services. On the other hand, income generation shall target the activities on vegetables cultivation and livestock at very small scale. Beneficiaries are the landless households who are residing in the rural village as majority of residents in the Ayeyawady Delta.

c) Implementation period of the D/P will be set based on the project size and volume to be formulated on component basis. Consideration will also be made on the degree of urgency for

disaster prevention, implementation capacity and financial availability of the implementing body.

d) Target area for the D/P will be 34 polders in Ayeyawady Region as stipulated in the Scope of Work (S/W) for the Project.

e) Implementing body will be determined on the project basis. Basically, the project for the rehabilitation of polder dikes will be done by ID, mangrove windbreak by local government together with villager beneficiaries, the improvement of farm management by MAS together with rice farmers, and income generation by local government and landless households together with line-departments (MAS, LBVD) depending on subjects.

f) Implementation method and process will also be determined on the project basis. Study and discussion will be made among the stakeholders concerned. There will be variations and alternatives in both implementation method and process to be employed, such as hiring of contractors for rehabilitation work, force account work by government agencies, extension services by government, and so on. Participatory approach and work sharing arrangement with farmer / villager beneficiaries may be employed in the implementation process. Such contents shall be demonstrated and evaluated in the pilot projects.

g) Procurement of project budget will be made by the government especially for the public infrastructure project for farming area preservation and disaster prevention such as rehabilitation of polder dikes, sluices and mangrove trees. On the other hand, projects such as rice seed production project under the farm management improvement and income generation project, from which individual farmers or landless people will directly benefit, will be planned in view of work sharing or cost sharing under self-help concept.

5.2 Scope of Development Plan

5.2.1 Components of Development Plan

This D/P is a basic proposal composed of various planning, technical and procedural guidelines for the preservation of farming area for urgent rehabilitation of agricultural production and rural life in the areas affected by Cyclone Nargis. Target areas of the D/P are 34 existing polders and embankments in Ayeyawady Region that need urgent rehabilitation and improvement in the following fields:

(1) Agricultural and rural infrastructure, which includes rehabilitation of polder dikes and sluice gates for urgent preservation of farming area,

(2) Farm management, which includes strengthening of extension services and production of rice quality seed for urgent restoration and increase of agricultural production,

(3) Income generation, which includes support of small business for income generation for urgent rehabilitation of rural life, and

(4) Mangrove windbreak trees, which include rehabilitation / replanting of mangrove trees along polder dike to protect for urgent preservation of farming area.

5.2.2 Target Polders on Development Plan

Target area of the D/P is 34 polders, which are scattered in Ayeyawady Region in the Ayeyawady Delta as listed in **Table 5.2-1**. It has a total population of about 248,000 (year 2010 estimate), a total protected area of 1,342 km^2 (134,200 ha) and a total dike length of about 940 km.

Table 5.2-1 List of 34 Polders for Development Plan

Township	Sr. No.	Name of polder	Population	Protected area (km^2)	Length of dike (km)
Labutta	1	Alegyun (1) polder	3,947	16.7	21.6
	2	Alegyun (2) polder	6,139	36.1	36.5
	3	Alegyun (3) polder	2,967	36.5	28.4
	4	Magybinmadaukkan	1,601	5.5	5.5
	5	Thingangyi	474	7.0	10.1
	6	Zinywe	633	6.2	9.7
	7	Leikkwin	392	3.8	6.0
	8	Labutta (South)	4,166	28.7	32.5
	9	Labutta (North)	15,547	78.3	61.2
	10	U Gaungpu	205	3.7	8.4
	11	Bitud Island (1)	1,191	19.0	22.6
	12	Bitud Island (2)	7,315	27.8	29.9
	13	Bitud Island (3)	3,743	32.2	45.1
	14	Bitud Island (4)	14,169	76.4	65.3
		Sub-total	**62,489**	**377.8**	**382.8**
Bogalay	15	Daunggyi	15,935	98.9	59.6
	16	Daunggyi (East)	8,433	89.3	54.6
	17	Daunggyi (West)	12,921	69.4	50.9
	18	Daunggyi (Upper)	4,066	13.8	16.9
		Sub-total	**41,355**	**271.4**	**182.0**
Phyapon	19	Daw Nyein polder	5,850	12.0	22.5
	20	Myokone polder	4,019	22.8	27.4
	21	Kyetphamwezaung	25,687	125.7	74.1
	22	Banbwezu	9,604	53.3	41.9
	23	Daydalu	4,072	17.2	20.9
	24	Letpanbin	4,195	34.6	32.2
	25	Zinbaung	3,992	26.7	24.2
		Sub-total	**57,419**	**292.3**	**243.2**
Daydaye	26	Myaseinkan	9,866	54.7	21.7
	27	Thandi	1,651	13.9	6.8
	28	Suclubbaluma	4,935	29.5	11.9
	29	Hleseikchaunggyi	2,026	9.1	11.9
	30	Tamatakaw	10,459	53.5	11.3
	31	Kyonsoat	316	2.4	8.1
		Sub-total	**29,253**	**163.0**	**71.7**
Kyaiklatt	32	Maubin Island (North)	27,386	110.0	20.0
	33	Maubin Island (South)	9,248	46.1	7.1
	34	Thonegwakyun	20,851	81.2	35.8
		Sub-total	**57,485**	**237.3**	**62.9**
		Total	**248,001**	**1,341.7**	**942.6**

Source: ID, TPDC, JICA Project Team

5.3 Rehabilitation Plan on Agricultural and Rural Infrastructure

5.3.1 Basic Concept of Rehabilitation of Agricultural and Rural Infrastructure

Basic concept for the rehabilitation of agriculture and rural infrastructure is set based on the result of the pilot project as follows:

- In the rehabilitation of dike embankment, the construction method of "soil improvement by natural drying up and dozer compaction" will be employed as it is evaluated most economical and viable in construction. In addition, manual embankment method will be considered at the place adjacent to houses and structures.
- In rehabilitation of sluice, rehabilitation method will either be repair or replacement and will be determined based on the result of gate function evaluation survey in consideration of low cost rehabilitation. For the gate material on new fabrication, stainless steel will be used in consideration of service life.
- To improve drainage condition of protected farmland, side-borrow area along the dike for embankment will be effectively utilized. Moreover, it will take into consideration utilization for ponds for possible drinking water.

5.3.2 Project Contents and Volume

The Project Area is 34 polders in Ayeyawady Region and project contents are determined as follows;

- To reconstruct dike embankment with required crest levels for safety.
- To rehabilitate sluices with required functions as flap or slide gates.

Table 5.3-1 gives project volume for the rehabilitation of dike and sluice under the D/P.

Table 5.3-1 Project Volume for Rehabilitation of Dike and Sluice

Component of Project	Project Volume	Remarks
1 Dike embankment (sud/m3)	3,381,022 sud / 9,568,292 m3	30 polders excluding 4 polders (No. 3,4,9,26) for dike length of 825 km, (see Table 5.3-4)
2 Rehabilitation of sluices	77 sluices	20 polders (see Table 5.3-7)
2-1 Flap gate (nos.)	332 (67 to replace & 265 to repair)	
2-2 Slide gate (nos.)	339 (159 to replace & 180 to repair)	
Total of gates	671 (226 to replace & 445 to repair)	

5.3.3 Results of Hydrology Analysis

Hydrological study was made in order to determine the high water levels for embankment design. Defining that the high tide level at the delta coastline is the sum of the highest normal tide in May, when the majority of severe cyclone occurred in the past, and the probable storm surge residual of 50 year recurrence, astronomical tides are collected from two stations, Diamond Island situated 10 km off the entrance of the Bassein River and Elephant Point located at the mouth of the Yangon River. There exist 12 ocean outfalls along the delta coast between the entrances of the Bassein and Yangon Rivers, and high tide levels are estimated at each outfall in accordance with pattern of the amplitudes of the major four tidal constituents, namely O_1, K_1, M_2 and S_2, which are available from existing document.

Flood water levels along the river systems upstream-ward were then estimated, starting from the given magnitude of tidal water levels (astronomical tide + surge amplitude) at the river mouths, employing the hydraulically simulated pattern of river water stages during the severe flood that actually occurred in 1974 and evaluated as once in 100 years event. High water levels estimated at river mouths and along the river systems were plotted on a plane map. Iso-lines of high water levels thus generated are shown in **Figure 5.3-1**. It is noted here that a freeboard is to be considered to determine the design crest elevation of embankment.

Details are given in **Appendix 3** of this report.

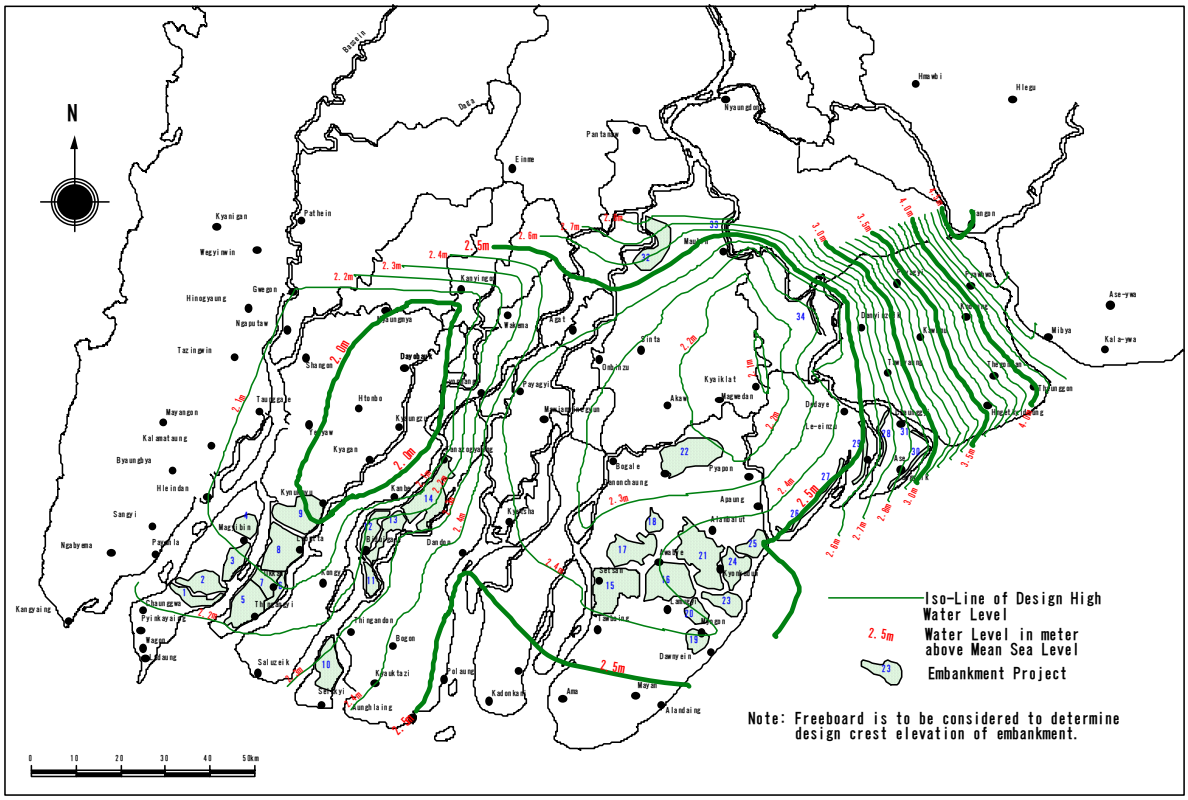


Figure 5.3-1 Iso-lines of Design High Water Level

5.3.4 Design and Construction Plan

(1) Typical Cross Section of Dikes

Definition for determination of the design crest level (hereinafter called as A.C.L) is provided in two ways separately for river dike and coastal dike, where extra height is added to the high water level, as a freeboard, in the following equation.

- Case 1 (for river dike): A.C.L = H.W.L + Freeboard (0.6m to 2.0m)
- Case 2 (for coastal dike): A.C.L = H.W.L + Design wave height + Freeboard (0 to 1.0m)

Here, the freeboard for the above case 1 is taken at 1.2 m (4.0 ft) in accordance with the Japanese Standard as shown in **Table 5.3-2**, and after considering that discharges of the external rivers of embankments, which are distributaries of the Ayeyawady River, would be between 2,000 and 5,000 m^3/sec during a severe flood of return period of 50 years or more.

Table 5.3-2 Relation between Design Flood Discharge and Freeboard

Design flood discharge	Freeboard (H)
Q < 200 m^3/s	H=0.6 m (2.0 ft)
200 < Q < 500 m^3/s	H=0.8 m (2.6 ft)
500 < Q < 2,000 m^3/s	H=1.0 m (3.3 ft)
2,000 < Q < 5,000 m^3/s	H=1.2 m (4.0 ft)
5,000 < Q < 10,000 m^3/s	H=1.5 m (5.0 ft)
10,000 m^3/s < Q	H=2.0 m (6.6 ft)

Design wave height for case 2 is also taken at 1.2 m (4.0 ft) as explained in **Figures 5.3-2 to 5.3-4**.

Actual height of wave is considered to decrease obstruction by coastal plants (mangrove and others), so that additional freeboard (0 to 1.0 m) is not adapted for the case 2.

In accordance with the results obtained above, extra height (freeboard) to be added to H.W.L is 1.2 m (4.0 ft) for all river and coastal dikes.

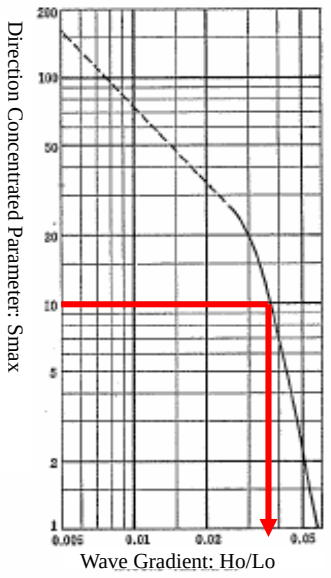


Figure 5.3-2 Wave Gradient Carve

- Ho/Lo=0.035 (refer to Fig-1), assumed
  Smax=10 (in case of winding wave)
- Cot α =1.5 (refer to Fig-2)
- R/Ho=1.3 (by Fig-3, Ho/Lo=0.035, Cot α =1.5)
- Lo=(gT^2)/2 π =(9.8*4.0^2)/(2*3.14)=25
  g: acceleration of gravity =9.8
  T: wave cycle =4.0
  (mean value of 0 to 8 in case of winding wave)
- Ho/Lo=0.035, Lo=0.035Lo=0.035*25=0.88
  R/Ho=1.3, R=1.3Ho=1.3*0.88=1.14=1.2m

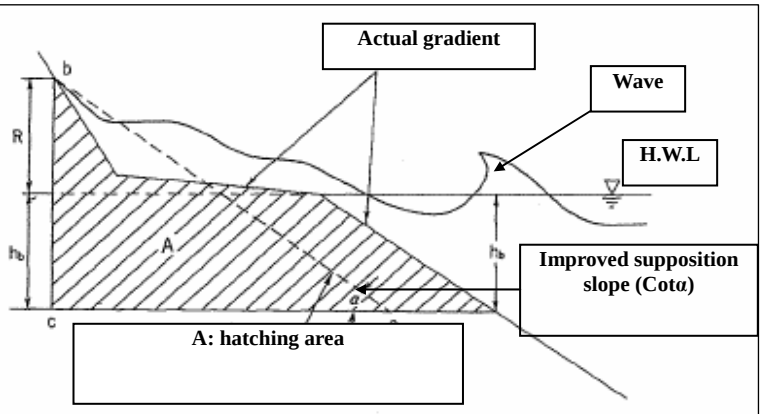


Figure 5.3-3 Improved Supposition Slope

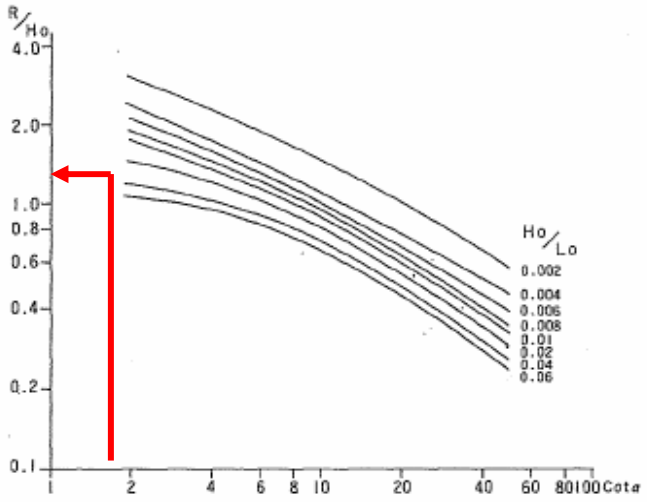


Figure 5.3-4 Improved Supposition Slope and Wave Run-up Height Ratio

In addition, slope gradient of 1:1.5 is adopted because of the following reasons.

- The height of dike is not more than 2-3 m (7-10 ft) from the ground elevation on the, so that the risk of slope sliding would be extremely low.
- It is observed that mangrove trees would protect dike embankment at river side.
- As the side slope becomes gentler, loss of paddy field becomes larger.
- Gentle slope would require more construction cost.

Furthermore, the crest width of embankment is adopted at 3.6m (12 ft) in consideration of the traffic conditions in the future, as presently designed by ID.

Typical cross section and crest level of polder dikes are shown in **Figure 5.3-5.**

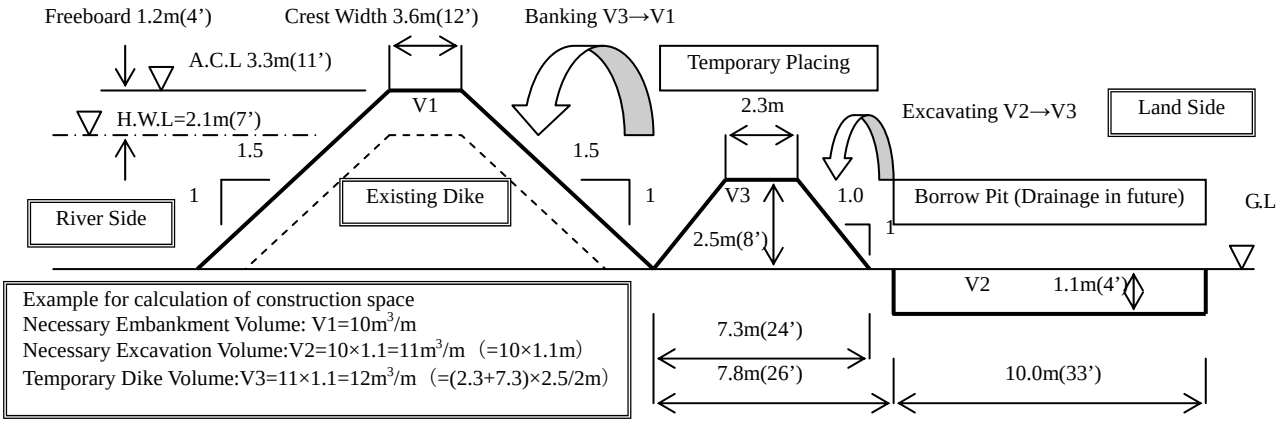


Figure 5.3-5 Proposed Typical Cross Section of Dike Embankment

In addition, as shown in the following table, there is different height by 0.0 to 4.0 ft between JPT design ACL and ID design ACL. In addition, reconstruction works of some polder dikes have been already completed by ID. Therefore, it shall consider the other method of additional embankment for raising completed polder dike.

Table 5.3-3 Differences of Design Crest Level and Progress of ID Rehabilitation by Polder

Township	No.	Name of Polder Dike	Dike Length (mile)	Paddy I&II Original CL (ft) (1)	Average Existing ECL (ft) (2)	JPT Design ACL (ft) (3))	ID Design ACL (ft) (4)	Difference ACL height of JPT & ID (ft) (5)=((3)-(4)	Progress (up to end of March 2011)
Labutta	1	Alegyun (1)	13.40	13.5	11.8	13.5	13.5	0	0%
	2	Alegyun (2)	22.70	13.5	10.8	14.0	14.0	0	0%
	3	Alegyum (3)	17.65	13.5	11.4	14.0	14.0	0	100% Completed
	4	Magyibinmadaukan	3.40	13.5	10.5	14.0	14.0	0	100% Completed
	5	Thingangyi	6.30	8.5	3.6	11.5	10.0	1.5	68%
	6	Zinywe	6.00	8.5	5.6	11.5	8.5	3.0	100% Completed
	7	Leikkwin	3.75	8.5	4.8	11.5	8.5	3.0	0%
	8	Labutta (S)	20.20	12.0	5.2	11.0	10.0	1.0	0%
	9	Labutta (N)	38.00	12.0	6.9	11.0	10.0	1.0	High priority only
	10	U Gaungpu	5.20	8.5	1.8	12.0	8.5	3.5	0%
	11	Bitud Island (1)	14.02	10.0	5.5	12.0	10.0	2.0	23%
	12	Bitud Island (2)	18.60	10.0	6.3	12.0	10.0	2.0	7%
	13	Bitud Island (3)	28.00	10.0	4.5	12.0	10.0	2.0	54%
	14	Bitud Island (4)	40.53	10.0	6.8	12.0	10.0	2.0	100% Completed
Bogalay	15	Daunggyi	37.00	7.5	8.0	12.0	8.5	3.5	17%
	16	Daunggyi (East)	33.90	7.5	6.4	12.5	8.5	4.0	368%
	17	Daunggyi (West)	31.60	7.5	6.8	12.0	11.0	1.0	100% Completed
	18	Daunggyi (Upper)	10.50	7.5	6.5	12.0	8.5	3.5	0%
Phyapon	19	Dawnyein	14.00	8.5	6.9	12.5	8.5	4.0	100% Completed
	20	Myokone	17.00	8.5	6.8	12.5	8.5	4.0	100% Completed
	21	Kyetphamwezaung	46.00	8.5	5.7	12.5	9.0	3.5	6%

	22	Banbwezu	26.00	8.5	7.8	12.0	8.5	3.5	0%
	23	Daydalu	13.00	9.0	5.9	12.5	9.0	3.5	100% Completed
	24	Letpanbin	20.00	8.5	7.9	12.5	8.5	4.0	100% Completed
	25	Zinbaung	15.00	8.5	7.8	12.5	8.5	4.0	18%
Daydaye	26	Myaseinkan	13.50	13.0	8.3	13.0	13.0	0	72%
	27	Thandi	4.25	13.0	8.5	13.0	12.0	1.0	100% Completed
	28	Suclubbaluma	7.40	9.0	10.7	13.0	11.0	2.0	100% Completed
	29	Hleseikchaunggyi	7.40	9.5	11.0	13.0	11.0	2.0	0%
	30	Tamatakaw	7.00	12.0	12.7	14.0	12.0	2.0	100% Completed
	31	Kyonsoat	5.00	12.0	11.3	14.0	13.0	1.0	100% Completed
Kyaiklatt	32	Maubin Island (N)	12.40	10.0	8.5	13.5	10.0	3.5	0%
	33	Maubin Island (S)	4.40	10.0	9.3	12.0	10.0	2.0	0%
	34	Thonegwakyun	22.25	12.0	10.3	13.5	12.0	1.5	0%

Note: Average ECL is based on longitudinal survey data by ID and JPT means JICA Project Team and progress is informed by ID.

When deciding the additional embankment method, it shall be important to take the following matters into consideration.

- To reduce the quantity of additional embankment volume by considering budget of project.
- To reduce the borrow pit area so as not to reduce the farming land of farmers.
- To undertake actual and suitable method for the construction and site conditions.

The following two (2) methods shall be proposed according to the raising height value.

Case-1 (raising height is more than 2.0 ft)

In this case, it is considered to overlay on the present completed embankment to achieve good contact between old embankment and new one.

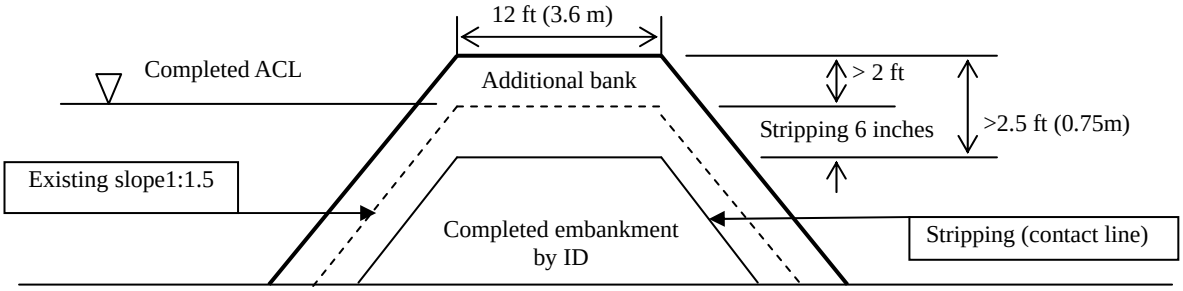


Figure 5.3-6 Additional Embankment Method (Case-1)

Case-2 (raising height is less than 2.0 ft)

In this case, it shall add e embankment at crest portion only according to the following reasons.

- Overlay is within 2 layers (maximum thickness of layer is 1.25 ft), so that the spreading and compacting works will not be so difficult on the existing crest.
- Filling soil is clayey, so stability of shoulder slope on additional embankment is secured due to keeping slope gradient gentler than 1:0.3.

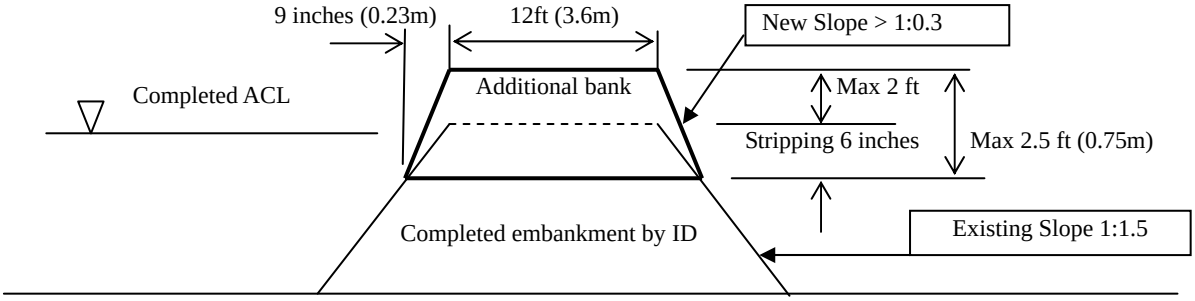


Figure 5.3-7 Additional Embankment Method (Case-2)

Moreover, according to the location of existing borrow pit it shall be necessary to consider whether the river side or land side will be expanded (**Figure 5.3-8 and 5.3-9**).

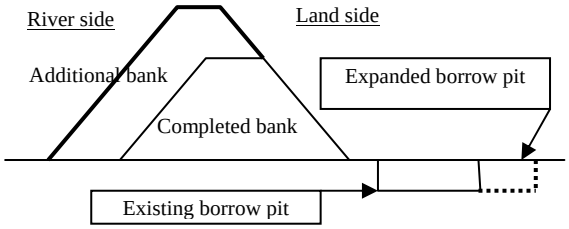


Figure 5.3-8 Case of Bank Expansion to River Side

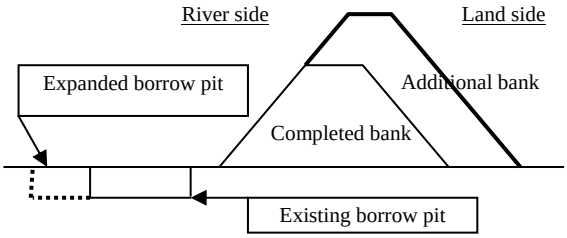


Figure 5.3-9 Case of Bank Expansion to Land Side

In accordance with design mentioned above, necessary embankment volume for rehabilitation is calculated based on 3 items: “remained volume for ID design”, “increased Volume for ID design” and “additional volume for completed works by ID” and results is shown in **Table 5.3-4.**

Table 5.3-4 Embankment Volume Required for 34 Polders on Development Plan

Township	No.	Name of Polder Dike	JPT Revised Design ACL (ft)	ID Original Design ACL (ft)	Difference ACL between JPT&ID (ft)	ID Design Volume (Sud)	Progress for ID Design Volume (%)	Remained Volume for ID design (Sud)	Increased Volume (Sud)	Additional Volume (Sud)
Labutta	1	Alegyun (1)	13.5	13.5	0.0	41,100	0	41,100	-	-
	2	Alegyun (2)	14.0	14.0	0.0	128,446	0	128,446	-	-
	3	Alegyun (3)	14.0	14.0	0.0	94,606	100	0	-	-
	4	Magyibinmadaukan	14.0	14.0	0.0	20,745	100	0	-	-
	5	Thingangyi	11.5	10.0	1.5	70,198	68	22,463	22,983	-
	6	Zinywe	11.5	8.5	3.0	37,132	100	0	-	40,998
	7	Leikkwin	11.5	8.5	3.0	25,743	0	25,743	20,194	-
	8	Labutta (S)	11.0	10.0	1.0	154,128	0	154,128	40,108	-
	9	Labutta (N)	11.0	10.0	1.0	186,518	86	25,518	48,482	
	10	U Gaungpu	12.0	8.5	3.5	61,854	0	61,854	45,718	-
	11	Bitud Island (1)	12.0	10.0	2.0	97,417	23	75,011	66,034	-
	12	Bitud Island (2)	12.0	10.0	2.0	103,586	7	96,335	75,767	-
	13	Bitud Island (3)	12.0	10.0	2.0	247,500	54	113,850	144,295	-
	14	Bitud Island (4)	12.0	10.0	2.0	224,103	100	0	-	68,223
Bogalay	15	Daunggyi	12.0	8.5	3.5	35,692	17	29,624	151,047	-
	16	Daunggyi (East)	12.5	8.5	4.0	125,000	36	80,000	246,292	-
	17	Daunggyi (West)	12.0	11.0	1.0	226,630	100	0	-	32,961
	18	Daunggyi (Upper)	12.0	8.5	3.5	41,156	0	41,156	65,917	-
Phyapon	19	Dawnyein	12.5	8.5	4.0	36,343	100	0	-	100,513
	20	Myokone	12.5	8.5	4.0	59,286	100	0	-	130,915
	21	Kyetphamwezaun	12.5	9.0	3.5	190,200	6	178,788	290,580	-
	22	Banbwezu	12.0	8.5	3.5	45,114	0	45,114	145,188	-
	23	Daydalu	12.5	9.0	3.5	61,943	100	0	-	92,932
	24	Lepanbin	12.5	8.5	4.0	35,400	100	0	-	138,356
	25	Zinbaung	12.5	8.5	4.0	22,800	18	18,696	96,433	-
Daydaye	26	Myaseinkan	13.0	13.0	0.0	134,274	72	37,597	-	-
	27	Thandi	13.0	12.0	1.0	16,931	100	0	-	4,151
	28	Suclubbaluma	13.0	11.0	2.0	5,944	100	0	-	11,654
	29	Hleseikchaunggyi	13.0	11.0	2.0	5,885	0	5,885	15,377	-
	30	Tamatakaw	14.0	12.0	2.0	3,902	100	0	-	8,021
	31	Kyonsoat	14.0	13.0	1.0	14,950	100	0	-	4,457
Kyaiklatt	32	Maubin Island (N)	13.5	10.0	3.5	12,060	0	12,060	50,940	-
	33	Maubin Island (S)	12.0	10.0	2.0	660	0	660	7,865	-
	34	Thonegwakyun	13.5	12.0	1.5	70,450	0	70,450	61,739	-
Total						2,637,696	52	1,264,479	1,594,959	633,181
Grand Total for remained, increased and additional embankment works								3,492,619 (9,884,112 m3)		
Grand Total except for No.3, 4, 9. 26 Polder								3,381,022 (9,568,292 m3)		

Note: 1. JPT means JICA Project Team and progress is informed by ID as of end of March 2011.

2. Increased Volume means necessary quantity added to ID design volume based on JPT design ACL.

3. Additional Volume means raising quantity for completed (nearly 100%) embankment.

(2) Rehabilitation Method for Sluice Gate

Rehabilitation method for all sluice gates will consider the following aspects:

- Leakage from each gate is observed in greater or less degree.
- Majority of gate hoists are devastated by the cyclone Nargis and gates are hardly operable.
- Installation of facilities has been undertaken 30 years ago, hence, most of these facilities are already old, dilapidated and non-functional.

Based on the functionality survey of 34 polder dikes, the extent of rehabilitation facilities were evaluated and categorized and divided into 3 kinds of rank "for replacement (new manufacture)", "for repair (overhaul in workshop)" and "non-repair". Results are shown in **Table 5.3-7** (Refer to **Appendix 6-3**).

Presented below is the evaluation method and criteria used for the rehabilitation of the sluice gate.

Table 5.3-5 Point Distribution in Function Evaluation Survey for Sluice Gate

Items / Member	Corrosion			Damage			Function		
	Good	Medium	Bad	Good	Medium	Bad	Good	Medium	Bad
Gate leaf	1	2	3	1	2	3	1	2	3
Gate frame	1	2	3	1	2	3	—	—	—
Hoist	1	2	3	1	2	3	1	2	3

Table 5.3.-6 Selection Criteria of Rehabilitation Method for Sluice Gate

Method	Member of Gate	Total Points	Evaluation Item and Example Point			Remarks (Items*Point)
			Corrosion	Damage	Function	
Replace (by new one)	Leaf & Hoist	More than equal 7	> 2	> 2	> 3	> 2i *2p+1i*3p
	Guide frame	More than equal 5	> 3	> 2	-	> 1i*2p+1i*3p
Repair	Leaf & Hoist	Between 6 and 5	2	2	2	3i*2p or 2i*2p+1i*1p
	Guide frame	4	2	2	-	2i*2p
Non Repair	Leaf & Hoist	Less than equal 4	< 2	1	1	< 2i*1p+2i*1p
	Guide frame	Less than equal 3	< 2	1	-	< 1i*2p+1i*1p

In addition, stainless steel is proposed to be used for the replacement of gates based on the pilot project study.

Table 5.3-7 Summary of Rehabilitation Plan for Sluice Gate at 34 Polders

Township	No.	Name of Polder	Nos. of Sluice	Flap Gate				Slide Gate			
				Nos.	Replace	Repair	Non-repair	Nos.	Replace	Repair	Non-repair
Labutta	1	Alegyun (1)	3	11	3	8		11	4	7	
	2	Alegyun (2)	4	22		22		22	13	9	
	3	Alegyun (3)	4	18		13	5	18	9	9	
	4	Magyibinmadaukan	Non								
	5	Thingangyi	Non								
	6	Zinywe	Non								
	7	Leikkwin	1	2	2						
	8	Labutta(South)	3	17		17		17		14	3
	9	Labutta(North)	9	48	6	28	14	48	34		14
	10	U Gaungpu	Non								
	11	Bitud Island (1)	2	(10)	Completed to repair			(10)	Completed to repair		
	12	Bitud Island (2)	4	35		35		19		19	
	13	Bitud Island (3)	4	16	7	9		7	7		
	14	Bitud Island (4)	6	32	7	25		16	7	9	
	Sub-Total		**40**	**201**	**25**	**157**	**19**	**158**	**74**	**67**	**17**
	Sub-Total (Except Labutta-N)		**31**	**153**	**19**	**129**	**5**	**110**	**40**	**67**	**3**
Bogalay	15	Daunggyi	6	44		5	39	44	14	30	
	16	Daunggyi(East)	3	41	12	29		25	25		
	17	Daunggyi(West)	4	20		8	12	20		20	
	18	Daunggyi(Upper)	1	5			5	5		5	
	Sub-Total		**14**	**110**	**12**	**42**	**56**	**94**	**39**	**55**	**0**
Phyapon	19	Dawnyein	1	8			8	8	4	4	
	20	Myokone	2	10			10	10	4		6
	21	Kyetphamwezaung	7	57	15	27	15	57	36	6	15
	22	Banbwezu	7	35		33	2	26	26		
	23	Daydalu	1	7		7		7	2	5	
	24	Letpanbin	4	22			22	22	5		17
	25	Zinbaung	4	17		17		17	3	14	
	Sub-Total		**26**	**156**	**15**	**84**	**57**	**147**	**80**	**29**	**38**
Dadeye	26	Myaseinkan	Non								
	27	Thandi	Non								
	28	Suclubbaluma	Non								
	29	Hleseikchaunggyi	Non								
	30	Tamatakaw	Non								
	31	Kyonsoat	Non								
	Sub-Total		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Kyaiklat	32	Maubin Island (north)	Non								
	33	Maubin Island (Southh)	(3)	(3)	Under repairing						
	34	Thonegwakyun	6	33	21	10	2	29		29	
	Sub-Total		**6**	**33**	**21**	**10**	**2**	**29**	**0**	**29**	**0**
Grand Total			**86**	**500**	**73**	**293**	**134**	**428**	**193**	**180**	**55**
Grand Total (Except Labutta North)			**77**	**452**	**67**	**265**	**120**	**380**	**159**	**180**	**41**

Note: No.11(Bitud-1) has already completed repairing assisted by CDN, so those nos. is not counted in this lis

(3) Construction Plan

In order to secure necessary quantity of the soil for embankment construction, the borrow pit at the paddy field adjacent to the existing polder dike needs the size of about 10 m (33 ft) wide multiplied by 1.2 m (4.0 ft) depth. In addition, the space of stock yard to place temporary embankment materials for improvement of moisture content by means of natural drying needs about 10 m (33 ft) in width. However, each width shall be decided by exact calculation from necessary embankment volume on each polder condition. Moreover, Location of borrow pit shall be selected in land side or river side based on the site condition.

Dry work on the installation of gate shall be made possible by dewatering and coffer dam on both

outside of flap and slide gate. Therefore, it is very important to decide the height of coffer dam in consideration of expected high tide during construction period.

Construction of embankment is made with special emphasis on quality control of the soil material, especially, controlling the compaction density of the soil to keep the target density by D-value 90% and lower limited density by D-value 85%, according to the standards for ordinary embankment work of roads and small dams in Japan.

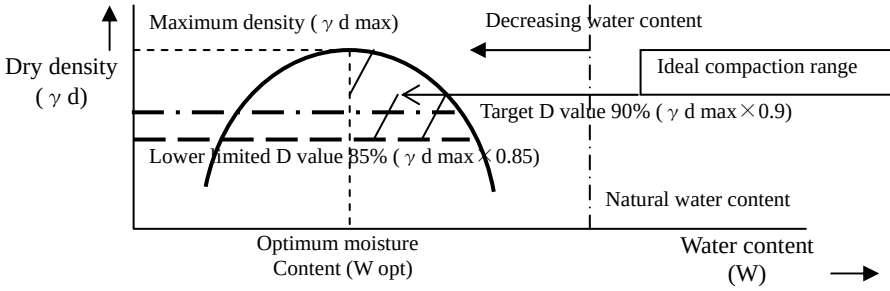


Figure 5.3-10 Concepts for Management of Embankment

5.3.5 Implementation Method and Implementing Body

(1) Implementation Method of Project

The force account work is common practice in government public works. In 1990, construction by contract has become acceptable norm for construction, hence from thereon, many private contractor has begun to be established. Taking the above background into considering, the method to implement polder dike and sluice gate as well as concrete work shall be by contract with private construction and manufacture companies.

Furthermore, the Project shall establish a Project Management Unit (PMU) and the related section of ID shall contract with consultant and be in charge of design, procurement and supervision under the PMU.

However, at present time ID has many available heavy machines used to carry out force account work for big project such as dam construction. With this in mind, it may also be possible for ID to implement this project themselves.

(2) Related Organization and Role

1) Central Government (MOAI)

a) Department of Agricultural Planning (DAP)

DAP shall coordinate with concerned and related organizations and initiate discussion on concerned project.

b) Irrigation Department (ID)

ID shall be responsible for the actual management and supervision of the Project from design to project supervision.

c) Settlement and Land Records Department (SLRD)

SLPD shall provide necessary data and information on farming area and other necessary related information and data.

2) Local Government and Local Office of Central Government

d) District and Township General Administration Department

The department shall be responsible to disseminate and inform people on coming events or projects implemented by the government and conduct the necessary land acquisition for project.

e) Region Office and Township Office in ID Maintenance

They shall provide assistance necessary to conduct survey, study and construction for implementation of the project.

(3) Implementing Body

The proposed implementing body based on the contract work by private contractor shall be as follows;

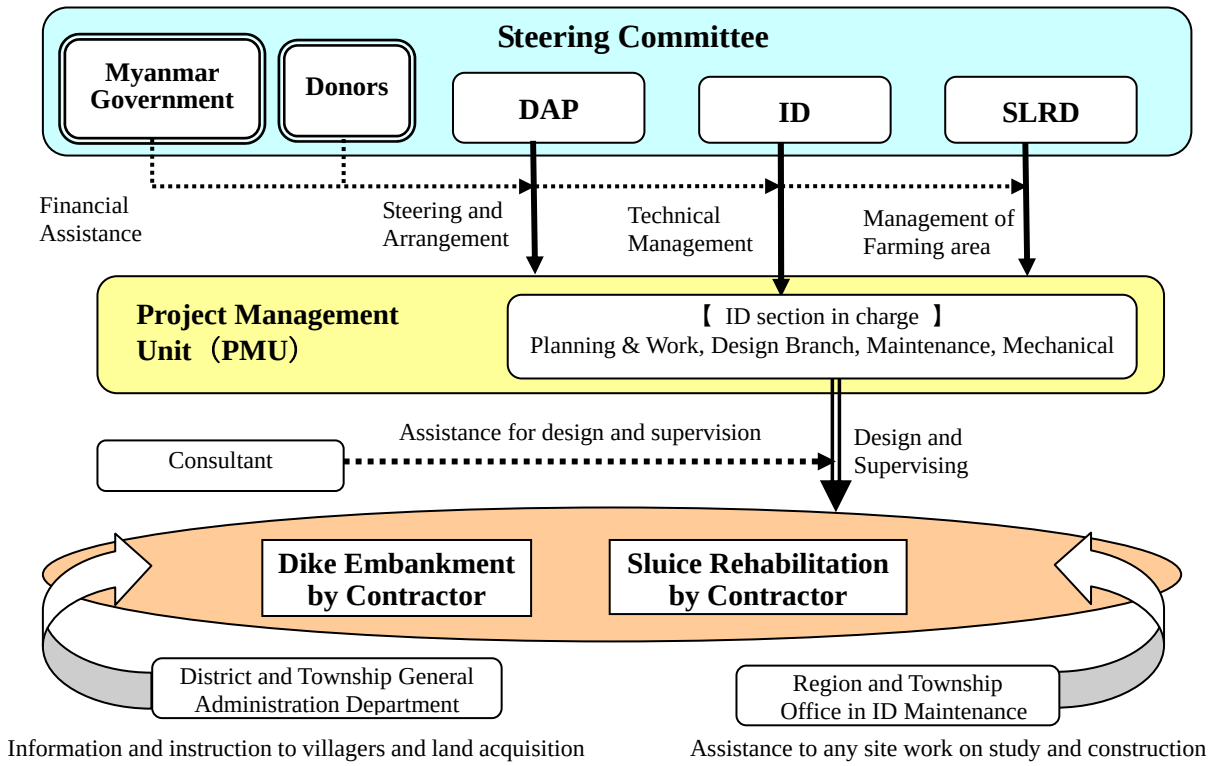


Figure 5.3-11 Implementation Structure for Rehabilitation of Polder Dike and Sluice

5.3.6 Operation and Maintenance

(1) Basic Policy for Maintenance

It is effective to formulate appropriate management and preventive maintenance measures for dike and sluice facilities by adopting the concept of stock management.

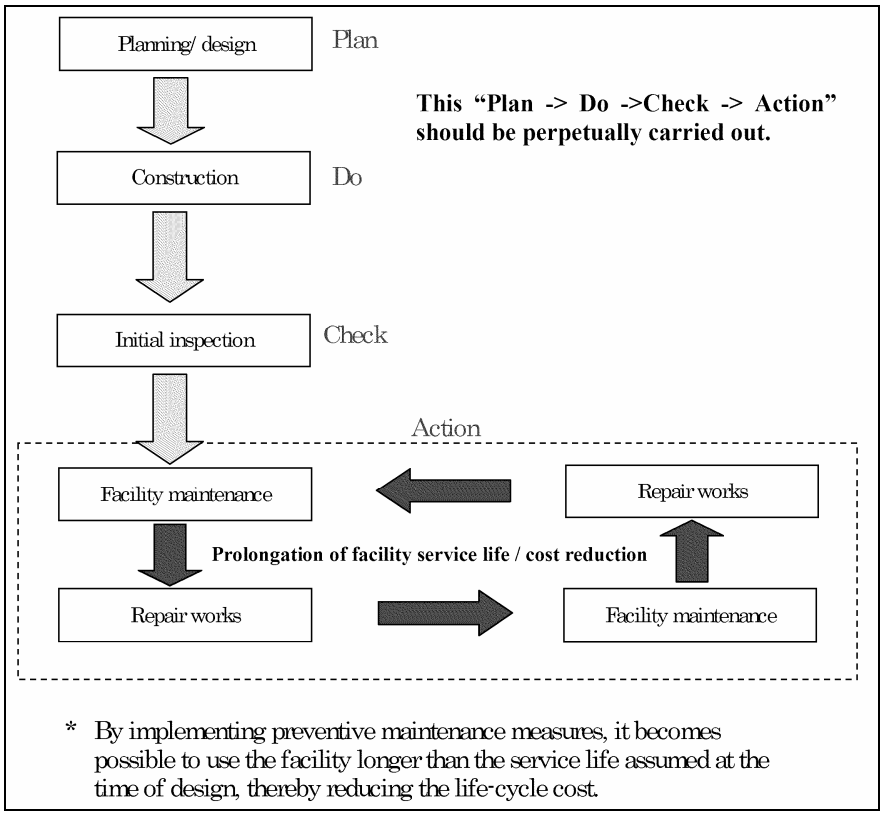


Figure 5.3-12 Concept of Preventive Maintenance Measures

Stock management refers to the technical system and management method for extending service life of facilities and for reducing the life-cycle cost, through preventive maintenance measures implemented based on facility function evaluation.

The life-cycle cost of facilities refers to the total of cost for their planning, design, construction, maintenance and scrapping. The purpose of stock management is to reduce the life-cycle cost and prolong the service life of facilities.

Moreover, judgment of shift from daily examination to function evaluation is very important in the scheme of preventive maintenance measures.

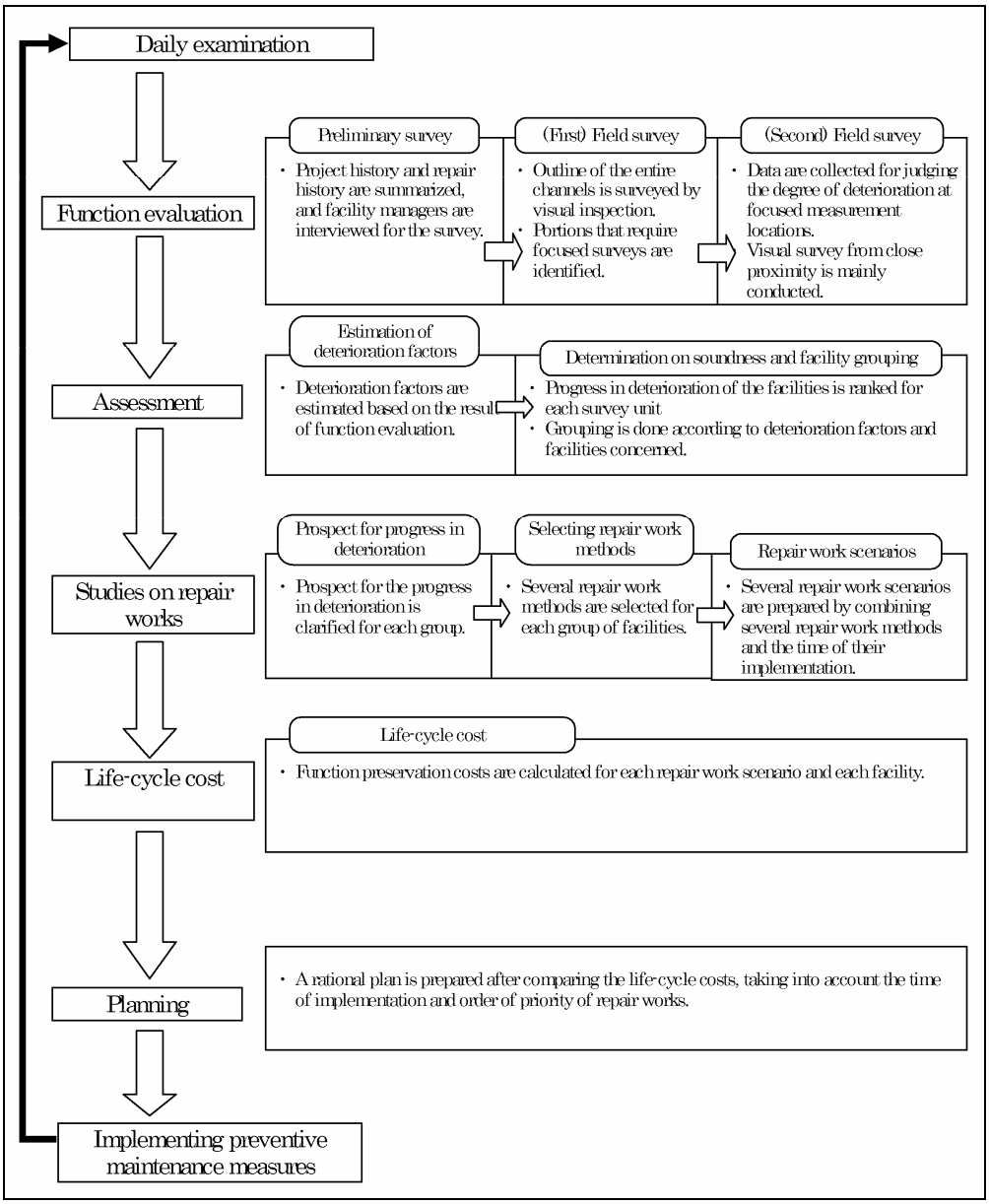


Figure 5.3-13 Scheme for Preventive Maintenance Measures

(2) Daily Examination

In order to maintain facilities in good conditions, it is indispensable to carry out appropriate evaluation and provide the necessary measures. In order to carry out appropriate evaluation, it is necessary to obtain information related to the facility safety, usage situation, and effects by a third party in addition to the information gained through daily inspections.

1) Variety of inspection on daily examination

a) Initial inspection

Initial inspections are performed to obtain the initial information on the facilities. The information obtained is used as the default values of facilities. Since the results of initial inspections provide the basic data for formulating maintenance plans, the survey items and methods should be selected so that

appropriate information can be obtained. Also, the obtained information needs to be managed appropriately.

b) Daily inspection

Daily inspections are simple visual inspection and other types of inspections performed daily by the facility administrator, within the scope that can be confirmed during a patrol, etc. The facilities need to be maintained in a good condition; the operation records, and the history of accidents, inspections and improvement work need to be organized and stored appropriately.

c) Routine inspection

Routine inspections are performed periodically from once every year to once every few years, in order to clarify the changes in conditions of facilities. The structure is surveyed in a broad range by visual inspection and utilizing measures instruments.

The reliability and safety of facilities can be ensured and their service lives can be prolonged, if patrolling and visual inspection of structures and surrounding conditions and on the facility operation are performed appropriately, along with minor improvement work within the scope of daily operation. For this reason, facility administrators need to carry out daily maintenance appropriately, so that the facility can be maintained in good conditions.

If facility administrators find any abnormality in the routine inspection, it should be reported immediately to higher-ranking officers of the organizations. The higher-ranking officers of the organizations will then perform function evaluation and proposed repair works needed based on the results of the evaluation.

d) Extra inspection

Extra inspections are performed when facilities are damaged by an earthquake, cyclone, or collision with vehicle or heavy equipment. In these cases, an extra inspection needs to be performed promptly.

e) Emergency inspection

When an accident occurs or severe deformation is found, even if no accident has occurred, in certain facilities, emergency inspection should be performed in similar facilities in order to confirm whether there is a possibility of occurrence of similar accidents or deformation. The inspections are performed utilizing appropriate methods to determine the causes of the accident and to confirm the presence of a similar deformation.

2) Survey items and contents on each facility

Survey items, necessary information, and survey method are formulated in the following table on each facility and inspection.

Table 5.3-8 Survey Items and Contents on Each Facility and Inspection

Facility	Inspection	Frequency	Survey Items	Information	Method	Survey Point
Common	Initial	First time	General conditions of facility	-Specifications, design standard -Design drawings -Construction work records -Maintenance records	-Document checking -Interviews	Each structure
			Usage condition of facility	-Usage conditions -Surrounding conditions	-Visual inspection -Interviews	
Dike	Daily	Every day	Abnormality and deformation in appearance	-Presence of big crack on crest -deformation on slope, presence of seepage	-Visual inspection -Hand measuring	Around all sluices
	Routine	Once a year				Every 10,000 ft of longitudinal

						section
Sluice (Structure)	Daly	Every day	Abnormality and deformation in appearance	-Presence of crack -Breakdown, separation -Presence of deformation -Presence of leakage from structure	-Visual inspection	All sluices
	Routine	Once a year				
Sluice (Gate)	Daily	Every day	Abnormality and deformation in appearance	-Presence of corrosion and breakdown -Presence of leakage from gate	-Visual inspection	All sluices
	Routine	Once a year	Operation conditions	-Conditions of hoist	-Manual checking	
Sluice (Surrounding)	Routine	Once a year	Sedimentation conditions	-Increase of sediment	-Reading gauge	All sluices
			Slope conditions	-Presence of erosion	-Visual inspection	

3) Methods of determination

The determination criteria need to be established if appropriate daily inspection is to be implemented. The determination criteria comprise the conditions of facility function, past accidents, history of repair works, conditions of surrounding environment and others.

The following three categories of determination criteria should be established, according to the facility conditions; A: no repair work needs to be provided; B: functional evaluation for determining whether repair or reinforcement measures are necessary; and C: prompt functional evaluation is necessary. The determination criteria for concrete structure are shown below as an example.

Table 5.3-9 Examples of Determination Criteria for Daily Inspection on Concrete Structure

Category	Description
A	There is no deformation or function degradation; or, if any, they are only minor ones, and emergency measures or a functional evaluation is not necessary.
B	Even though there is deformity and function degradation, no emergency measure is needed. However, functional evaluation needs to be performed to determine whether repair and/or reinforcement measures are necessary.
C	Significant deformity and function degradation is observed and facilities are judged to be unable to fully perform their functions. Therefore, a functional evaluation needs to be performed to determine whether fundamental measures are needed after providing emergency measures.

Locations identified to fall under Category C have to be kept under surveillance by implementing priority daily inspections until functional evaluation and emergency measures are provided and completed.

(3) Functional Evaluation

The objectives of functional evaluation are to clarify the degree of deterioration of facilities as quantitatively as possible and to identify the deterioration factors. In view of efficiency, functional evaluation is performed in the following procedures.

1) Preliminary survey by collecting document and interviewing facility administrators.
2) First field survey by visual observation.
3) Second field survey for quantitative survey through visual observation from close proximity, measurements and tests.

Additional detailed survey will be performed as necessary.

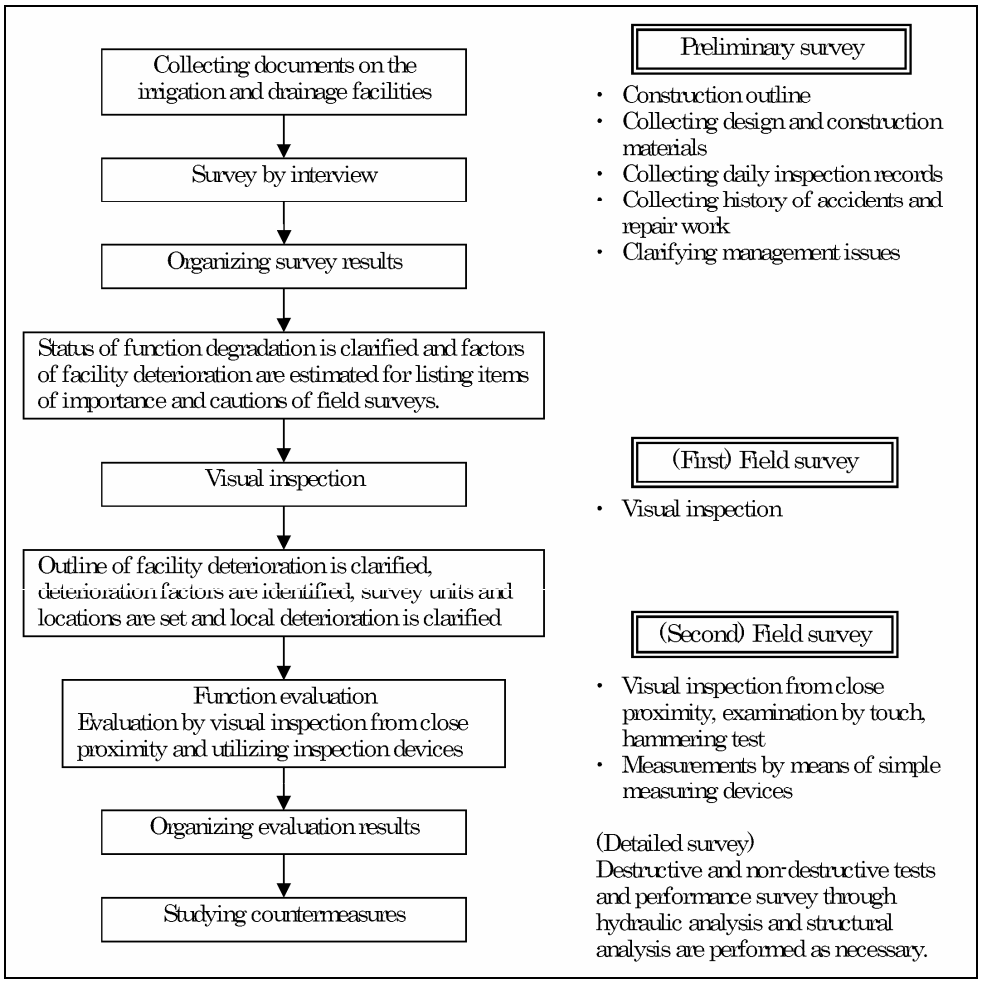


Figure 5.3-14 Procedural Flow of Function Evaluation

5.4 Improvement Plan on Farming

5.4.1 Basic Concept of Improvement of Farming

Purpose of improvement of farming project in the D/P is "Recovery and improvement of agriculture in 34 polders affected by Cyclone Nargis".

As mentioned in Chapter 2 "Present situation of the Agriculture in Ayeyawady Region", there are several problems in agriculture. Among problems cited, the improvement of farming shall focus on the "Strengthening of Production of Agricultural Input" that became serious issues after Nargis attack as well as on the "Strengthening of MAS Technical Support on Farming Technique" from the viewpoint of emergency. These challenges are not only for 34 polders but also other areas in Ayeyawady Region. The project on the improvement of farming is prepared based on following basic concepts.

1) Strengthening of both aspects of "Production" and "Demand" of high quality paddy seed

Importance of dissemination of high quality seed is recognized by many governmental agencies such as MAS. The establishment of the Seed Law in January 2011 implies its' deep understanding of the importance quality seeds in agricultural production. However, the farmers' understanding is not yet sufficient. In fact, sales of paddy seeds in the Pilot Project were difficult to determine due to unstable price and insufficient seed demand. Therefore, the project intends strengthening of both aspects of "Production" and "Demand" to realize dissemination of the seed.

2) Reflection of local demand (demand in the Project Area)

In the Project Area, demand of local variety is still high. And, it is highly possible that the preferable variety is varied depending of the location of farming land (up, middle and downstream of the delta area) due to different production environment. On the other hand, availability of high quality seed for local variety is relatively low as compared with the improved variety. Therefore, the variety for the high quality paddy seed production should be selected carefully in accordance with demand in the Project Area.

3) Utilization of local resources for provision of extension work for wider area

Same as problem on seed quality, low farming technique is common problem for many farmers in the Project Area. Extension work taken by MAS has important role for improving farming technique. However, number of MAS staff was drastically decreased in recent years. Therefore, maximum utilization of local resources like installation of village level demonstration farm in cooperation with advance farmer should be considered for strengthening of the extension work.

4) Consideration and Contribution to the Government Policy

As mentioned above, Government of Myanmar established Seed Law on January 2011. One of the important contents of the Law is "encouragement of participation of private sector in high quality seed production". The participation of the private sector is important to reduce farmers' problem such as lack of farming budget, lack of market channel etc. And, development of advanced farmers would be important factor to encourage the participation of the private sector by adopting contract farming.

On the other hand, excessive official support to the farmers on high quality paddy seed production can lead to loss of market equilibrium and then discourages private sector's participation in the seed production. Therefore, the support for the seed production should be limited to technical aspects as much as possible and, information sharing between official and private sectors should be promoted to enhance participation of private sector in the seed production.

5.4.2 Project Contents and Volume

(1) Project Contents

The project consists of the following three main contents.

1) Development and strengthening of contact farmers for high quality paddy seed production

The strategy here is to develop and strengthen contact farmers for high quality paddy seed production through technical support. The support will be done through field guidance and in-room seminar. The support will be implemented continuously for 2 years (for individual farmer) at the maximum. It is proposed that that high quality paddy seed production area per farmer is limited to approximately 2 acres in consideration of production budget, capacity of storage and others. **Table 5.4.1** and **Table 5.4.2** show comparison of net income for paddy grain and high quality paddy seed production and for local variety and HYV.

Table 5.4-1 Comparison of Net Incomes / Acre between Grain and High Quality Paddy Seed Production

Local Variety

	Grain Paddy	High Quality Paddy Seed	Difference
Production Cost (Kyat)	109,200	220,500	
Cropping Yield (Basket/Acre)	42	53	
Unit Price (Kyat/Basket)	5,956	8,000	
Gross Income (Kyat)	250,152	424,000	
Net income (Kyat)	140,952	203,500	＋62,548

HYV (High Yielding Variety)

	Grain Paddy	High Quality Paddy Seed	Difference
Production Cost (Kyat)	105,000	228,900	
Cropping Yield (Basket/Acre)	54	74	
Unit Price (Kyat/Basket)	4,131	6,000	
Gross Income (Kyat)	223,074	444,000	
Net income (Kyat)	118,074	215,100	+ 97,026

Table 5.4-2 Increase of Farming Income by High Quality Paddy Seed Production

Local Variety

	Grain Paddy	Grain Paddy＋High Quality Paddy Seed		Difference
	Grain Paddy	Grain Paddy	High Quality Paddy Seed	
Production Area (Acres)	11	9	2	
Net Income / Acre (Kyat)	140,952	140,952	203,500	
Net Income (Kyat)	1,550,472	1,268,568	407,000	
Total Net Income (Kyat)	1,550,472	1,675,568		+ 125,096 (+8.1%)

HYV (High Yielding Variety)

	Grain Paddy	Grain Paddy＋High Quality Paddy Seed		Difference
	Grain Paddy	Grain Paddy	High Quality Paddy Seed	
Production Area (Acres)	11	9	2	
Net Income / Acre (Kyat)	118,074	118,074	215,100	
Net Income (Kyat)	1,298,814	1,062,666	430,200	
Total Net Income (Kyat)	1,298,814	1,492,866		+ 194,052 (+15.0%)

2) Strengthening of MAS's supporting system for high quality paddy seed production

This is the content to strengthen MAS's supporting system for high quality paddy seed production through "installation of equipment for seed quality check" and "training of MAS staff on seed quality check". In addition, detailed survey on seed quality and seed demand will be done to develop basic information required for the support.

3) Strengthening of MAS's extension work about high quality paddy seed and farming technique

This is the content to strengthen MAS's extension work mainly focus on dissemination of use of high quality seed and advance farming technique through enhancement of demonstration farm etc.

In the demonstration farm, "comparison between advance and traditional farming technique (seed production)" and "comparison between high quality seed and low quality seed" should be demonstrated to show the difference visually to farmers. For establishment of the demonstration farm, utilization of advanced farmers should be considered taking into account limited number of MAS staffs.

These activities intend not only to improve farming technique but also to stabilize seed demand and enhancing farmers understanding on importance of high quality seed.

(2) Project Volume

Target group of the program is farmers at 34 polders in Ayeyawady Region with 227,195 acres of paddy growing area. Duration of program is 5 years as single project and 9 years as a component of the D/P.

Annual target of dissemination of use of high quality seed is whole paddy growing area mentioned above. Area for seed production is calculated based on estimated amount of seed assuming once in four years of seed renovation frequency.

Yearly target of dissemination of use of high quality seed is 10% of the growing area and eventually 50% of the growing area as a result of the five or nine years of the program period. Area for seed production is calculated based on estimated amount of seed that the farmers wish to renovate during four years period.

Target area of direct extension work which intends development of high quality seed demand and improvement of farming technique is 50% of the abovementioned high quality seed dissemination target area. Nevertheless, all farmers will have opportunity to receive extension work indirectly from the demonstration farm. **Table 5.4-3** shows target extension work area, high quality seed production area and direct extension work area.

Table 5.4-3 Project Volume (Target Area) for Improvement Plan on Farming

Polder		Estimated Paddy Area (Acres)	Target Extension Area of High Quality Paddy Seed and Advance Farming Technique (Acre)	Area for High Quality Paddy Seed Production (Acres)	Area for Direct Extension Work High Quality Paddy Seed and Advance Farming Technique (Acres)
1	Alegun (1)	1,753.2	1,753.2	10.9	876.9
2	Alegun (2)	4,036.8	4,036.8	25.0	2,018.0
3	Alegun (3)	5,196.0	5,196.0	32.2	2,598.6
4	Magyibinmadaukkan	337.9	337.9	2.1	168.7
5	Thingangyi	779.4	779.4	4.8	390.0
6	Zinywe	29.2	29.2	0.2	15.4
7	Leikkwin	11.4	11.4	0.1	6.5
8	Labutta (South)	2,453.2	2,453.2	15.2	1,226.6
9	Labutta (North)	9,826.7	9,826.7	60.8	4,913.5
10	U Gaungpu	106.6	106.6	0.7	53.4
11	Bitud Island (1)	662.4	662.4	4.1	331.2
12	Bitud Island (2)	4,572.5	4,572.5	28.3	2,286.9
13	Bitud Island (3)	3,881.3	3,881.3	24.0	1,940.3
14	Bitud Island (4)	10,179.5	10,179.5	63.0	5,089.7
15	Daunggyi Island	12,997.7	12,997.7	80.5	6,498.7
16	Daunggyi (East)	18,809.7	18,809.7	116.5	9,404.9
17	Daunggyi (West)	15,145.4	15,145.4	93.8	7,572.7
18	Daunggyi (Upper)	2,859.2	2,859.2	17.7	1,430.1
19	Daw Nyein	990.2	990.2	6.1	495.1
20	Myokone	3,082.3	3,082.3	19.1	1,540.7
21	Kyetphamwezaung	26,028.7	26,028.7	161.2	13,014.5
22	Banbwezu	9,898.5	9,898.5	61.3	4,949.1
23	Daydalu	2,165.5	2,165.5	13.4	1,082.9
24	Letpanbin	6,671.3	6,671.3	41.3	3,335.9
25	Zinbaung	5,437.7	5,437.7	33.7	2,718.7
26	Myaseinkan	9,532.1	9,532.1	59.0	4,765.7
27	Thandi	2,617.1	2,617.1	16.2	1,309.0
28	Suclubbaluma	5,879.8	5,879.8	36.4	2,940.1
29	Hleseikchaunggyi	1,742.8	1,742.8	10.8	872.1
30	Tamatakaw	10,084.8	10,084.8	62.4	5,042.9
31	Kyonsoat	403.4	403.4	2.5	201.9
32	Maubin Island (North)	22,681.5	22,681.5	140.4	11,340.4

Polder		Estimated Paddy Area (Acres)	Target Extension Area of High Quality Paddy Seed and Advance Farming Technique (Acre)	Area for High Quality Paddy Seed Production (Acres)	Area for Direct Extension Work High Quality Paddy Seed and Advance Farming Technique (Acres)
33	Maubin Island (South)	10,575.9	10,575.9	65.5	5,287.5
34	Thonegwakyun	15,765.1	15,765.1	97.6	7,882.7
Total		227,194.6	227,194.6	1,406.8	113,601.1

Above table shows high quality seed paddy production area for 34 polders in consideration for calculation of benefit of the project for each polder. However, it is realistic to select the production area in consideration of "accessibility to MAS office (easiness of technical support)", "accessibility to farmers for sales of the seed", "production environment" etc.

5.4.3 Implementation Method and Implementing Body

(1) Implementing Method

Implementing method of the program is as explained below and **Figure 5.4-1**.

Strengthening of supporting system of high quality seed production

Install equipment for seed quality check to three MAS district offices to improve accessibility of farmers to MAS seed quality check at MAS laboratory. Then, conduct of training on seed quality check to MAS township staff prior to commencement of seed quality / demand survey. Regarding to venue of the training, MAS region office and three district offices are considerable.

Implementation of seed quality / demand survey

Carry out the seed quality / demand survey to determine correctly detailed situation of problem and demand of the seed. At least, 1) seed quality of farmers, 2) variety and yield, 3) cultivation method, 4) knowledge about high quality seed, and 5) accessibility to high quality seed should be surveyed.

Through the survey, candidate farmers for "seed production" and "management of demonstration farm" should be selected. Considerable selection criteria of farmers for seed production based on the experience in the Pilot Project are as shown in **Table 5.4-4**.

Table 5.4-4 Selection Criteria of Farmers for Seed Production

Criteria / Consideration		Detailed Explanation
1	Cultivation Method (experience in advance Cultural practices	Advance cultivation method is required for high quality paddy seed production. Farmer's presently practicing advance management systems and practices maybe more easy to convince and participate.. Therefore, it is recommended to select the farmers who have experience of advance cultural practices as much as possible.
2	Grade of reliance on debt	Harvested seed usually should be stored 5-6 months until that the seed demand is increased for next growing season. On the other hand, most of farmers prefer to sell paddy immediately after harvest to re-repay agricultural loan. Therefore, it is recommended to select the farmers who do not strongly depend on loan as much as possible.
3	Availability, capacity and condition of the storage	As abovementioned, seed should be stored 5-6 months. Therefore, storage is indispensable for seed production. It is recommended to select the farmers who have own a storage that is clean and with sufficient capacity.
4	Location and condition of farm land	Condition of farm land such as drainage, fertility should be good for seed production. Also, farming land should be isolated from cropping area of other variety. Therefore, it is recommended to select the farmers who have farm land in good condition as mentioned above.

Preparation of training plan, activity materials such as technical manuals and plantlets shall be based on the result of the survey. Beginners' Manual for High Quality Seed Production was prepared in the pilot project. Preparation of the materials takes long time and large amount of work. Therefore, it is considerable to use the Beginners' Manual with necessary modification for effective preparation of the

materials.

Technical support for high quality paddy seed contact farmer

Technical support will be provided to selected farmers for high quality paddy seed production. As mentioned in Section 5.4.1, the Government of Myanmar established the Seed Law to promote participation of private sector in high quality seed production. Therefore, provision of input required for seed production is assumed as farmer's responsibility to keep effectiveness of the law (fairness of the market). Program of the technical seminars is shown in the **Table 5.4-5**.

Table 5.4-5 Program of Technical Seminar on High Quality Paddy Seed Production

Title	Program
Orientation and Seed Production Technique 1	- Explanation on Importance and Advantage of High Quality Paddy Seed - Explanation of Official High Quality Seed (Certified Seed) Production Procedure - Seed Production Technique 1 (Land Preparation, Seed Selection, Nursery Preparation) - Preparation of Production Plan (Production Amount, Variety, Cropping Schedule, Sales Method etc.)
Seed Production Technique 2	- Confirmation of Progress and Discussion on encountered difficulties - Seed Production Technique 2 (Transplanting, Fertilization, Weed Control, Rouging, Pest and Disaster Control)
Seed Production Technique 3	- Confirmation of Progress and Discussion on encountered difficulties - Seed Production Technique 3 (Harvesting and Post Harvesting)

As a result of the pilot project, stages of land preparation, rouging and harvesting are considered as the most serious stages of decreasing seed quality like mixture with other varieties' seed etc. It is therefore necessary to carry out at least 3 times of field technical guidance in abovementioned stages. These stages are almost same with timing of MAS's field seed quality check (field inspection). Therefore, this field technical guidance schedule can realize effective work for entire Project.

Extension work on high quality seed and advance cropping technique

Extension seminar will be conducted for farmers (non seed producer) on importance of high quality seed and advance cropping technique. This is an important activity to improve cropping technique and also to increase the demand of the seed. Therefore, the extension work should be carried out in parallel with production of high quality paddy seed.

Implementation of demonstrative activity on high quality seed and advance cropping technique

Carry out demonstrative activity on high quality paddy seed and advance cropping technique. This activity is implemented in all 34 polders to realize technical extension work and disseminate advance cropping technology to farmers in wider area. Location of demonstration farms will be MAS demonstration farm, township demonstration farm and/or farmland of advanced farmers in the village. Two cropping trials "comparison between advance cultural practices and cultural practices" and "comparison between high quality seed and low quality seed" is implemented in the demonstration farm. The purpose of theses trials includes verification of effectiveness of the seed and practices. Therefore, input for the demonstration activity is provided by the program (implementing body).

Demonstrative activity is very effective way to promote farmers' understanding and motivation because people saying that "seeing is believing". Also, it is expected that demonstration farm (base of extension work) increases effectiveness of the extension work. On the other hand, failure of the trial can be clearly shown or bad lesson / unsuccessful story. Therefore, farmers who manage demonstration farm should be selected very carefully.

Table 5.4-6 Implementation Schedule for Improvement Plan on Farming

	Activities	Year																			
		1				2				3				4				5			
1	Strengthening of Supporting System of High Quality Seed Production																				
2	Seed Quality and Demand Survey																				
3	Technical support for High Quality Paddy Seed Production Farmer																				
4	Extension work on high quality seed and advance cropping technique																				
5	Implementation of demonstrative activity on high quality seed and advance cropping technique																				

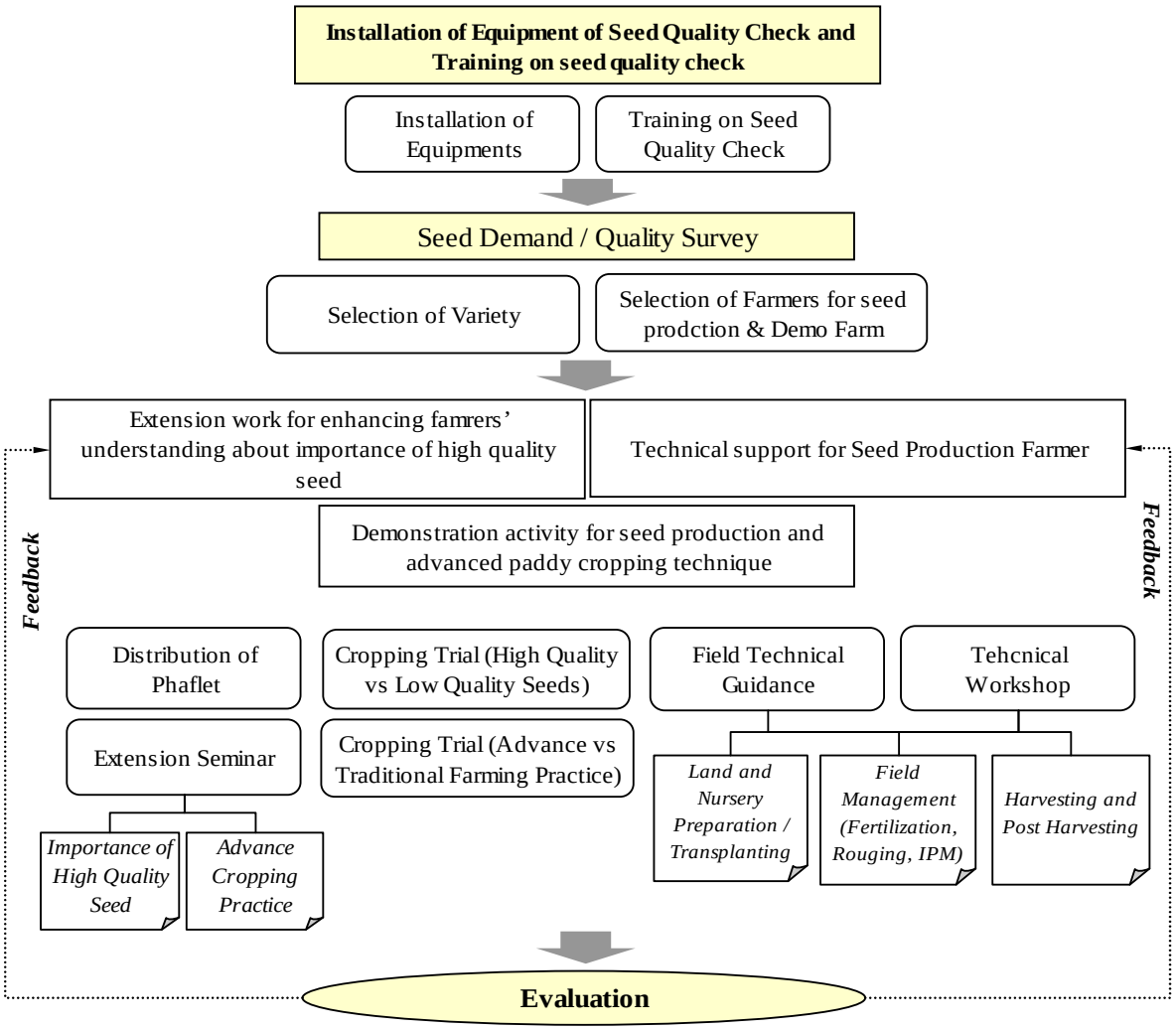


Figure 5.4-1 Implementing Flow for Improvement Plan on Farming

(2) Implementing Body

MAS region office is core organization for implementation of the Program, and MAS district and township offices are responsible for field activities. **Table 5.4-7** and **Figure 5.4-2** show the implementing body and role of related organizations for the Program

Table 5.4-7 Implementing Body for Improvement Plan on Farming

Organization	Role
Implementing Organization	
Headquarter of Myanma Agricultural Services (MAS)	- Coordination with related governmental organizations (Central Level) - Provision of equipment for seed quality check - Provision of technical support
MAS Region Office	- Coordination with related governmental organizations (Region Level) - Monitoring and progress control of whole of the program - Provision of technical support & preparation of material to be used in the program
MAS Seed Farms	- Provision of Registered Seed - Implementation of technical training of seed quality check to MAS staffs
MAS District Offices	- Monitoring and progress control of the program (District Level) - Provision of seed quality check service - Provision of technical support
MAS Township Offices	- Monitoring and progress control of the program (Township Level) - Provision of seed quality check service - Coordination with private sector etc. - Implementation of technical support to farmers on high quality paddy seed production - Implementation of extension work about importance of advance farming technique and high quality seed - Management of demonstration farm
Related Organizations	-
TPDC and Private Companies	- Coordination with implementing organizations on seed demand and advance farmers - (Participation in the Program, if possible)

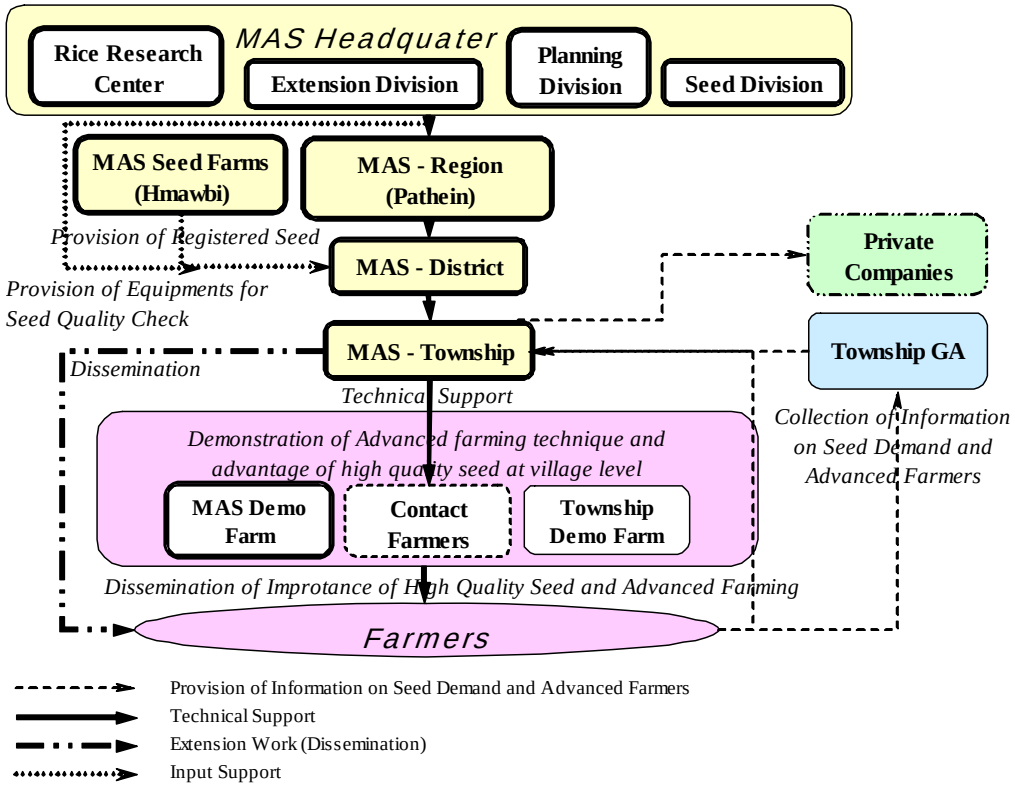


Figure 5.4-2 Implementation Structure for Improvement Plan on Farming

As mentioned above, participation of private sector is key factor to achieve a sustainable work program and full awareness of the process of high quality paddy seed production. In addition, the collaboration of the government officials and private sector can lead to smooth implementation of the program (e.g technical support by government and inputs and sales support by private sector). Therefore, information sharing between government officials and the private sector should be promoted to seek possibility of cooperation and/or collaboration.

5.5 Income Generation Plan

5.5.1 Basic Concept of Income Generation

Landless households are the poorest group in the Project Area, as their physical and financial situations makes it difficult for them to generate income. Also, the Project Area has less resource for income generation if compared with other regions. Several social and economic situations were identified during the study, which must be considered in the formulation of the master plan.

1) The goal of the D/P for income generation is to increase income generation opportunities for landless people who live in weak living condition and thereby their income will be increased by self-help efforts and rural life will be improved at 34 polders.

2) Income generation activities must:

- Require only small amount of initial investment so that the people will be able to re-pay without difficulty.
- Use simple techniques that will be easy for them to understand and comprehend.
- Small scale and small risk to encourage people to participate without hesitation.
- Require short time investment – short term return cycle so that vulnerable people will be able to see and realize income within a short-period of time.
- Presence of basic infrastructures such as transportation, roads and available local market to guarantee product sales.

3) To meet these requirements, activities that some inhabitants have already experienced are appropriate to extend.

4) Commencement of such activities requires supports from outside resources (information, awareness, improved techniques, and administration matters)

5.5.2 Project Contents and Volume

(1) Scope of Income Generation Activities

1) Target area and target people

- Villages inside 34 polders are the target area. Town areas are not included because industrial job opportunities exist there to a certain extent.
- Landless households, who get income as paddy workers, wage labours, casual labours or small scale fishermen, are the planned target people in this D/P. They have neither means of production except their labour force nor opportunity of getting cash income from stable and annual sources. The ratio of landless households to all households is estimated at 69.3% for all townships in the study area (source: TPDC and TS-SLRD). On the other hand, for farmer households, improvement of rice production is the best way of income generation.
- Though the study area is spread over 1,342 km^2 in the delta, there is no great difference among villages in these polders from the social, economic, physical and natural conditions except the difference between riverside areas and inland areas.

2) Activities

- After the polder embankments and sluice gates are rehabilitated according to the ‘D/P for

Preservation of Farming Area', quality of creek water inside polders will be improved (become fresh water); therefore, to obtain the maximum benefit from project, activities in agriculture are considered as an appropriate one.

- However, other activities can be promoted if they meet the natural condition.
- Also, land used for agriculture-related activities must be arranged and guaranteed by administrative organisations.
- As the target households are poor and don't have enough money for investment, combination of activities creates more net return. For example, they can use residue of vegetables (stem, leaves) as feed for pigs, manure of animals can be converted as fertilizers, etc.

(2) Selection of Target Activities

Among income generation activities that some landless households actually do on a small scale, five activities of low initial investment and relatively easy production technique (vegetables cultivation, fruit tree plantation, technical improvement of primary processing of small fish and prawn, raising of domestic animals and processing of farm produce) were identified. Project feasibility in the framework of this D/P was examined from several viewpoints: precondition to start, profit return period, government support, and scope and scale of implementation. As a result, two activities, vegetable cultivation and pig raising, were considered feasible as income generation projects to be implemented in this D/P. Examination is summarized in **Table 5.5-1** and the preliminary project sheets for five (5) candidate activities are presented in **Appendix 8-1**.

Table 5.5-1 Examination of existing income generation activities

Viewpoint	**Activity-1** Vegetable cultivation	**Activity-2** Fruit tree (banana, mango) plantation	**Activity-3** Technical improvement of fish/prawn processing	**Activity-4** Breeding or fattening pig	**Activity-5** Processing of farm produce
Activity of participant household	Cultivation of vegetables on 0.1 acre land	Plantation of one banana tree and one mango tree on house garden	Processing fish/ prawn using improved technique	Breeding and fattening pigs (1 pig per household)	Processing value added produces using rural raw produces/materials
Precondition to start	• Guarantee of land use • Availability of fresh water	Availability of small plot of land for 30-40 years	• Existence of food hygiene/ quality standard • Market price increase according to the quality	Existence of animal market	• Opportunity of appropriate raw materials • Continuous identification of market value processed goods
Profit return	2- 3 months	More than 3 years	Institutional settings may take long time.	1 year	Finding of appropriate goods and market may take long time
Government support	Nil but MAS has potential	Nil but MAS has potential	No support to improve marine products processing quality	Nil but LBVD has potential	Nil, Local governments have no experience.

Scope and scale of project	• 1-2 year technical support • Land use guarantee	1 day training on planting	• Establishment of quality standard and dissemination • 1-2 year technical support	• Extension of veterinary service • 2 to 4 year technical support	• 3 year study and trial • Establishment of producing method • Marketing
As income generation by landless households	Easy to start and get income quickly when they can use land and get technical skill.	Easy to start if they have small land but only one day training is enough.	Difficult due to absence of quality standard and guarantee of profit increment	Easy to start if they can afford to buy piglets and get trained.	Difficult due to lack of government support and marketable produces
Need of project implementation	High	Low (MAS normal work can cover)	Low (institutional setting up project – medium)	High	rural development project – high

1) Activity-1: Vegetable cultivation

Vegetables cultivation can provide additional cash income to the growers within a few months with relatively low techniques, and MAS has human resources to support them. Thus it is judged as appropriate for income generation activity.

2) Activity-2: Fruit tree (banana, mango) plantation

Banana and mango trees bear fruits for a long period of time, easy to grow and also, fruits can contribute to improvement of nutrition condition when they are consumed at home.

From viewpoint of project effect, this activity would not require continuous technical support after basic techniques are once transferred to growers[7]. Even if MAS does not provide extension work on site, local farmers/ growers having empirical knowledge could harvest fruits in certain quality and quantity over a period of time.

Based on the above considerations, fruit tree plantation activity is judged as an effective means for income generation but not included in the sub projects of the D/P because it does not need special technical support of project scale. However, raising awareness of landless households on the importance of planting fruit trees is recommended to be undertaken by the local government in charge of poverty reduction and to consider fruit tree plantation as potential activity.

3) Activity-3: Technical improvement of primary processing of small fish and prawn

This activity is effective if farm gate price increases according to the quality level. However, it was found that neither quality standard was established nor its necessity is widely known at this moment. Thus, the actual condition is that processors cannot get proper amount of incremental profit even when they improve processing technique.

Quality improvement is an important factor for strengthening future marine products industry, but this scope is different from income generation of landless households, the purpose of the income generation D/P. For this reason, this activity was not judged to be included in the D/P. It is better to start this activity for landless households when DOF and regional government establish the quality standard and incremental profit is generated in consistency with the improved range of product's quality.

[7] According to the experts of MAS

4) Activity-4: Breeding or fattening of domestic animal (pig)

Pig raising brings additional cash income to the implementer and LBVD has human resources and experience to support them. Though profit is generated one year after the start of breeding, and is not a quick responding activity, people keep pigs regarding it as a kind of saving. Thus it is feasible to apply for income generation activity.

5) Activity-5: Processing of farm produce

This activity is regarded as not only household income generation but also a kind of village development activity.

Though inhabitants in the target area produce rice powder cake and other products, it is generally difficult for landless households to get raw materials other than rice. This activity is more appropriate to be implemented as second phase after the landless households will have succeeded in producing vegetables and fruits and have sufficient materials for processing. Adding to this, the local government is supposed to be in charge of providing support to village development planning, technical training and market research for production of value added products; however, they have no experience at the moment. This activity must be carefully promoted by the local government for village economy development activities, but local government has not experienced in this matter at this moment.

In conclusion, this activity is proposed to be implemented as second stage after landless people succeed vegetables cultivation and fruit tree plantation. When the local government staff will have obtained sufficient enough knowledge and experience in poverty reduction activity, this activity can be started with the survey of available materials and market.

(3) Vegetables Cultivation Sub-project

This sub-project aims to generate cash income through effective use of the result of rehabilitation component of the project proposed in the D/P. Lessons learned from the Pilot Project are applied to technical support.

1) Target area and target people: 10% of landless households in 34 polders[8].

2) Components of the project

- The goal of the project is to promote income increase to landless households (implementers) and make them self-reliant through sustainable vegetables cultivation.
- The output of the project is to provide knowledge and experience to landless farmers necessary for vegetables cultivation.
- To achieve the project goal and identified output, implementers will cultivate four (4) types of vegetables (yard long bean, okra, roselle and water cress) in a 0.025 acre each (total 0.1 acre) on borrowed paddy field during dry season without payment. They will be guided to keep a record of all activities and cost during their cultivation to understand real profit. Cucumber was also tried at the pilot project but resulted in low yield and negative profit for many participants. Cucumber cultivation is difficult and risky for landless people who are almost beginners. It is difficult for them to undertake systematic taking care of cucumber cultivation when condition is bad (like long rain). For this reason, cucumber was not selected.
- Staff of MAS township office will provide support activities to implementers for 2 years in terms of technical assistance in collaboration with the local government (region, district, township and village tract). VFRDC and MAS extension divisions will provide technical support to the township offices.

[8] Set in consideration with supporting capacity of MAS.

3) Key points for project implementation

Following are key points of vegetables cultivation. Lessons learned from the pilot project area were reviewed and most of them applied to this plan.

- Generally landless implementers lease paddy field from land right holders during dry season. To assure of cultivation place, local authorities (township, village tract) guarantee the land use.
- Implementer need to confirm following issues.
  - enough labour force for 0.1 acre vegetables cultivation;
  - cultivation plot is appropriately located near water source and house;
- Implementer must start as early as possible because the earlier they harvest, the higher the market price.
- Training must be given on basic techniques in a week course, using simple words and explanation for low-educated, less experienced people to understand easily. MAS show a concrete way of good practice to the implementers in the demonstration farm. Support of MAS and local administration staff for income generation recognized that it is helpful for implementers to gain confidence in vegetables cultivation.

4) Project period

- The project of each polder starts one year after the rehabilitation of embankment and sluices in the polder.
- Project period is two years at each polder and will take 7 years to cover all polders (refer to **Table 5.8-6**).

5) Project volume

- Number of target polders: 34 polders
- Number of target households: 4,023 HH (10% of total landless households)
- Number of townships concerned 5 townships

Based on these figures, project volume is estimated as shown in **Table 5.5-2.**

6) Project costs

Project costs are estimated at 249,097,750 Kyats, with 61,918 Kyats/HH.

Table 5.5-2 Project Volume of Vegetable Cultivation Sub-project

No.	Item	Volume setting	Total quantity	unit	unit price Kyat	total Kyat
V1	Extension workshop to implementers	1 time/ HH	4	times	4,996	20,100,000
V2	Technical workshop for implementers	4 time/ HH	16,092	times	4,996	80,400,000
V3	Print of manual for implementers	1 HH	4,023	copies	2,500	10,057,500
V4	Technical training for MAS staff	3 time/ township	15	times	300,000	4,500,000
V5	Management of demonstration farm (2 years)	1 Polder	34	farms	1,500,000	51,000,000
V6	Onsite consultation (2 years)	1.5 day/ HH	6,035	days	10,000	60,345,000
Sub-total						226,452,500
Physical contingency (10% of sub-total)						22,645,250
Total (2 years)						249,097,750
Total per household (2years)						61,918

7) Crop budget and effect on income generation

a) Crop budget

Production cost and net profit are estimated based on the result of the pilot project and data described in the MAS vegetable manual as shown in **Table 5.5-3**. As a result, it is estimated that a household will earn 29,343 Kyats of net income by one dry season cultivation.

Table 5.5-3 Crop Budget for Vegetables Cultivation Sub-project

Items	Long yard bean	Okra	Roselle	Watercress	4 vegetables/1.0 acre (household)
Cost for 0.025 acre cultivation (Kyat)					
Seed	788	1,125	30	150	2,093
Fertilizer	2,240	2,435	2,123	1,798	8,596
Agrochemicals	2,700	750	113	113	3,675
Transportation	125	333	373	334	1,165
Sub-Total	5,852	4,643	2,639	2,394	15,529
Physical Contingency (5%)	293	232	132	120	776
Total cost (Kyat)	6,145	4,875	2,771	2,514	16,305
Return from 0.025 acre cultivation					
Yield kg/ 0.025 acre each	50	98	50	50	
Losses	0.9	0.9	0.9	0.9	
Net Yield (kg/ 0.025 acre)	45	88	45	45	
Farm gate price (Kyat/ kg)	496	128	143	128	
Gross return (Kyat)	22,302	11,188	6,419	5,739	45,648
Net return (Kyat)	16,157	6,313	3,648	3,225	29,343

Source: Pilot Project, MAS manual

b) Effect on income generation

Result of the Present condition survey indicates that the 2009 annual income of landless households in the target five townships was between 655,000 Kyats and 2,333,000 Kyats with the average of 1,422,000 Kyats[9]. When a household earns 29,343 Kyats from vegetable cultivation, 1.3% to 4.5% of income generation will be expected.

Table 5.5-4 Effect on Income Generation Unit: Kyat/HH/year

Township	2009 Household income Kyat	Net profit from vegetable cultivation Kyat	Incremental rate (2009 income = 100)
Labutta	1,231,685	29,343	1.024
Bogaley	655,000	29,343	1.045
Phyarpon	1,512,333	29,343	1.019
Daydaye	2,333,214	29,343	1.013
Kyaiklatt	1,354,333	29,343	1.022
All townships	1,422,448	29,343	1.021

(4) Pig Raising Sub-project

This project is planned to give income generation opportunities to the landless households living in 34 polders after dike embankment and sluice gates are rehabilitated.

1) Target area and target people: 5% of landless households in 34 polders[10].

[9] Main income sources of the respondent households were casual labour (29%), agricultural labour (21%) and /fishery labour (19%).

[10] Set in consideration with supporting system and capacity of LBVD as well as the return period <initial investment – income gaining> longer than that of vegetable cultivation.

2) Components of the project

- The goal of the project is that target landless households (implementers) will implement sustainable pig raising livelihood activity that would give them additional income and will make them self-reliant.
- The output of the project is that the implementers gain knowledge and experience necessary for pig raising, and at the same time additional income by selling pigs;
- To achieve the project goal and identified the output, implementers will organize a unit of sixteen households for the raising of the pig. Each 6 households will breed pigs with a 4-year-cycle and the remaining ten households will fatten pigs with a 1-year-cycle, and
- LBVD support will be required to improve implementer's technical knowledge by holding extension workshops, technical workshops, and providing printing materials/manuals to the participants. Also, LBVD will undertake on-site coaching/consultation with landless farmers specifically on health matters and vaccination.

3) Key points for project implementation

- LBVD shall collect basic information of capacity and problem of implementers as much as possible in the beginning months and provide training and coaching/consultation on-site.

4) Project period

- The period of implementation is the same as that of the rehabilitation of embankment and sluices project and the year of commencement is one year after the rehabilitation of each polder.
- Project period is four years at each polder (length of breeding). It will take 9 years to support all polders (refer to **Table 5.8-7**).

5) Project volume

- Number of target polder: 34 polders
- Number of target households: 2,080 HH (5% of total landless households)
- Number of pig raising unit (16 HH) 130 units
- Number of townships concerned 5 townships

Based on these figures, the project volume is estimated as follows.

6) Project costs

Project costs are estimated at 79,640,000 Kyats for the four year support covering 34 polders. Project costs per target unit of 16 households are 612,615 Kyats and 38,288 Kyats/HH for four years. **Table 5.5-5** shows project volume and estimated project cost of the pig raising sub-project.

Table 5.5-5 Project volume and project cost of pig raising sub-project

No.	Item	Volume setting	Total quantity	unit	unit price Kyat	total Kyat
P1	Extension workshop (breeding)	1 time/ polder	34	times	100,000	3,400,000
P2	Extension workshop (fattening)	1 time/ polder	34	times	100,000	3,400,000
P3	Printing of manual for implementers	2080 HH	2,080	copies	2,500	5,200,000
P4	Technical workshop (breeding)	2 time/ polder	68	times	100,000	6,800,000
P5	Technical workshop (fattening)	1 time/ polder	34	times	100,000	3,400,000
P6	Technical training for LBVD staff	2 time/ township	20	times	300,000	6,000,000
P7	Onsite consultation on breeding (4 years)	4 day/ HH	3,120	days	10,000	31,200,000

P8	Onsite consultation on fattening (1 year)	1 day/ HH	1,300	days	10,000	13,000,000
Sub-total						72,400,000
Physical contingency (10% of sub-total)						7,240,000
Total (4 years)						79,640,000
Total per household (4 years)						38,288

7) Pig raising budget and effect on income generation

(a) Pig raising budget

Pig raising cost and net profit are estimated based mainly on the data described in LBVD manual as shown in **Table 5.5-6**. As a result, it is estimated that the net income of a household doing breeding will be 741,155 Kyats for a 4-year-cycle and that of pig fattening will be 361,976 Kyats for the same period.

Table 5.5-6 Cost and Benefit of Pig Raising per Household Unit: Kyat

Activity	Item	1st Year	2nd Year	3rd Year	4th Year	4-year-cycle
Breeding	Breeding cost					
	Breeding cost	113,508	204,275	232,175	134,656	684,615
	Physical Contingency (5%)	5,675	10,214	11,609	6,733	34,231
	Total Cost	119,184	214,489	243,784	141,389	718,845
	Income from breeding					
	Sale of piglets	0	106,667	133,333	200,000	440,000
	Sale of medium pigs	0	320,000	400,000	200,000	920,000
	Sale of parent pigs	0	0	0	100,000	100,000
	Gross Income	0	426,667	533,333	500,000	1,460,000
	Net income	-119,184	212,178	289,550	358,611	741,155
Fattening	Fattening cost					
	Fattening cost	107,744	77,744	77,744	77,744	340,975
	Physical Contingency (5%)	5,387	3,887	3,887	3,887	17,049
	Total Cost	113,131	81,631	81,631	81,631	358,024
	Gross Income	180,000	180,000	180,000	180,000	720,000
	Net Income	66,869	98,369	98,369	98,369	361,976

(b) Effect on income generation

Effect of the income increment got from pig raising is calculated using the 2009 income of landless households as mentioned in **Table 5.5-7**. As the result, households doing pig breeding will have losses in the first year but increase in their income by 15% to 25% of 2008 household income from the second to the fourth year. Households doing pig fattening will increase household income by 4.7% in the first year and 7% in the second year on the average.

Table 5.5-7 Effect on Income Generation unit: kyat

Item	Labutta	Bogaley	Phyarpon	Daydaye	Kyaiklatt	All townships
Income 2009 Kyat	1,231,685	655,000	1,512,333	2,333,214	1,354,333	1,422,448
Breeding						
Breeding 1st year	-119,184	-119,184	-119,184	-119,184	-119,184	-119,184
Incremental rate	0.903	0.818	0.921	0.949	0.912	0.916
Breeding 2nd year	212,178	212,178	212,178	212,178	212,178	212,178
Incremental rate	1.172	1.324	1.140	1.091	1.157	1.149
Breeding 3rd year	289,550	289,550	289,550	289,550	289,550	289,550
Incremental rate	1.235	1.442	1.191	1.124	1.214	1.204

Breeding 4th year	358,611	358,611	358,611	358,611	358,611	358,611
Incremental rate	1.291	1.547	1.237	1.154	1.265	1.252
Fattening						
Fattening 1st year	66,869	66,869	66,869	66,869	66,869	66,869
Incremental rate	1.054	1.102	1.044	1.029	1.049	1.047
Fattening 2nd year	98,369	98,369	98,369	98,369	98,369	98,369
Incremental rate	1.080	1.150	1.065	1.042	1.073	1.069

Source: Manual of LBVD

5.5.3 Implementation Method and Implementation Body

Administration system of local governments in Myanmar is actually in transition stage and work demarcation between both the central government and the regional government and among departments within the regional/district/township governments is not clearly defined at the study period. However, it is said that the regional government will have financial and administrative responsibility of rural development. The latest information will be added in this section as soon as the study team gets it.

(1) Vegetables cultivation sub-project

1) Process of implementation and role

The D/P proposes the implementation method of vegetable cultivation sub-project be as follows: landless households do the cultivation; regional government takes the initiative of project implementation by assuring land use guarantees, budget allocation and other administration matters; and MAS will provide technical support. Procedure of implementation and stakeholder in charge of each activity is shown in **Table 5.5-8**.

Table 5.5-8 Implementation Procedure of Vegetable Cultivation Sub-project

No.	Activity	Explanation	Stakeholder in charge
1	Planning and establishment of implementation system		
1.1	Budget acquisition for supervision/administration		MOAI (DAP, MAS) / Region Govt.
1.2	Establishment of implementation supporting structure		MOAI (DAP, MAS) and Region Govt.
1.3	Action plan making for each polder		MAS Region, District & Township
1.4	Budget acquisition for project implementation and budget allocation		MOAI (MAS) / Region Govt.
2	Preparation of implementation		
2.1	Polder-wise survey of natural and social condition	- Natural conditions: water source, land availability, soil and water quality (pH, EC) - Intention of landless households	- MAS and Township & Village Tract - Landless households
2.2	Selection of the project area in each polder	- according to the soil and water conditions and intention of landless people	- MAS and Township
2.3	Training of MAS township staff	- vegetables cultivation technique - extension work method	Trainer: MAS extension division & VFRDC Trainee : township office
2.4	Printing manual		- MAS (extension division)
3	Implementation in the target polders		
3-1	Selection of implementer and cultivation plot	- based on the intention and willingness of landless household - Arrangement of head of village tract. - MAS township office confirms.	- Landless household - Village tract - MAS township office
3.2	Preparatory workshop	- land use agreement (implementer	- Landless implementers

		& farmer) - confirmation of role of each stakeholder - schedule of implementation	- MAS township office - Village Tract
3.3	Technical workshop 1	- 5 day workshop at the beginning of the project - on basic technique of vegetable cultivation	- Implementers (landless HH) - MAS township office - Support from VFRDC
3.4	Onsite consultation for 2 years/polder	- during cultivation period	- MAS township office
3.5	Management of demonstration farm	- 0.1 acre for four vegetables - hiring workers	- MAS township office - Support from VFRDC
3.6	Technical workshop 2	- observation of the demo farm	- Implementers (landless HH) - MAS township office - Support from VFRDC
3.7	Technical workshop 3, 4	- 2 day workshop based on the result of monitoring	- Implementers (landless HH) - MAS township office - Support from VFRDC
3.8	Coordination	- Between implementers and other stakeholders	
3.8.1	Coordination at the village tract level	- Intervention in the village tract level problems: land use problem, cattle penetration etc.	- Implémenter - Village Tract - Other inhabitants
3.8.2	Coordination between village tract and township	- Transfer of implementer's requests and information to MAS and Township - Arrangement of MAS consultation	- Village Tract - MAS township office - Township general administration Dpt.
3.8.3	Coordination of related authorities	- Information exchange - Problem/conflict solution among ministry offices concerned	- Township general administration Dpt. - Ministry township offices
3.9	Evaluation	Evaluation of two year cultivation	- Implementers - MAS township office - VFRDC - Township general administration Dpt.

According to this procedure, stakeholders share role for implementation.

Table 5.5-9 Roles Sharing for Vegetable Cultivation Sub-project

Stakeholder	Important roles
Implementer of the project	- Shows intention and willingness to start vegetable cultivation - Agrees with land right holders about land use for vegetable cultivation - Participates in technical trainings - Cultivate - Cultivates vegetables using own seed and according to the trained cultivation method - Gets income by selling harvest
MAS Management Direction	- Overall decision making of the income generation project - Financial assistance - Establishment of implementation supporting system
MAS Extension Division	- Makes extension plan - Provides training to MAS staff in charge of onsite project implementation (Extension works)
VFRDC	- Provides technical advice - Provides training to MAS staff in charge of onsite project implementation (vegetable production)
MAS Division Office	- Coordination with Region Government on implementation plan and budget acquisition - Supervision of making action plan of 34 polders
Ayeyawady Regional Government	- Coordination with MAS Region Office on budget acquisition - Coordination with district general administration departments
MAS district Office	- Coordination with Region Government on implementation plan - Support in the preparation of the action plan
District General	- Coordination with township general administration departments

Administration Department	
MAS Township Office	- Polder-wide survey for implementation - Selection of the project area and target households - Project implementation: Organizes preparatory workshop and technical workshop, manages demo farm management, and on site consultation for 2 years - Supervision of implementer's vegetable cultivation - Evaluation
Township General Administration Department	- Polder wide survey for implementation - Administrative supervision: coordination with related organizations and district and village tract organizations - Evaluation
Village Tract	- Support selection of implementers - Intervenes and guarantees use of paddy field for vegetable cultivation - Conflict/problem resolutions - Coordination with Township on conflicts/problems outside the village tract

Figure 5.5-1 shows a flow chart of implementation and supporting system consisting of technical matters and administration matters.

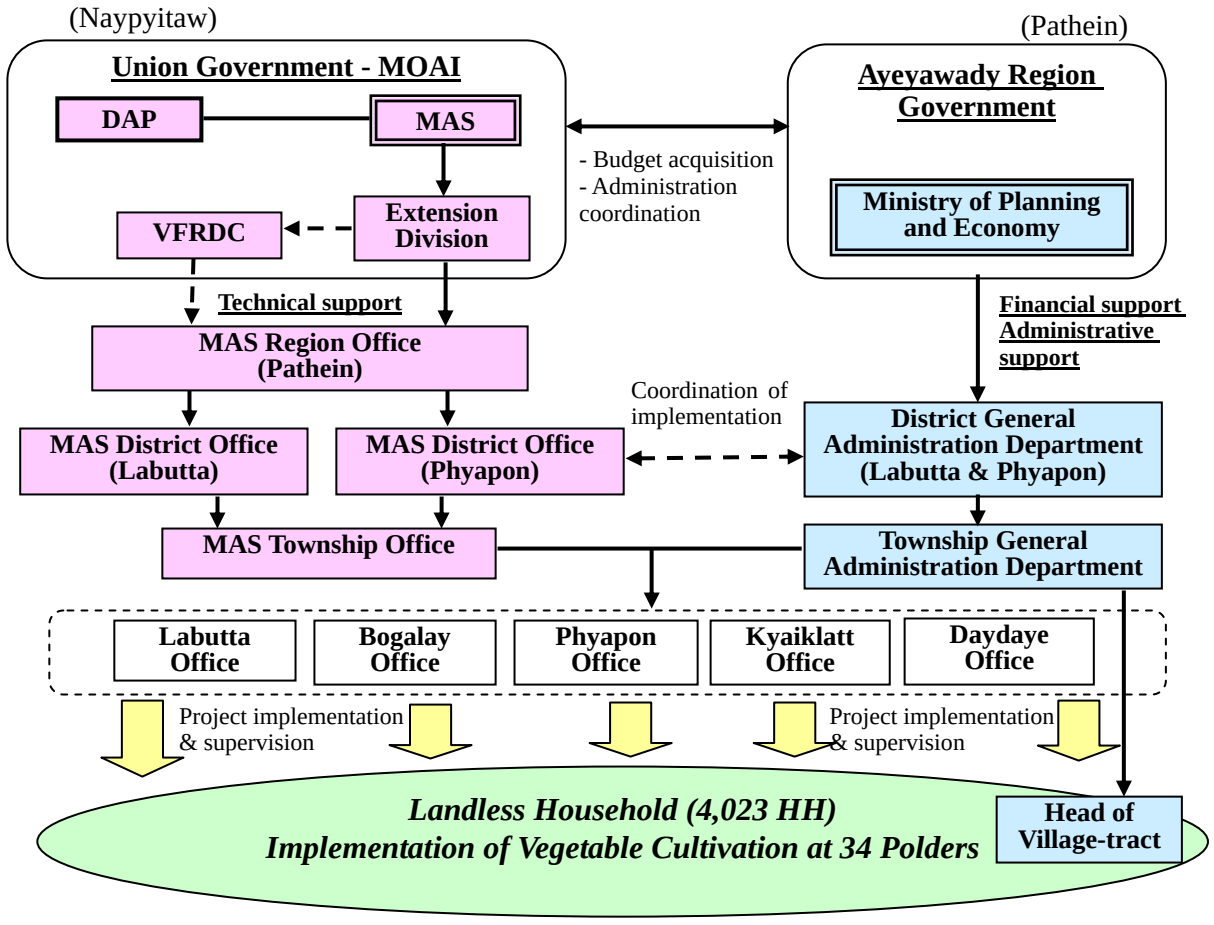


Figure 5.5-1 Implementation Structure for Vegetable Cultivation Sub-project

(2) Pig Raising Sub-project

1) Process of implementation and role sharing

The method of implementation is that sixteen landless households are organized as one unit. Of this unit six will do breeding and the remaining ten households will do fattening works. The number of this unit of sixteen households will depend on the number of landless household in each polder but every polder will have at least one unit.

LBVD will provide technical support while the local government will provide budget allocation and support to other administration matter. Procedure of implementation and stakeholder in charge of each activity is shown in **Table 5.5-10.**

Table 5.5-10 Implementation Procedure of Pig Raising Sub-project

No	Activity	Implementation body	Stakeholders in charge
1	Planning and establishment of implementation system		
1.1	Budget acquisition for supervision/administration		MOLF (LBVD) / Region Govt.
1.2	Establishment of technical supporting structure		MOLF (LBVD) and Region Govt.
1.3	Action plan making for each polder		LBVD Region, District & Township
1.4	Budget acquisition for project implementation and budget allocation		MOLF (LVD) / Region Govt.
2	Preparation of implementation		
2.1	Polder-wide survey of market and social condition (piglet availability, intension of landless households)	- Natural conditions: water source, land availability, soil and water quality - Intention and willingness of landless households	LBVD And Township & Village Tract
2.2	Training of LBVD township staff in pig raising and extension work	- Pig raising technique including health issues - extension work method	MOLF (extension div.) & LBVD
2.3	Printing pig raising manual		MOLF (extension div.) & LBVD
3	Implementation in the target polders		
3.1	Selection of implementers	- Based on the intention and willingness of landless households - Arrangement by head of village tract	Landless household Village Tract LBVD township
3.2	Preparatory workshop (breeding)	- Organization of unit consisting of 6 households (breeding) - confirmation of role of each stakeholders - schedule of implementation	Implementers LBVD township office Village Tract
3.3	Preparatory workshop (fattening)	- Organization of unit consisting of 10 households (fattening) - confirmation of role of each stakeholders - schedule of implementation	Implementers LBVD township office Village Tract
3.4	Technical workshop (breeding)	- for the first two years of breeding	Implementers LBVD township office
3.5	Technical workshop (fattening)	- for one year	Implementers LBVD township office

3.6	Onsite consultation	- Including vaccination	LBVD township office
3.7	Coordination	- Problem solution inside village tract - Transfer to township	Village Tract
3.8	Coordination	- Problem solution among villages or ministry offices	Township general administration department
3.9	Evaluation	Evaluation of two years activity	- Implementers - LBVD township office - Township general administration Dpt.

According to this procedure, stakeholders share role for implementation.

Table 5.5-11 Role Sharing for Pig Raising Sub-project

Stakeholder	Important roles
Implementer of the project	- Receives training - Prepare pig hut and buy piglets - Feed pigs till they sell pigs and vaccination - Continues pig raising
MOLF planning direction	- Decision making of the income generation project - Financial assistance
LBVD central level	- Extension plan - Training to LBVD staff in charge of onsite project implementation (Extension works) - Technical advice
LBVD Regional office	- Coordination with Region Government on implementation plan and budget acquisition - Supervision in the preparation of the action plan of 34 polders
LBVD district office	- Coordination with Region Government on implementation plan - Support in the preparation of the action plan
LBVD township office	- Project implementation: Organize extension workshop, organize technical training, and on site consultation for 4 years - Supervision of pig raising activities of the implementers
Township General Administration Department	- Administrative supervision: coordination with related organizations, district and village tracts

Figure 5.5-2 shows flow chart of implementation and supporting system consisting of technical and administration matters.

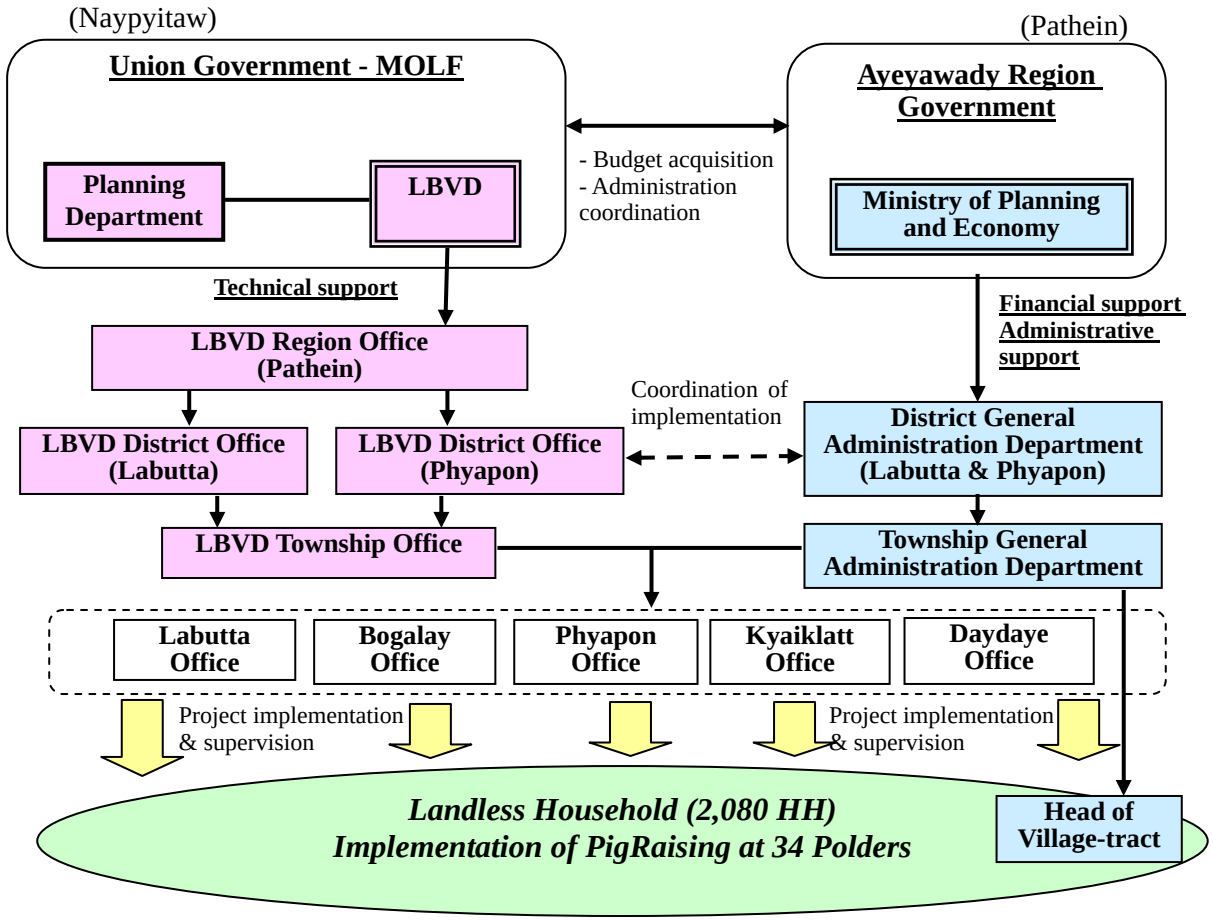


Figure 5.5-2 Implementation Structure for Pig Raising Sub-project

5.6 Rehabilitation Plan on Mangrove Windbreak

5.6.1 Basic Concept of Rehabilitation of Mangrove Windbreak

The objective of the subproject is to rehabilitate mangrove trees for the protection of the polder dike. The windbreak mangrove tree is planted in front of the dike to protect the dike from direct attack of tidal wave. As mentioned in Section 2.7, deterioration of the mangrove forest directly contributed to the increase in the damages caused by Cyclone Nargis. The proposal to rehabilitate and re-forest the mangrove along the polder dike will ensure protection of the dike against cyclones that damage and destroy dikes and embankments.

Basic concept for the rehabilitation of mangrove windbreak in the D/P is explained below:

Implementation of rehabilitation activities for windbreak mangrove tree in target polders
(1) To plant mangrove species in the depleted and degraded area beside polder dike to protect the dike from disasters.
(2) To consider planting design feature that will to protect the area from tidal wave.
(3) To use planting techniques acceptable to FD District/Township Officers and local residents.

(4) To select suitable mangrove species that will help control the area from tidal wave.

(5) To select suitable mangrove species considering natural and socio-economic conditions of planting site.

(6) To select suitable mangrove species considering local demand and utilization for villagers.

(7) To select suitable mangrove species considering availability of seeds and seedling supply from the nursery.

(8) The mangrove windbreak subproject would need the village participation to undertake the maintenance activities after subproject implementation as it is not under the management of the Forest Department. For this purpose, a village committee to manage and maintain and at the same time to determine utilization of the mangrove windbreak shall have to be organized

5.6.2 Project Contents and Volume

(1) Scope of Project

The scope of the mangrove windbreak restoration subproject is along the bank of 34 polders in the Ayeyawady Delta. The study team investigated the damage situation of mangrove windbreak by Cyclone Nargis at 34 polders in the target area in March 2011. The result of the investigation is shown in **Table 5.6-1**. The result of the investigation shows that mangrove windbreak of the 22 out of 34 polders had had been affected by Cyclone Nargis. Total estimated required length of mangrove windbreak in 22 polders was 206.9 km. It is about 22% of total length of 34 polder dikes/embankments.

Table 5.6-1 Target Length of Mangrove Windbreak Rehabilitation by Polder

Sr. No	Polder Name	Length of Polder		Current length of mangrove (mile)	Target for rehabilitation	
		mile	km		mile	km
1	Alegyun (1) polder	13.40	21.60	13.30	0.10	0.20
2	Alegyun (2) polder	22.70	36.50	20.20	2.50	4.00
3	Alegyun (3) polder	17.65	28.40	8.00	10.00	16.00
4	Magybinmadaukkan	3.40	5.50	2.00	1.40	2.20
5	Thingangyi	6.30	10.10	0.00	0.00	0.00
6	Zinywe	6.00	9.70	0.00	0.00	0.00
7	Leikkwin	3.75	6.00	6.00	0.00	0.00
8	Labutta (South)	20.20	32.50	19.75	0.75	1.20
9	Labutta (North)	38.00	61.20	36.50	1.50	2.40
10	U Gaungpu	5.20	8.40	1.40	0.00	0.00
11	Bitud Island (1)	14.02	22.60	11.20	3.00	4.80
12	Bitud Island (2)	18.60	29.90	8.00	8.00	12.80
13	Bitud Island (3)	28.00	45.10	18.00	10.00	16.00
14	Bitud Island (4)	40.53	65.30	15.00	25.50	40.80
15	Daunggyi	37.00	59.60	30.00	7.00	11.20
16	Daunggyi (East)	33.90	54.60	33.90	0.00	0.00
17	Daunggyi (West)	31.60	50.90	31.90	0.00	0.00
18	Daunggyi (Upper)	10.50	16.90	10.30	0.20	0.30
19	Daw Nyein polder	14.00	22.50	14.00	0.00	0.00
20	Myokone polder	17.00	27.40	17.00	0.00	0.00
21	Kyetphamwezaung	46.00	74.10	39.00	17.00	27.20
22	Banbwezu	26.00	41.90	26.00	0.00	0.00
23	Daydalu	13.00	20.90	13.00	0.00	0.00
24	Letpanbin	20.00	32.20	20.00	0.00	0.00
25	Zinbaung	15.00	24.20	15.00	0.00	0.00
26	Myaseinkan	13.50	21.70	12.00	1.50	2.40
27	Thandi	4.25	6.80	2.75	1.50	2.40
28	Suclubbaluma	7.40	11.90	6.40	1.00	1.60

29	Hleseik chaunggyi	7.40	11.90	4.40	3.00	4.80
30	Tamatakaw	7.00	11.30	0.00	7.00	11.20
31	Kyonsoat	5.00	8.10	2.60	2.40	3.80
32	Maubin Island (North)	12.40	20.00	2.40	10.00	16.00
33	Maubin Island (South)	4.40	7.10	0.40	4.00	6.40
34	Thonegwakyun	22.25	35.80	10.25	12.00	19.20
Total		**585.35**	**942.40**	**450.65**	**129.35**	**206.90**

(2) Planning and Design

1) Planting mangrove species

Considerations in the selection of mangrove tree species were based on natural condition of plantation site, seedling supply, local demand, biodiversity and so on. For the D/P, three mangrove species, namely *Sonneratia apetala* (Sa, local name is Kanbala), *Nypa fruticans* (Nf, local name is Dani) and *Avicennia officinalis* (Ao, local name is Thame Gyi) are chosen based on the experience of the Pilot Project.

Selected three mangrove species：***Sonneratia apetala*** **(left)**、 ***Nypa fruticans*** **(center)**、***Avicennia officinalis*** **(right)**

Sonneratia apetala is suitable mostly in river ward zone like long submerging place. Sa has wider spread aerial roots, and is resistant to strong tide and wave. To protect the village from further disasters, it would be necessary to plant Sa in most of river ward zone. Moreover, as huge number of Sa is available in the FD Thar Kone nursery, seedling procurement of Sa is relatively easy.

Nypa fruticans are suitable in middle and land ward zone, and are found in flat wetland like back marsh of river. Nypa leaflet is good material for roofing and house construction. It will be a good cash income source for local residents.

Avicennia officinalis has widest adaptation against any circumstance of mangrove habitat. Ao can survive over wet area like river ward zone, also drought area like land ward zone. Ao can multiply by vegetative propagation, and a possible good source for fuel wood.

2) Planting design and amount

Planting design of the D/P is shown in **Figure 5.6-1** and **Figure 5.6-2**. *Sonneratia apetala* is planted at most river ward zone, *Nypa fruticans* at the middle portion and *Avicennia officinalis* most at the land ward zone. Width of Sa and Nf are 15m each, width of Ao is 20m, total width is 50m. Planting length is dependent on the required length of windbreak rehabilitation along the dike. Planting spacing of each three species are 2m x 2m. Spacing of planting trees is arranged as equilateral triangle shape, as it is more effective protection from tidal wave.

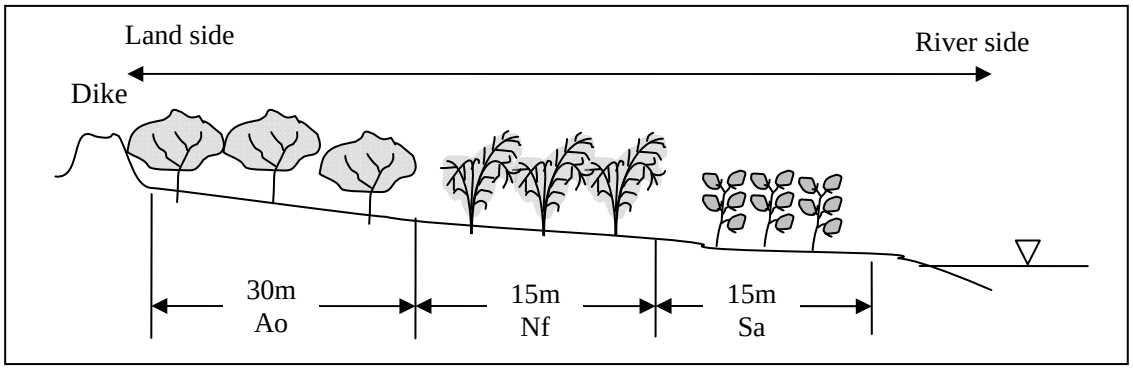


Figure 5.6-1 Cross Section of Typical Planting Site

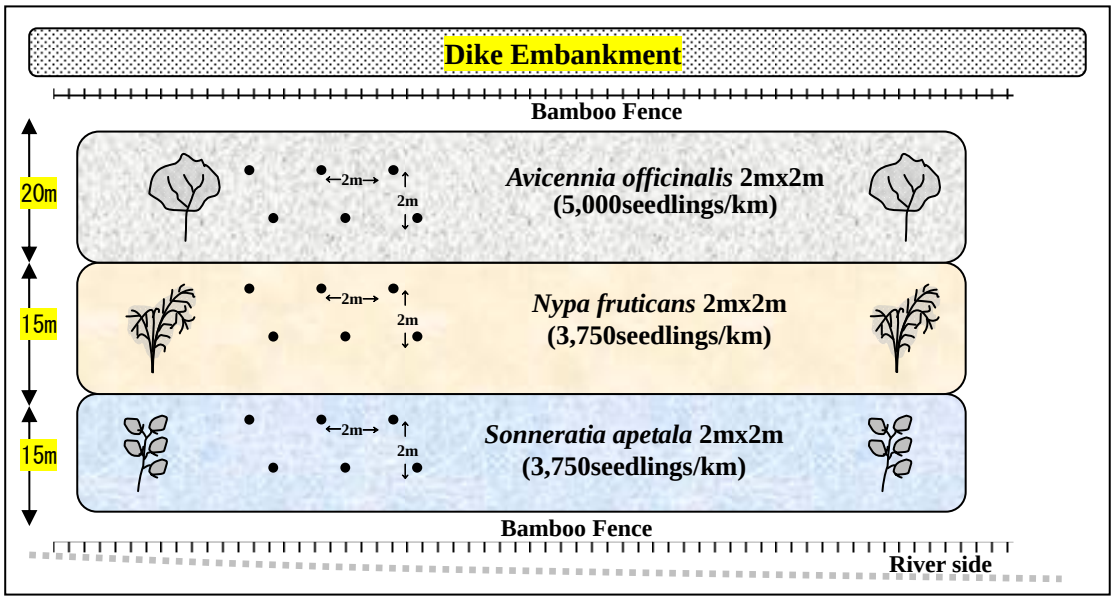


Figure 5.6-2 Typical Design for Mangrove Plantation

Planting volume of Sa and Nf are 3,750 seedlings and Ao is 5,000 seedlings, each for one kilometer.

3) Procurement of seeds and seedlings

Information for procurement of seeds and seedlings for planting mangrove species is shown in **Table 5.6-2**. Seedling of Sa and Ao Seedling can be obtained from the Thar Kone nursery and Kwakwakalay nursery which are managed by FD. NF seeds also are prepared by FD and local farmers who are at present managed Nf plantation. For the seedling breeding of Nf, temporary nursery for Nf will be prepared at the planting site.

Table 5.6-2 Seed and Seedling Information for Three Mangrove Species

Species	Type of Seed	Procurement body	Type of seedling	Price	Breeding place	Transportation
Sonneratia apetala (Sa)	Non-viviparous seed	FD nursery	Pot	100k/seedling	FD nursery	Boat
Nipa fruticans (Nf)	Non-viviparous seed	FD and private nursery	Without pot	50k/seed	Planting site	Boat
Avicennia officinalis (Ao)	Non-viviparous seed	FD nursery	Pot	100k/seedling	FD nursery	Boat

5) Fencing

In the Ayeyawady Delta area, when monsoon season onset, waves become big and rough. Rough waves affect negatively the growth of planted mangrove trees, as the trees are often severely damaged by the rough wave. To avoid this negative affect, bamboo fence made by knitting a bamboo in the pin grid array format, will be installed around the plantation. The bamboo fence will also serve as protection of the plantation, from entry of animals. The fence will be 10 feet long bamboo trunk where part of four feet is put under the ground, and the remaining part of 6 feet is on the ground. Dimension of the fence is shown on **Figure 5.6-3**.

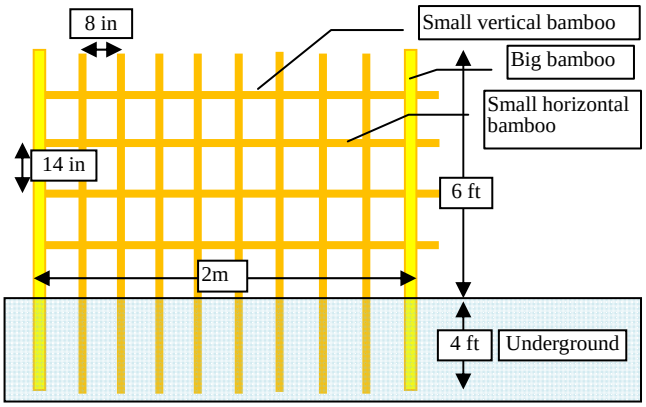


Figure 5.6-3 Dimension of Bamboo Fence

6) Temporary nursery

For the nursery activity of Nf seeds, a temporary nursery is installed in the planting site. The temporary nursery is made of bamboo sticks and Nypa leaves. Bamboo sticks are used to support the roof and the small fence is made around the nursery for the protection of seedlings from tidal waves. Nypa leaves are used for shade.

Temporary nursery

7) Work schedule

As suitable mangrove planting season starts middle of May, Ao and Sa seedling are prepared according to this planting season at the FD nursery. Although suitable season for collecting seed of Nf is middle of March to middle of May, seed of Nf is available throughout the year. As mentioned–above, breeding of Nf seedling is carried out at the temporary nursery in the planting site. Working process will be implemented as follows; (i) Land survey for planting site, (ii) Establishment of temporary nursery, (iii) Breeding of Nf seedling, (iv) Installation of fence, (v) Planting of Sa, Ao seedling, (vi) Planting of Nf seedling, (vii) Maintenance, (viii) Monitoring for supplemental planting, (ix) Supplemental planting. Work schedule is shown as **Table 5.6-3**.

Table 5.6-3 Typical Schedule for Mangrove Windbreak Rehabilitation Work

Work contents	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Land survey for planting site	—											
Establish temporary nursery		—										
Breeding of Nf seedling			—	—								
Fencing			—									
Procurement of Ao & Sa seedlings				—								
Planting				—								
Maintenance					—	—						
Monitoring							☆					
Supplemental planting									—			

(3) Project Volume

1) Unit Quantity required

Facilities, materials and equipment required to establish mangrove plantation site of 1.0 km in length along the dike embankment are presented in **Table 5.6-4**. And **Table 5.6-5** gives project volume required for the mangrove windbreak rehabilitation 34 polders**.**

Table 5.6-4 Unit Quantity required for Mangrove Windbreak Rehabilitation

Length of fence (m)	Number of Sa seedling	Number of Nf seedling	Number of Ao seedling	Number of temporary nursery	Number of marking stick
2,000	3,750	3,750	5,000	1	12,500

Table 5.6-5 Project Volume by Polder for Mangrove Windbreak Rehabilitation

Sr. no.	Polder name	Target of rehabilitation (km)	Planting area (ha)	Length of fence (m)	No. of Sa seedling	No. of Nf seedling	No. of Ao seedling	No. of temporary nursery
1	Alegyun (1) polder	0.2	1	400	750	750	1,000	1
2	Alegyun (2) polder	4	20	8,000	15,000	15,000	20,000	4
3	Alegyun (3) polder	16	80	32,000	60,000	60,000	80,000	16
4	Magybinmadaukkan	2.2	11	4,400	8,250	8,250	11,000	3
5	Thingangyi	0	0	0	0	0	0	0
6	Zinywe	0	0	0	0	0	0	0
7	Leikkwin	0	0	0	0	0	0	0
8	Labutta (South)	1.2	6	2,400	4,500	4,500	6,000	2
9	Labutta (North)	2.4	12	4,800	9,000	9,000	12,000	3
10	U Gaungpu	0	0	0	0	0	0	0
11	Bitud Island (1)	4.8	24	9,600	18,000	18,000	24,000	5
12	Bitud Island (2)	12.8	64	25,600	48,000	48,000	64,000	13
13	Bitud Island (3)	16	80	32,000	60,000	60,000	80,000	16
14	Bitud Island (4)	40.8	204	81,600	153,000	153,000	204,000	41
15	Daunggyi	11.2	56	22,400	42,000	42,000	56,000	12
16	Daunggyi (East)	0	0	0	0	0	0	0
17	Daunggyi (West)	0	0	0	0	0	0	0
18	Daunggyi (Upper)	0.3	1.5	600	1,125	1,125	1,500	1
19	Daw Nyein polder	0	0	0	0	0	0	0
20	Myokone polder	0	0	0	0	0	0	0
21	Kyetphamwezaung	27.2	136	54,400	102,000	102,000	136,000	28
22	Banbwezu	0	0	0	0	0	0	0
23	Daydalu	0	0	0	0	0	0	0
24	Letpanbin	0	0	0	0	0	0	0
25	Zinbaung	0	0	0	0	0	0	0
26	Myaseinkan	2.4	12	4,800	9,000	9,000	12,000	3
27	Thandi	2.4	12	4,800	9,000	9,000	12,000	3
28	Suclubbaluma	1.6	8	3,200	6,000	6,000	8,000	2
29	Hleseik chaunggyi	4.8	24	9,600	18,000	18,000	24,000	5
30	Tamatakaw	11.2	56	22,400	42,000	42,000	56,000	12
31	Kyonsoat	3.8	19	7,600	14,250	14,250	19,000	4
32	Maubin Island (North)	16	80	32,000	60,000	60,000	80,000	16
33	Maubin Island (South)	6.4	32	12,800	24,000	24,000	32,000	7
34	Thonegwakyun	19.2	96	38,400	72,000	72,000	96,000	20
	Total	**207**	**1,035**	**413,800**	**775,875**	**775,875**	**1,034,500**	**217**

The total target length of the mangrove windbreak rehabilitation in the whole region at 34 polders is 207 km, and the rehabilitation area is 1,035 ha. The total length of the fence to be prepared is 413,800

m. The required number of Nf and Sa seedlings required for the rehabilitation works is 775,875 seedlings each, while the required number of Ao seedlings for rehabilitation is 1,034,500 seedlings. The total number of the temporary nursery to be put up is 217 nurseries.

5.6.3 Implementation Method and Implementing Body

(1) Implementing Body

The composition of the organization which is proposed to implement mangrove windbreak rehabilitation project is shown in **Figure 5.6-4.**

Local Government

Purpose and tasks of Mangrove windbreak rehabilitation project is to plant mangrove along the polder dike. However, this kind of rehabilitation project is out of the administrative scope of ID and FD, as both departments does not have the mandate to manage planting activity along the dike. Therefore, support to the mangrove windbreak rehabilitation project will have to be provided by local administration. Unfortunately, local administration does not have implementation body for mangrove wind break rehabilitation so far. The local administration will contract local consultant to implement the mangrove wind break rehabilitation activities.

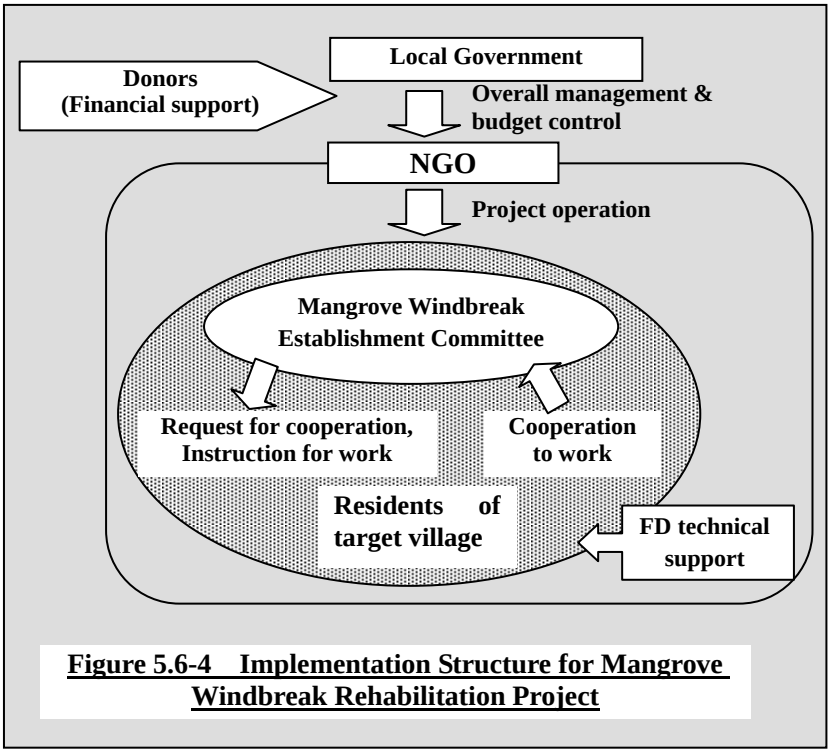


Figure 5.6-4 Implementation Structure for Mangrove Windbreak Rehabilitation Project

Local consultants

The consultant will organize the local villagers group, and will organize a "Mangrove Windbreak Establishment Committee" to implement mangrove tree planting in each target village. The local consultant will control and manage the windbreak rehabilitation project through this committee. The local consultant will receive budget allocated by the local administration for the required materials and equipment. The villagers residing within the Project Area will be provided the required training and skill through the conduct of technology transfer training by a local NGO. The local villagers will have the responsibility to participate not only in the rehabilitation activities but also in the operation and maintenance of the project after project completion

Mangrove Windbreak Establishment Committee

A mangrove windbreak development committee is composed of members of the village community. The committee will be provided guidance and assistance by the local NGO specifically in the delineation of roles and responsibilities and in the preparation of work schedule of the windbreak rehabilitation project

Local residents

The local resident will be requested to cooperate and assist in the work activities for the mangrove windbreak rehabilitation project according to the request of the mangrove windbreak establishment committee.

Forest Department (FD)

FD conducts technical support for the mangrove windbreak rehabilitation project. The seedling which is used for the planting is procured from the FD nursery.

Donors

There is a need to look for donors that will provide financial support for the mangrove windbreak rehabilitation project.

(2) Implementing Method

Figure 5.6-5 describes the implementation process of the mangrove windbreak rehabilitation project. In the mangrove windbreak rehabilitation project, the role of the local NGO is very important as it would be involved in almost all aspects of the implementation process. The local NGOs will organize the mangrove windbreak establishment committee that would be the core of project. The NGO will also provide the necessary training and technology transfer necessary for the efficient and effective implementation and management of the by the committee.

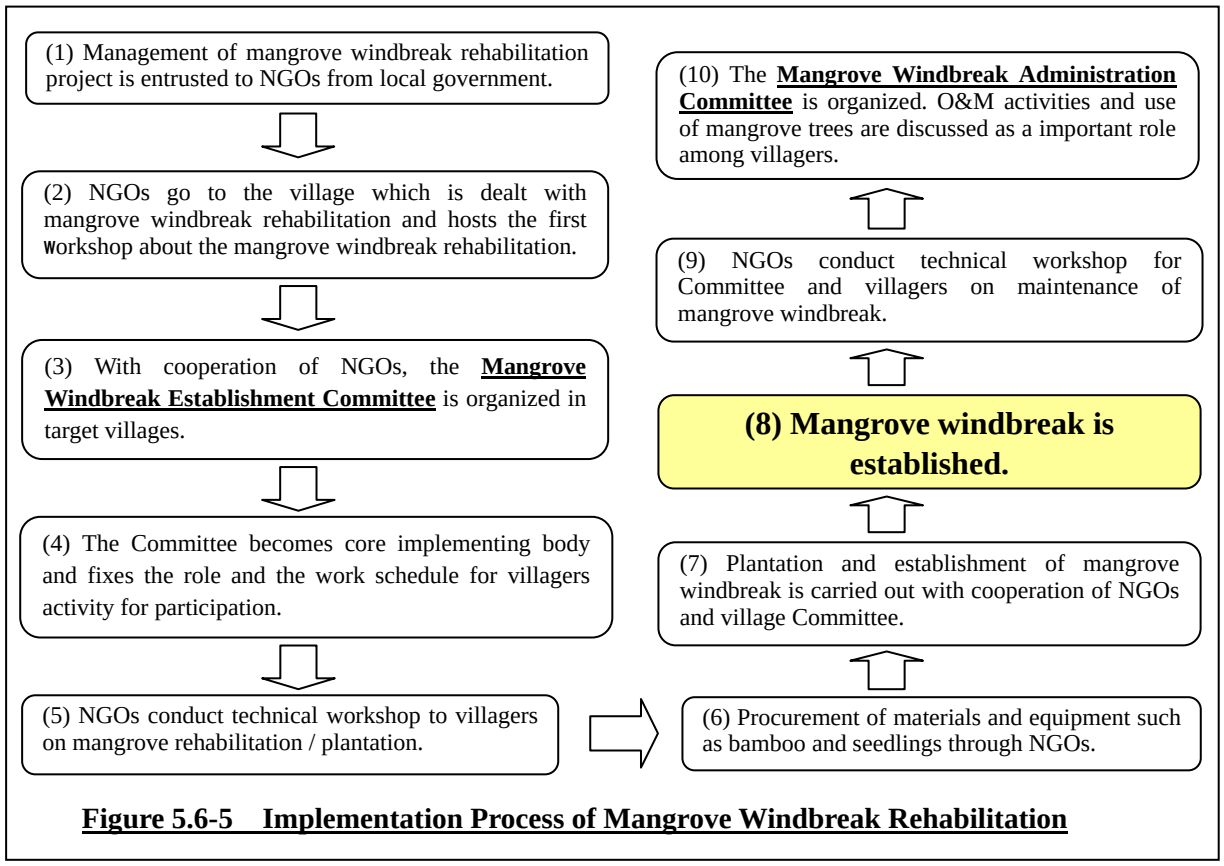


Figure 5.6-5 Implementation Process of Mangrove Windbreak Rehabilitation

5.7 Environmental Study

5.7.1 Guideline on Environmental Impact Assessment

Myanmar has environmental problems such as deforestation, decrease of biological resources, land degradation due to wind and water erosion, urbanization and improper waste management nationwide. In 1990, a new organization known as the National Commission for Environmental Affairs (NCEA) was initiated by the Ministry of Foreign Affair to act as a central management agency for environmental concerns. This organization was transferred under the stewardship of the Ministry of Forestry in 2005. Current NCEA is responsible for environment issues within the Forest Reserve area only thus it is not mandated to control the area outside of the forestry reserved area. According to NCEA officers, TPDCs have authority on environmental matters such as land acquisition. Therefore, the collaboration between a proponent organization and township office is essential to assess the environmental impacts.

Currently, the country has no formal system for environmental impact assessment (EIA). EIAs are conducted to some extent, however, they are implemented on a case-to-case basis for projects or particular activity funded by international organizations and some foreign corporations. The ID has some experiences in assessing environmental effects caused by irrigation structure constructions, however, there are no stipulated guidelines or manuals describing specified procedures to assess effects and mitigate negative impacts so far. Taking into consideration this situation, the proponent was recommended to comply with "JICA Guidelines for Environmental and Social Considerations" as stipulated in M/M on S/W signed between GoJ and GoUM.

5.7.2 Initial Environmental Examination (IEE)

The proposed components of Development Plan are 1) rehabilitation of agricultural and rural infrastructures, 2) Improvement of farming, 3) Income generation, and 4) rehabilitation of mangrove windbreak and are almost same as those in the Pilot Project. Therefore, expected impacts are also almost the same as the ones described in Chapter 4.4. Considering that main activities are rehabilitation of existing structures or promotion/ improvement of current activities, negative impacts on the natural environment by the development plan can be very minimal. Furthermore, since improvement of farming shall target farmers, and income generation will target landless people, there will be more people that benefit from the project, in other words, there will be less inequality of benefit among people.

However, increasing ~~of~~ the height of existing polder dikes, which will need large quantity of soil, is proposed to secure farmland and rural life, therefore, this component needs land acquisition. Taking into consideration that a customary rule (described in Chapter 4.3) restricts the land use for private purposes within 50 feet from toe of dike of Labutta North Polder, it is needed to confirm the area of ROW to be reserved in each target polder to clarify the boundary of legal and illegal area, since it is possible that the ROW can be different depending on polders. Moreover, it is necessary, that when the Development Project is implemented, investigation should be carried out on the land use conditions and presence of illegal occupants in the 34 polder dikes in collaboration with TPDCs concerned. Main anticipated impacts, countermeasure against them and monitoring plan are shown below.

(1) Social Impacts

Generally, in the Ayeyawady Delta, agriculture is the most important income source. On the other hand, some villages depend on fishery. Since both farmers and fishermen lost their necessary properties e.g. cattle, farming equipments to make living caused by cyclone Nargis, the rehabilitation plan is beneficial for the most of people in terms of security of their lives and economic activities. Furthermore, since the plan will be introduced by ID in collaboration with TPDCs to the people, existing social institutions will not be affected.

As to ethnic distribution in the area, Burma people is the major ethnic group (more than 90%) in

Daydaye, Kyaiklatt, Labutta, Ngaputaw and Phyapon, while 13 percent of the population in the polders of Bogalay is Karen tribe (2010, JICA Team)[11]. According to TCG, January 2009, "Post-Nargis Social Impacts Monitoring: November 2008", the relationship among various people is relatively good, sometimes, mixed ethnic group reside in the same villages. At the implementation stage of development plan, there will be no need to consider ethnic groups because of their limited number and their minimal cultural differences.

Probable affected people will be legal/illegal cultivators and legal/illegal residents around the polder dikes. Before implementation, it is necessary to handle carefully this issue. Principally, it is not needed to provide new farm lands or residential area for illegal occupants. However, considering that these people are the poorest stratum in community, there is a need to exert efforts to minimize the negative impacts on them. Construction methods are proposed according to the situations in the sites. This attempt consists of two stages, namely, design stage and construction stage.

Concerning the design stage, as mentioned in Chapter 4.4 for the Pilot Project, the construction methods to minimize the negative impact on the people are also proposed for the Development Plan. The proposed side slope of dike embankment for rehabilitation is 1:1.5, which is the same as that proposed in the Development Plan, to minimize loss of farmlands. This slope is also appropriate in terms of safety.

At the construction stage, machinery equipment is very useful in terms of efficiency and cost effectiveness, however, in this case, temporary dike setting is needed for soil moisture adjustment, which needs wide area. Therefore, if there are some houses along the embankments, manpower utilization for banking is proposed, which can adjust soil moisture by manpower tamping without temporally dike setting. Furthermore, when borrow pits are set near the embankment, it can damage neighboring houses. For minimization of resettlement, the location of borrow pits can be determined based on the site conditions, which means that soil will be transported from neighboring borrow pits.

(2) Natural Impacts

The natural impacts caused by the implementation of master plan are generally negligible since the plan aims to rehabilitate the existing structures instead of new constructions. Rehabilitation of Mangrove Tree is one of components of the Development Plan and it is to rehabilitate the damaged Mangrove caused by Cyclone Nargis. Mangrove has various species, and the most common species in the area was taken into consideration for eco-system conservation. The planting of mangrove will be carried out in environment-friendly manner, *i.e.;* without machinery, equipment, chemicals and fertilizers. Therefore, the impacts on the natural environment can be very limited.

(3) Pollution

The main anticipated negative impacts are air pollution, water deterioration, waste, noise and vibration and so on. They are tentative activities and the period is limited to construction stage only. Concerning dust, if manpower is used for the construction, it is possible to suppress the dust generation to some extent. According to the lessons learnt in the Pilot Project, since the soil is relatively wet, the possibility to generate dust can be low. In addition, machines will be used in non-residential areas. Water pollution due to disposal of used fuel and lubricants can be expected. Proper disposal of used oil and lubricants and/or recycle used oil and lubricants should be ensured. Solid waste such as construction materials will be generated and it is needed to set a stockyard for all the construction materials far from rivers and bodies of water. It is proposed that waste material as recycled as much as possible. Since construction works can cause noise and vibration around the sites, working hours can be set from morning to evening to avoid disturbing the people. In addition, maintenance of construction equipment and vehicles, and using appropriate sound abate devices are needed.

(4) Scoping Checklist

[11] Present Condition Survey (JICA Team, 2010)

A scoping checklist describing environmental impact by the project in the Development Plan is summarized below.

Table 5.7-1 Scoping Checklist for the Development Plan

No.	Impacts	Rating	A Brief Description
Social Environment: *Regarding the impacts on "Gender" and "Children's Right", might be related to all criteria of Social Environment.			
1	Involuntary Resettlement	B	It is essential to confirm distribution of houses around polder dikes. Based on the result, it is necessary to minimize resettlement of households including illegal residents by construction works. It is necessary to provide compensation for the legal residents that will be resettled, if any.
2	Local economy such as employment and livelihood, etc.	D	The rehabilitation works will generate employment opportunity to local people that is expected to be beneficial for the local economy. Equal employment opportunity should be provided for the people.
3	Land use and utilization of local resources	B	It is needed to study the current width to be reserved in each polder, which is managed by ID. Due to expansion of the area under control by ID, there is possibility that some farmers will lose their lands. Standing crops which can be spoiled by the Development Plan should be compensated.
4	Social institutions such as social infrastructure and local decision-making institutions	D	The possible activities to be implemented under the project are not expected to influence directly social institutions.
5	Existing social infrastructures and services	D	The possible activities to be implemented under the project are not expected to influence adversely on the social infrastructure and local decision-making institutions.
6	The poor, indigenous and ethnic people	B	Majority of the residents in the Project Area are Burmese with limited number of minority. These people are new residents due to new development history of Ayeyawady Delta, where indigenous people are not observed. It is important to pay attention to equal job opportunity provision instead of targeting specified ethnic, cultural, religious groups. The residents along the polder dike can be affected by the Development Plan, construction method to minimize the resettlement and land acquisition e.g. manpower use and so on should be applied.
7	Misdistribution of benefit and damage	D	Sufficient attention to equal employment of local work force can avoid misdistribution of benefit.
8	Cultural heritage	C	Important cultural heritages are temples; however, they are not located on or near the polder dikes and possibility of negative effect on the cultural heritages is negligible. It is needed to confirm the situation based on result of on-going socio-economic survey.
9	Local conflict of interests	D	Lack of consideration to hire local work force as per "Item 7" above has potential to lead to local conflict of interest.
10	Water Usage or Water Rights and Rights of Common	D	Saline water from outside can be prevented through the rehabilitation works, which leads to improvement of water quality.
11	Sanitation	D	The project will not cause impairment on sanitation and flood prevention by the repair works can lead to improvement of sanitation.
12	Hazards (Risk) Infectious diseases such as HIV/AIDS	B	It is recommended to employ workers within the study area as much as possible to minimize hazard from outside.
Natural Environment			

No.	Impacts	Rating	A Brief Description
13	Topography and Geographical features	D	The structural measures are of small-scale such as repair works to cause any significant effects on these features.
14	Soil Erosion	D	During the rehabilitation works, soil erosion might occur at construction spots without using appropriate construction method. Bank protection such as vegetation should be implemented to prevent bank from soil erosion.
15	Groundwater	D	All project activities do not extract groundwater and have no significant effect on groundwater or its quality.
16	Hydrological Situation	D	The repair works will enable to drain saline water from the polder effectively and it is expected not to cause negative impact on hydrological situation.
17	Coastal Zone (Mangroves, Coral reefs, Tidal flats, etc.)	D	Master plan will include rehabilitation of windbreak such as mangrove plantation. The project will not give adverse effects on the coastal zone.
18	Flora, Fauna and Biodiversity	D	Since new civil engineering facilities will not be constructed, no significant impact on biodiversity is expected.
19	Meteorology	D	There are no activities that may affect the meteorology.
20	Landscape	D	The civil engineering works are mainly rehabilitation and are of small-scale to cause any significant adverse effects including visual impact on landscape.
21	Global Warming	D	There are no activities with constant emission of green house substances.
Pollution			
22	Air Pollution	B	The construction vehicles could increase exhaust gas, however, it will be temporary. Moreover, manual works will be applied in the residential areas. Machines will be mainly used in the non-residential areas, which can minimize dust generation and gas emission.
23	Water Pollution	B	Construction works along rivers would cause short-term deterioration in water quality due to increased turbidity.
24	Soil Contamination	D	There are no activities necessitating the use of toxic materials that may lead to soil contamination.
25	Waste	B	Construction wastes will be generated that has to be managed appropriately focused on reuse of the wastes as much as possible.
26	Noise and Vibration	B	Construction works have potential generate short-term noise and vibration. This has to be managed appropriately in particular when such work is carried out near residential areas.
27	Ground Subsidence	D	There is no extraction of groundwater which leads to ground subsidence.
28	Offensive Odor	D	Temporary offensive odor is expected due to exhaust gas of construction vehicles and machine during only construction period and at low level.
29	Bottom sediment	D	Disposal of harmful substances such as heavy metals or organic chlorine compounds to river/sea is not planned and there is no possibility that bottom sediment will be polluted by the project.
30	Accidents	B	Accidents may occur in any construction work, basically occupational health and safety issue is limited to the period of construction works. Careful consideration to avoid any accident is necessary.

Rating: A: Serious impact is expected. B: Some impact is expected.
C: Extent of impact is unknown D: No or negligible impact including positive impact is expected.

(5) Recommendations on Environmental Consideration

1) Set-up of the committee for orientation of the Development Plan

The information of land acquisition and resettlement resulted by the embankment works was not transmitted effectively at the Pilot Project, even though there is information–distributing system, namely, from the TPDC to VPDC and finally, to the villagers. If people can get information early, they will be able to prepare or take countermeasures, e.g. abandon of seeding in the affected area. Therefore, it is recommended to form a committee consisting of personnel from various agencies e.g. ID, SLRD, TPDC, which will be responsible for effective information dissemination at the village level. Accordingly, this committee will arrange compensation/supports for resettlement of legal residents.

2) Explanation of ROW to the people

Some people in the Pilot Project area did not understand area of ROW sufficiently, it is needed to enhance people's understanding about this matter. Therefore, it is recommended that ID has to confirm area of ROW in each polder dike and to take initiative to explain about ROW in collaboration with other authorities.

3) Minimization of resettlement

Through the Pilot Project, resettlement was minimized t by application of manual works based on the site conditions, e.g. house distribution, even though they were illegal. It is recommended to ID to consider these experiences in the development plan implementation.

4) Support for the people

In the Pilot Project implementation stage, based on the request from villages, some borrow pits were modified into water ponds for village and school use, which made people happy. Such support for the surrounding people can be disseminated through the Development Plan.

(6) Monitoring Plan on Environmental Consideration

Based on the recommendations mentioned above, a series of consideration to minimize adverse effect will be necessary to be undertaken in the Development Plan. The main negative impacts can be caused by the embankment works. It is needed to monitor the situations during the pre-construction stage and construction stage of the implementation of Plan. The items to be monitored are as follows:

Table 5.7-2 Proposed Monitoring Plan

Stage	Items to be monitored	Responsible organization	Number of times/ Frequency
Pre-construction	Identification of house location that will be affected by works and their numbers	ID	Once
	Notice of project to people and confirmation of people's awareness of project	Committee consisting of ID, SLRD, TPDC and so on	Notice: once Confirmation of awareness: once per two months
	Identification of standing crop and its area	Committee consisting of ID, SLRD, TPDC and so on	Once
	Monitoring of people's understanding of ROW	ID in collaboration with other authorities	Once per two months
	In case of legal resettlement, compensation for the affected people have to be provided	Committee consisting of ID, SLRD, TPDC and so on	Once per month
Construction	Minimization of resettlement and number of resettled houses	ID	Once per month

5.8 Implementation Plan and Schedule

5.8.1 Overall Implementation Plan

The D/P will require certain period to implement its component projects over 34 polders. Therefore, in order to formulate the implementation schedule on polder basis, the selection of grouping and priority of polders will be needed through the various studies. Method and flow of overall study are shown below.

Step-1	Contents of Study
Grouping of 34 polders	- Available yearly embankment volume - Geographical conditions

⇩

Step-2	Contents of Study
Study on priority ranking 1 Emergency (Risk) evaluation 2 Effective disaster prevention	Among each group and each polder 1 Difference between planed height and existing height 2 Economic benefit with implementation of development

⇩

Step-3	Contents of Study
Implementation schedule	- Overall construction period - Schedule plan considering priority of polder group

In addition, each project for “Improvement Farming”, “Income Generation” and “Mangrove Windbreak” shall be implemented one by one in the polder when rehabilitation of polder dike and sluice will be completed.

5.8.2 Selection of Priority Polders and Embankments

(1) Grouping of 34 polders

For the grouping of 34 polders, the following conditions are taken into account:

1) Available yearly embankment volume by ID’s actual results and work sharing with contractor

- Actual results by ID in 2 DS (dry season): 2,637,696 sud x 0.52(progress)/3=457,200 sud/DS
- Target volume considering work sharing: 235,000 sud / 1 season (refer to pilot project in Labutta North)

Therefore, grouping shall be decided based on target unit volume by 346,000 sud/DS (979,000 m3/DS) which is almost mean volume of above. However, polders (No.3, 4, 9, 26) of more than 70% of present construction progress shall be deducted from the grouping, since these polders are supposed to be completed within dry season.

2) Considering geographical conditions

- 1 group of polders shall be kept in the same township taking ID’s supervision into consideration.
- To unify near distance of polders by 1 group considering flexibility of equipment transportation.

Based on the above, 34 polders were divided into 10 groups as presented in the following table.

Table 5.8-1 Grouping of 34 Polders for Construction Planning in Development Plan

Township	No	Name of Polder Dike	ID Design Volume (Sud)	Progress for ID Design Volume (%)	Remained Volume for ID design (1) (Sud)	Increased Volume (2) (Sud)	Additional Volume (3) (Sud)	Remained Necessary Volume (1)+(2)+(3) (Sud)	Construction Grouping No.	Bank Volume on Each Group (Sud)
Labutta	1	Alegyun (1)	41,100	0	41,100	-	-	41,100	1	
	2	Alegyun (2)	128,446	0	128,446	-	-	128,446	1	363,782
	3	Alegyun (3)	94,606	100	0	-	-	0	-	
	4	Magyibinmadaukan	20,745	100	0	-	-	0	-	
	5	Thingangyi	70,198	68	22,463	22,983	-	45,446	2	
	6	Zinywe	37,132	100	0	-	40,998	40,998	2	
	7	Leikkwin	25,743	0	25,743	20,194	-	45,937	2	239,953
	8	Labutta (S)	154,128	0	154,128	40,108	-	194,236	1	
	9	Labutta (N)	186,518	86	25,518	48,482		74,000	-	
	10	U Gaungpu	61,854	0	61,854	45,718	-	107,572	2	
	11	Bitud Island (1)	97,417	23	75,011	66,034	-	141,045	3	
	12	Bitud Island (2)	103,586	7	96,335	75,767	-	172,102	3	313,147
	13	Bitud Island (3)	247,500	54	113,850	144,295	-	258,145	4	
	14	Bitud Island (4)	224,103	100	0	-	68,223	68,223	4	326,368
Bogalay	15	Daunggyi	35,692	17	29,624	151,047	-	180,671	6	
	16	Daunggyi (East)	125,000	36	80,000	246,292	-	326,292	5	326,292
	17	Daunggyi (West)	226,630	100	0	-	32,961	32,961	6	
	18	Daunggyi (Upper)	41,156	0	41,156	65,917	-	107,073	6	320,705
Phyapon	19	Dawnyein	36,343	100	0	-	100,513	100,513	7	
	20	Myokone	59,286	100	0	-	130,915	130,915	7	421,730
	21	Kyetphamwezaun	190,200	6	178,788	290,580	-	469,368	8	469,368
	22	Banbwezu	45,114	0	45,114	145,188	-	190,302	7	
	23	Daydalu	61,943	100	0	-	92,932	92,932	9	
	24	Lepanbin	35,400	100	0	-	138,356	138,356	9	
	25	Zinbaung	22,800	18	18,696	96,433	-	115,129	9	346,417
Daydaye	26	Myaseinkan	134,274	72	37,597	-	-	37,597	-	
	27	Thandi	16,931	100	0	-	4,151	4,151	10	
	28	Suclubbaluma	5,944	100	0	-	11,654	11,654	10	
	29	Hleseikchaunggyi	5,885	0	5,885	15,377	-	21,262	10	
	30	Tamatakaw	3,902	100	0	-	8,021	8,021	10	
	31	Kyonsoat	14,950	100	0	-	4,457	4,457	10	
Kyaiklatt	32	Maubin Island (N)	12,060	0	12,060	50,940	-	63,000	10	
	33	Maubin Island (S)	660	0	660	7,865	-	8,525	10	
	34	Thonegwakyun	70,450	0	70,450	61,739	-	132,189	10	253,259
Total			2,637,696	52	1,264,479	1,594,959	633,181	3,492,619	10	3,381,022
Grand Total for remained, increased and additional vol.				1sud= 2.83m3	3,492,619	(9,884,112 m3)				
Grand Total except No.3,4,9,26 Polder					3,381,022	(9,568,292 m3)		Group av.	338,000 (956,000m3)	

Note: 1. JPT means JICA Project Team and progress is informed by ID as of end of March 2011.

2. Increased Volume means necessary quantity added to ID design volume based on JPT design ACL.

3. Additional Volume means raising quantity for completed (nearly 100%) embankment.

(2) Study on Priority Ranking

1) Evaluation of Emergency Risk

Criteria for evaluation of each polder are shown in the table and evaluation method for each polder group is estimated by weighted average on each polder point in the group as follows;

- Evaluation point of group = (ΣV×P) / (ΣV)
  Where, V: embankment volume on each polder
  P: evaluation point on each polder

Results shall be referred to **Appendix A6-7 Table 6-7-1.**

Criteria of Emergency Risk	
ACL – ECL (ft)	Evaluation Points
> 6.0ft (1.8m)	3 (High)
6.0~3.0ft (1.8～0.9m)	2 (Mean)
< 3.0ft (0.9m)	1 (Low)

2) Evaluation of Disaster Prevention Effects

Disaster prevention effect on each polder has been ranked in terms of ratio of annual prevention value to embankment volume according to the evaluation criteria as shown in table.

- Evaluation point of group = (ΣA×P) / (ΣA)
  Where, A: annual prevention value on each polder,
  P: evaluation point on each polder

Results are presented in **Appendix 6-7-2.**

Criteria of Disaster Prevention Effects	
Annual prevention value/embankment volume	Evaluation Points
＞4.0	3 (High)
1.5 – 4.0	2 (Mean)
＜1.5	1 (Low)

3) Selection of Priority Polder Groups

As for overall evaluation, the sum up points for emergency evaluation and points for disaster prevention effects shall be added to determine the priority ranking of polders and group. As shown in **Table 5.8-2**, priority ranking of polder groups in Labutta & Bogalay Township was evaluated higher than others.

Table 5.8-2 Priority Ranking of Polder Groups

Township	Gr. No	Polder No.	Name of polder	Evaluation of Emergency		Evaluation of Disaster Prevention Effects		Overall Evaluation		Priority Ranking	Remarks
				Each Polder (1)	Each Group (2)	Each Polder (3)	Each Group (4)	Each Polder (1)+(3)	Each Group (2)+(4)	Group Basis	Progress by ID's Work (%)
Labutta	1	1	Alegyun (1)	1		3		4			0
		2	Alegyun (2)	2		2		4			0
		8	Labutta (South)	2	1.9	2	2.3	4	4.2	4	0
	-	3	Alegyun (3)	1		3		4			100
	-	4	Magybinmadaukkan	2		2		4			100
	-	9	Labutta (North)	2		3		5			70
	2	5	Thingangyi	3		1		4			68
		6	Zinywe	2		1		3			100
		7	Leikkwin	3		1		4			0
		10	U Gaungpu	3	2.8	1	1.0	4	3.8	8	0
	3	11	Bitud Island (1)	3		1		4			23
		12	Bitud Island (2)	2	2.5	2	1.7	4	4.2	4	7
	4	13	Bitud Island (3)	3		1		4			54
		14	Bitud Island (4)	2	2.8	2	1.5	4	4.3	3	100
Bogalay	5	16	Daunggyi (East)	3	3.0	2	2.0	5	5.0	1	36
	6	15	Daunggyi	2		3		5			17
		17	Daunggyi (West)	2		3		5			100
		18	Daunggyi (Upper)	2	2.0	2	2.9	4	4.9	2	0
Phyapon	7	19	Daw Nyein	2		1		3			100
		20	Myokone	2		1		3			100
		22	Banbwezu	2	2.0	1	1.0	3	3.0	10	0
	8	21	Kyetphamwezaung	3	3.0	1	1.0	4	4.0	7	6
	9	23	Daydalu	3		1		4			100
		24	Letpanbin	2		1		3			100
		25	Zinbaung	2	2.3	1	1.0	3	3.3	9	18
Daydaye	-	26	Myaseinkan	2		2		4			72
	10	27	Thandi	2		2		4			100
		28	Suclubbaluma	1		3		4			100
		29	Hleseikchaunggyi	1		2		3			0
		30	Tamatakaw	1		3		4			100
		31	Kyonsoat	1		1		2			100
Kyaiklatt		32	Maubin Island (N)	2		2		4			0
		33	Maubin Island (S)	1		3		4			0
		34	Thonegwakyun	2	1.8	1	2.3	3	4.1	6	0

5.8.3 Implementation Schedule

Project period for the D/P depends on the construction period of dike embankment which is the most critical and dominant work in all projects. According to the above study and implementation period on each project, total implementation period is estimated as nine (9) years for 34 polders. Overall implementation schedule for the whole project is shown in **Table 5.8-3**.

Table 5.8-3 Implementation Schedule by Polder and by Component

Sr. No	Polder name	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year	8th Year	9th Year	Rehabilitation of Agricultural and Rural Infrastructure Group
1	Alegyun (1)										No.1
2	Alegyun (2)										
3	Alegyun (3)										Only for sluice gate
4	Magybinmadaukkan										-
5	Thingangyi										No.2
6	Zinywe										
7	Leikkwin										
8	Labutta (South)										No.1
9	Labutta (North)										-
10	U Gaungpu										No.2
11	Bitud Island (1)										No.3
12	Bitud Island (2)										
13	Bitud Island (3)										No.4
14	Bitud Island (4)										
15	Daunggyi										No.6
16	Daunggyi (East)										No.5
17	Daunggyi (West)										No.6
18	Daunggyi (Upper)										
19	Daw Nyein										No.7
20	Myokone										
21	Kyetphamwezaung										No.8
22	Banbwezu										No.7
23	Daydalu										No.9
24	Letpanbin										
25	Zinbaung										
26	Myaseinkan										-
27	Thandi										No.10
28	Suclubbaluma										
29	Hleseikchaunggyi										
30	Tamatakaw										
31	Kyonsoat										
32	Maubin Island (North)										
33	Maubin Island (South)										
34	Thonegwakyun										

: Rehabilitation of agricultural and rural infrastructure
: Rehabilitation of mangrove windbreak
: Improvement of farming
: Income generation

(1) Rehabilitation Plan on Agricultural and Rural Infrastructure

This project period is proposed to be implemented within five (5) years because of the following reasons.

- Embankment volume of polder dike with high ranking for emergency (much difference between ACL and ECL) still remains comparatively so much, so it is necessary to complete early to prevent disaster caused by high tide or high flood.
- Taking existing construction results into consideration, it was estimated that it will be possible to complete two (2) groups of embankment by 700,000 sud/DS (1,980,000 m3/dry-season).

In addition, rehabilitation work of sluice shall be carried out simultaneously with the rehabilitation works of the dike embankment. It is also proposed that for the remaining sluice rehabilitation in Alegyun (3) shall be implemented at the same time as the rehabilitation of group No.1 or No.2 which is located near Alegyun (3).

Table 5.8-4 Implementation Schedule for Rehabilitation on Agricultural and Rural Infrastructure

Group	Polder Name	Nos. of Polders	1st year	2nd year	3rd year	4th year	5th year
No. 1	Alegyun (1)~(2), Labutta (S)	3		▬			
No. 2	Thingangyi, Zinywe, Leikkwin, UGaungpu	4				▬	
No. 3	Bitud Island (1)~(2)	2			▬		
No. 4	Bitud Island (3)~(4)	2		▬			
No. 5	Daunggyi (East)	1	▬				
No. 6	Daunggyi, Daunggyi (West, Upper)	3	▬				
No. 7	Dawnyein, Myokone, Banbwezu	3					▬
No. 8	Kyetphamwezaun	1				▬	
No. 9	Daydalu, Lepanbin, Zinbaung	3					▬
No. 10	Thandi, Suclubbaluma, Hleseikchaunggyi, Tamatakaw, Kyonsoat, Maubin Island (N)&(S), Thonegwakyun	8			▬		

(2) Improvement Plan on Farming

The Project will be implemented in accordance with the priority group on polder rehabilitation as explained in Section 5.8.2. The implementation period is five (5) years for each group, a total of nine (9) years for 34 polders. **Table 5.8-5** shows overall implementation schedule of the Project.

Table 5.8-5 Implementation Schedule for Improvement Plan on Farming

Group	Polders	Nos. of Polder	Year									
			1	2	3	4	5	6	7	8	9	10
No. 1	Alegyun (1)~(2), Labutta (S),	3		▬	▬	▬	▬	▬				
No. 2	Thingangyi, Zinywe, Leikkwin, UGaungpu	4				▬	▬	▬	▬	▬		
No. 3	Bitud Island (1)~(2)	2			▬	▬	▬	▬	▬			
No. 4	Bitud Island (3)~(4)	2		▬	▬	▬	▬	▬				
No. 5	Daunggyi (East) , Alegun (3), Magyibinmadaukkan, Labutta (North), Myaseinkan,	5	▬	▬	▬	▬	▬					
No. 6	Daunggyi, Daunggyi (West, Upper)	3	▬	▬	▬	▬	▬					
No. 7	Dawnyein, Myokone, Banbwezu	3					▬	▬	▬	▬	▬	
No. 8	Kyetphamwezaun	1				▬	▬	▬	▬	▬		
No. 9	Daydalu, Lepanbin, Zinbaung	3					▬	▬	▬	▬	▬	
No. 10	Thandi, Suclubbaluma, Hleseikchaunggyi, Tamatakaw, Kyonsoat, Maubin Island (N)&(S), Thonegwakyun	8			▬	▬	▬	▬	▬			

(3) Income Generation Plan

Income generation sub-projects start one year after the rehabilitation work on each polder dike. The implementation period is two (2) years for each group on Vegetable Cultivation sub-project and expected to be completed within seven (7) years, and 4 years for each group for the Pig Raising sub-project, a total of nine (9) years for 34 polders. The schedule proposed for each sub-project is presented in the two (2) tables below.

Table 5.8-6 Implementation Schedule for Vegetable Cultivation Sub-project on Income Generation

No	Polder	Year of rehabilitation	Year of IG starting	Nos HH	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	Alegun (1)	2nd Year	3rd year	75							
2	Alegun (2)	2nd Year	3rd year	112							
3	Alegun (3)	Completed	1st year	60							
4	Magyibinmadaukkan	Completed	1st year	28							
5	Thingangyi	4th Year	5th year	11							
6	Zinywe	4th Year	5th year	12							
7	Leikkwin	4th Year	5th year	7							
8	Labutta (South)	2nd Year	3rd year	78							
9	Labutta (North)	Completed	1st year	271							
10	U Gaungpu	4th Year	5th year	4							
11	Bitud Island (1)	3rd Year	4th year	25							
12	Bitud Island (2)	3rd Year	4th year	131							
13	Bitud Island (3)	2nd Year	3rd year	72							
14	Bitud Island (4)	2nd Year	3rd year	216							
15	Daunggyi Island	1st Year	2nd year	236							
16	Daunggyi (East)	1st Year	2nd year	112							
17	Daunggyi (West)	1st Year	2nd year	320							
18	Daunggyi (Upper)	1st Year	2nd year	51							
19	Daw Nyein	5th Year	6th year	93							
20	Myokone	5th Year	6th year	69							
21	Kyetphamwezaung	4th Year	5th year	363							
22	Banbwezu	5th Year	6th year	156							
23	Daydalu	5th Year	6th year	62							
24	Letpanbin	5th Year	6th year	60							
25	Zinbaung	5th Year	6th year	63							
26	Myaseinkan	Completed	1st year	180							
27	Thandi	3rd Year	4th year	29							
28	Suclubbaluma	3rd Year	4th year	94							
29	Hleseikchaunggyi	3rd Year	4th year	38							
30	Tamatakaw	3rd Year	4th year	199							
31	Kyonsoat	3rd Year	4th year	6							
32	Maubin Island (North)	3rd Year	4th year	369							
33	Maubin Island (South)	3rd Year	4th year	127							
34	Thonegwakyun	3rd Year	4th year	294							

Note: IG means income generation

Table 5.8-7 Implementation Schedule for Pig Raising Sub-project on Income Generation

No.	Polder	Year of rehabilitation	Year of IG starting	Nos HH	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year	8th year	9th year
1	Alegun (1)	2nd Year	3rd year	32									
2	Alegun (2)	2nd Year	3rd year	64									
3	Alegun (3)	Completed	1st year	32									
4	Magyibinmadaukkan	Completed	1st year	16									
5	Thingangyi	4th Year	5th year	16									
6	Zinywe	4th Year	5th year	16									
7	Leikkwin	4th Year	5th year	16									
8	Labutta (South)	2nd Year	3rd year	32									
9	Labutta (North)	Completed	1st year	128									
10	U Gaungpu	4th Year	5th year	16									
11	Bitud Island (1)	3rd Year	4th year	16									
12	Bitud Island (2)	3rd Year	4th year	64									
13	Bitud Island (3)	2nd Year	3rd year	32									
14	Bitud Island (4)	2nd Year	3rd year	112									
15	Daunggyi Island	1st Year	2nd year	112									
16	Daunggyi (East)	1st Year	2nd year	64									
17	Daunggyi (West)	1st Year	2nd year	160									
18	Daunggyi (Upper)	1st Year	2nd year	32									
19	Daw Nyein	5th Year	6th year	48									
20	Myokone	5th Year	6th year	32									
21	Kyetphamwezaung	4th Year	5th year	176									
22	Banbwezu	5th Year	6th year	80									
23	Daydalu	5th Year	6th year	32									
24	Letpanbin	5th Year	6th year	32									
25	Zinbaung	5th Year	6th year	32									
26	Myaseinkan	Completed	1st year	96									
27	Thandi	3rd Year	4th year	16									
28	Suclubbaluma	3rd Year	4th year	48									
29	Hleseikchaunggyi	3rd Year	4th year	16									
30	Tamatakaw	3rd Year	4th year	96									
31	Kyonsoat	3rd Year	4th year	16									
32	Maubin Island (North)	3rd Year	4th year	192									
33	Maubin Island (South)	3rd Year	4th year	64									
34	Thonegwakyun	3rd Year	4th year	144									

Support in fattening and breeding Support in breeding

(4) Rehabilitation Plan on Mangrove Windbreak

The mangrove windbreak rehabilitation project will be implemented along with the polder dike restoration project. Period implementation of this project is four (4) years for 22 polders within 34 polders. The implementation schedule for the mangrove windbreak rehabilitation project is shown in **Table 5.8-8.**

Table 5.8-8 Implementation Schedule for Rehabilitation Plan on Mangrove Windbreak

	Polder name	Target for rehabilitation (km)	1 year	2 year	3 year	4 year	5 year
1	Alegyun (1) polder	0.2		0.2			
2	Alegyun (2) polder	4		4			
3	Alegyun (3) polder	16	16				
4	Magybinmadaukkan	2.2	2.2				
8	Labutta (South)	1.2		1.2			
9	Labutta (North)	2.4	2.4				
11	Bitud Island (1)	4.8			4.8		
12	Bitud Island (2)	12.8			12.8		
13	Bitud Island (3)	16		16			
14	Bitud Island (4)	40.8		40.8			
15	Daunggyi	11.2	11.2				
18	Daunggyi (Upper)	0.3	0.3				
21	Kyetphamwezaung	27.2				27.2	
26	Myaseinkan	2.4	2.4				
27	Thandi	2.4			2.4		
28	Suclubbaluma	1.6			1.6		
29	Hleseik chaunggyi	4.8			4.8		
30	Tamatakaw	11.2			11.2		
31	Kyonsoat	3.8			3.8		
32	Maubin Island (North)	16			16		
33	Maubin Island (South)	6.4			6.4		
34	Thonegwakyun	19.2			19.2		
	Total (km)	206.9	34.5	62.2	83.0	27.2	0

5.9 Cost Estimates

5.9.1 Condition of Cost Estimates

Project costs are estimated based on the following conditions.

i) Project costs for four components, namely 1) rehabilitation of agricultural and rural infrastructure, 2) improvement of farming, 3) income generation, and 4) rehabilitation of mangrove windbreak, will be estimated separately because of different implementation arrangement to be employed.

ii) Rehabilitation of agricultural and rural infrastructure, such as dike embankment and rehabilitation of sluice gates, will be carried out in combination of force account work by ID and contracted work by private contractors.

iii) The component for the improvement of farming, income generation and rehabilitation of mangrove windbreak, only government support costs were included as they are self-benefited self-help projects.

iv) Price level of the cost estimates is as of March 2011.

v) Exchange rate applied is US$ 1 = 869 Kyats (market rate).

5.9.2 Project Costs

The total project costs are estimated at 41,541 million Kyats (equivalent to 47.8 million US Dollar) as summarized in **Table 5.9-1** and **Table 5.9-2**.

Table 5.9-1 Summary of Total Project Costs

Component	Project Costs (1000 Kyats)	Remark
1. Rehabilitation of agricultural & rural infrastructure	39,661,713	To cover 30 polders for embankment & 20 polders for sluice, for 5 years
2. Improvement of farming	231,509	To cover 34 polders for 9 years
3. Income generation	328,738	To cover 34 polders for 9 years
4. Rehabilitation of mangrove windbreak	1,070,583	To cover 22 polders for 4 years
Total	41,292,543	
(In US Dollar)	(47,517,311)	

Table 5.9-2 Summary of Project Costs by Polder and by Component

Unit: 1,000 Ks

Sr. No	Polder name	Rehabilitation of agricultural & rural infrastructure	Improvement of farming	Income generation	Rehabilitation of mangrove windbreak	Total
		(1)	(2)	(3)	(4)	(5)=(1)+(2)+(3)+(4)
1	Alegyun (1)	533,278	1,788	5,869	1,035	541,970
2	Alegyun (2)	1,576,725	4,112	9,385	20,698	1,610,920
3	Alegyun (3)	121,300	5,296	4,940	82,790	214,326
4	Magybinmadaukkan	0	345	2,346	11,384	14,075
5	Thingangyi	498,179	795	1,294	0	500,268
6	Zinywe	449,420	32	1,356	0	450,808
7	Leikkwin	512,721	13	1,046	0	513,780
8	Labutta (South)	2,214,215	2,500	6,055	6,209	2,228,979
9	Labutta (North)	0	10,014	21,681	12,419	44,114
10	U Gaungpu	1,179,204	109	860	0	1,180,173
11	Bitud Island (1)	1,546,136	675	2,161	24,837	1,573,809
12	Bitud Island (2)	2,028,182	4,660	10,562	66,232	2,109,636
13	Bitud Island (3)	2,929,946	3,955	5,683	82,790	3,022,374
14	Bitud Island (4)	913,821	10,372	17,663	211,116	1,152,972
15	Daunggyi	2,190,115	13,244	18,901	57,953	2,280,213
16	Daunggyi (East)	3,868,073	19,166	9,385	0	3,896,624
17	Daunggyi (West)	446,918	15,431	25,940	0	488,289
18	Daunggyi (Upper)	1,190,735	2,915	4,383	1,552	1,199,585
19	Daw Nyein	1,143,024	1,008	7,596	0	1,151,628
20	Myokone	1,462,690	3,140	5,498	0	1,471,328
21	Kyetphamwezaung	5,542,112	26,521	29,215	140,744	5,738,592
22	Banbwezu	2,338,090	10,086	12,722	0	2,360,898
23	Daydalu	1,064,921	2,208	5,064	0	1,072,193
24	Letpanbin	1,551,158	6,798	4,940	0	1,562,896
25	Zinbaung	1,367,744	5,541	5,126	0	1,378,411
26	Myaseinkan	0	9,711	14,821	12,419	36,951
27	Thandi	45,504	2,667	2,408	12,419	62,998
28	Suclubbaluma	127,751	5,992	7,658	8,279	149,680
29	Hleseikchaunggyi	233,074	1,777	2,966	24,837	262,654
30	Tamatakaw	87,926	10,276	15,997	57,953	172,152
31	Kyonsoat	48,858	412	984	19,663	69,917
32	Maubin Island (North)	690,606	23,110	30,199	82,790	826,705
33	Maubin Island (South)	93,451	10,776	10,314	33,116	147,657
34	Thonegwakyun	1,665,836	16,064	23,718	99,348	1,804,966

	Total	39,661,713	231,509	328,738	1,070,583	41,292,543
	(In US Dollar)	(45,640,636)	(266,409)	(378,295)	(1,231,971)	(47,517,311)

5.9.3 Disbursement Schedule

Disbursement schedule of the project costs is presented in **Table 5.9-3**.

Table 5.9-3 Disbursement Schedule of Project Costs

Unit: 1,000 Ks

	Component-1	Component-2	Component-3	Component-4	
	Rehabilitation of Agricultural & Rural Infrastructure	Improvement of Farming	Income Generation	Rehabilitation of Mangrove Windbreak	Total Amount
1st Year	7,695,841	23,146	26,847	178,517	7,924,351
2nd Year	8,167,985	22,284	50,627	321,848	8,562,744
3rd Year	6,567,324	42,546	48,152	429,474	7,087,496
4th Year	8,302,936	42,901	83,239	140,744	8,569,820
5th Year	8,927,627	41,631	59,157	-	9,028,415
6th Year	-	28,337	40,120	-	68,457
7th Year	-	19,070	17,494	-	36,564
8th Year	-	8,510	2,046	-	10,556
9th Year	-	3,083	1,056	-	4,139
Total	39,661,713	231,509	328,738	1,070,583	41,292,543
(In US$)	(45,640,636)	(266,409)	(378,295)	(1,231,971)	(47,517,311)

Note: The 4th year cost of component-1 includes the costs of Alegyun (3) that require only sluice rehabilitation.

5.10 Project Justification

5.10.1 Technical Evaluation

(1) Rehabilitation of Agricultural and Rural Infrastructure

- Appropriateness of Design Standards

  In formulating the D/P for embankment and sluice gates, design standards for polder embankments and other major facilities in terms of technical safety, cost effectiveness, implementation scheduling, as well as local conditions were taken into consideration. Therefore, the standards to be adopted in the Plan are deemed technically sufficient to prevent impacts from high cyclone tidal waves like that of Nargis.

- Effective Utilization of Machine and Manual Construction

  For the embankment work, effective and efficient use of construction machines has been planned by assessing construction conditions in-situ and confirming specifications and availability of heavy equipment such as excavators and compaction machines, as well as analyzing the construction period required for polder rehabilitation. The importance of manpower embankment construction is also taken into consideration since combination of manpower with machine showed more effective result. As a result, selection of either machine or manual construction, or an appropriate combination thereof suited to local conditions is considered technically feasible and economically viable.

(2) Improvement of Farming

- Transfer of Technology

  To accomplish the D/P, it is essential to take advantage of seed multiplication technology. MAS

transfers technology and experience to beneficiary farmers, and registered seeds can be purchased from MAS for certified seed production. Technology transfer is technically feasible, and good linkage and close relationship between farmers and MAS can be tied.

- Fostering Awareness about Quality Control

  As appropriate quality control ensures an advantageous farm gate price, as well as ~~a~~ more attractive for seed collection agents, it is planned to educate farmers through MAS training programme to develop awareness and knowledge about the importance of quality control. Such training is equally important to seed multiplication technology.

(3) Income Generation

- Transfer of Technology

  Under the D/P, for vegetables production and pig fattening/breeding concerned departments will support technically i.e. MAS for vegetables production and LBVD for pig fattening/breeding. Such support to rural poor having socio-economically weak segment, i.e. landless households, who generally lack knowledge and modern technique, is deemed to be feasible. Understanding of new techniques by beneficiaries will be continually reinforced as they achieve such activities repeatedly and can reduce reliance on traditional agriculture and pig fattening/breeding.

(4) Windbreak Mangrove Rehabilitation

- Transfer of Technology

  Technical support (training and guidance) for planting and management for 3 species of mangrove from FD to beneficiary communities in the polder areas is deemed to be feasible. Once mangroves are planted, very little labour-intensive management is expected to be needed.

5.10.2 Financial and Economic Evaluation

(1) General

1) Purpose of Evaluation

The purpose of financial evaluation is to assess the benefit of a particular project from an individual economy standpoint, while economic evaluation assesses the project in terms of its contribution to the national economy as a whole.

2) Methodology of Evaluation

On the basis of project benefit and cost comparison for the two cases of (i) future without project (FW/O) and (ii) future with project (FW), the economic viabilities of the projects are examined in terms of the three criteria of net present value (NPV), benefit-cost ratio (B/C ratio) and internal rate of return (IRR), except for two projects, i.e. improvement of farming and income generation.

3) Evaluation Criteria

a) Interpretation of Future Without Project Case

Considering future direction, it is assumed that the present conditions will keep status quo without project.

b) Project Life

Project life for agricultural and rural infrastructure rehabilitation is set at 50 years considering the utility life of the proposed facilities and the O&M capacity of the line agency, including construction period works. The other three project components, i.e. improvement of farming~~,~~ and income generation are assumed to have 20-year project life, while windbreak mangrove rehabilitation is assumed to have the same project life as that of agricultural and rural infrastructure.

c) Project Benefit and Cost

Under financial evaluation, project benefit and cost are expressed in terms of market prices (financial prices). Economic evaluation, on the other hand, eliminates transfer payment and application of respective conversion factors. Moreover, project benefit and cost are based on 2009/10 prices.

d) Inputs and Outputs

With regard to traded and non-traded goods expressed in financial prices, these are based on 2009/10 prices. On the other hand, in the case of economic prices the composition of non-traded goods is broken down into traded component, non-traded component, labour and transfer payment. In the case of the traded, non-traded and labour components, border price, standard conversion factor (SCF), and shadow wage rate are applied, respectively.

e) Opportunity Cost of Capital

Referring to past agriculture-related reports, a discount rate of 12% is applied as the opportunity cost of capital for Myanmar.

f) Foreign Exchange Rate

In the evaluation, the foreign exchange rate of US$ 1 = 869 Kyats as of 2011 March is applied.

g) Labour

Nominal wages are used for financial evaluation. Under economic evaluation, on the other hand, (i) skilled labour is multiplied by the SCF and (ii) unskilled labour is also multiplied by the SCF but with adjustment of a coefficient of labour productivity, i.e. 0.8.

4) Conversion Factors

a) Standard Conversion Factor (SCF)

Estimation of a precise SCF is constrained due to unavailability of recent customs data (the latest published data covers only the period 1997/98~1999/2000) and lack of reliable figures in the breakdown of annual customs duties into export and import categories. Under these circumstances, the following estimation method has been adopted to calculate annual export and import customs duty values in recent years. Annual customs duties in the recent years have been computed based on (i) official average customs duty value for the period 1997/98~1999/2000, and (ii) estimated import-export ratio to breakdown estimated custom duty values in recent years into import and export portions. Under this method, the same average tariff rate is applied for both imported and exported commodities.

As a result, the SCF is computed at 1.02 based on the official 1997/98~1999/2000 trade and customs data and the recent trade data as shown in **Table 5.10-1**.

Table 5.10-1 Standard Conversion Factor (SCF)

Unit: Million Kyats

Year	Value of imports (CIF)	Import duties*	Value of exports (FOB)	Export duties*	Custom duties	SCF
1997/98	14,366.1	5,922.0*	6,446.8	2,657.0*	8,579.0	0.86
1998/99	16,871.7	3,696.0*	6,755.8	1,479.9*	5,175.9	0.91
1999/2000	16,264.8	3,226.0*	8,947.3	1,774.0*	5,000.0	0.95
Total/average	47,502.6	12,844.0*	22,149.9	5,910.9*	18,754.9	0.91
2004/05	11,338.6	1,017.7	16,697.0	1,498.6	2,516.3**	1.02
2005/06	11,514.2	1,033.5	20,647.0	1,853.2	2,886.6**	1.03
2006/07	16,835.0	1,511.0	30,026.0	2,695.0	4,206.0**	1.03
2007/08	18,418.9	1,653.2	35,297.0	3,168.1	4,821.2**	1.03
2008/09	24,873.8	2,232.5	37,028.0	3,323.4	5,556.0**	1.02
Total/average	82,980.5	7,447.9	139,695.0	12,538.3	19,986.2**	1.02

Note: 1) *Estimated in terms of ratios of export/import values due to non-categorization of customs duties into

export and import duties.
2) ** Applied by average custom duty value calculated for the period 1997/98~1999/2000.
Source: Statistical Yearbook 2002 & 2009, Central Statistical Organization.

Commodity-wise tariff rates for 2010 which are assumed to have not changed for the last 4~5 years indicate 10% for exported rice, 5% for imported chemical fertilizers, 5~15% for imported food (20% for frozen chicken, and 26% for imported fruit juice), and 10~16% for imported textile.

b) Other Conversion Factors

Estimated other conversion factors are summarized in **Table 5.10-2.**

Table 5.10-2 Other Conversion Factors

Item	Conversion factors	Remarks
Paddy	1.23	See Table A12-1 for details
Chemical fertilizers		See Table A12-2 for details
- Urea	0.99	
- TSP	0.98	
- MOP	0.99	
Rain-fed and irrigate paddy cultivation incomes	1.47	See Table A12-3 for details
- Rain-fed paddy cultivation income	1.53	
- Irrigated paddy cultivation income	1.40	
Skilled labour	1.02	See A12-4 for details
Unskilled labour	0.82	
Construction work	0.98	See Table A12-5 for details
- Embankment work	0.98	
- Sluice gate rehabilitation work	0.96	
- Construction supervision	1.00	

(2) Financial and Economic Evaluation

The pilot projects (Polder No.9 Labutta North) comprise four (4) components, i.e. (i) rehabilitation of agricultural and rural infrastructure (rehabilitation of 40 km of dikes and 6 sluice gate sites), (ii) improvement of farming (targeted are potential/land possess farmers to promote the production of quality rice seed in 50 acres of land), (iii) income generation (targeted at landless farmers to promote the production of vegetables in 2 designated villages), and (iii) rehabilitation of windbreak mangroves (introduction of 3 species of mangrove in a five (5) ha land). For other 33 polders, the pilot project results are applied to compute the respective project costs and benefits for the D/P.

1) Rehabilitation of Agricultural and Rural Infrastructure

Among 34 polders, financial and economic evaluation for four polders, i.e. No.3, 4, 9, and 26 were excluded due to completed or on-going construction works.

a) Project Cost

Polder-wide project costs comprise the construction cost (rehabilitation of existing embankment, sluice gate rehabilitation and construction supervision), the annual O&M cost, the replacement/ repair cost of the sluice gates during the project life, and other relevant costs. It is noted that the salvage value of the facilities is not included in this evaluation. Additionally, resettlement cost is not taken into account due to a negligible proportion of its cost to the total project cost.

i) Construction Cost

The construction cost for 30 polders excluding four (4) polders f (No.3, 4, 9 and 26) from the financial and economic terms has been estimated at 39,540 million Kyats and 38,750 million Kyats, respectively, as shown in **Table A12-6.**

ii) Annual O&M Cost

Annual O&M cost in the FW case remains unchanged, compared to that of the FW/O case.

Therefore, no additional cost will be incurred.

iii) Replacement/repairing Cost of Sluice Gates

Sluice gates will generally be replaced every 30 years. Replacement/repairing cost in financial terms is converted to economic terms applying a conversion factor of 0.96. As a result, replacement/repairing costs of sluice gates from the financial and economic terms have been estimated at 2,478 million Kyats and 2,379 million Kyats respectively, as shown in **Table A12-6.**

b) Project Benefit

The benefits to be generated under the project are diverse, including external economic benefits (secondary benefits). The direct benefits which can be quantified are considered in this evaluation. In calculating the project benefit from rehabilitation of agricultural and rural infrastructure, damaged asset valuation survey has been carried out to estimate the assets damaged by high cyclone tidal waves in each village tract exhibiting different socio-economic backgrounds. As a result, anticipated disaster prevention values for the respective polders have been computed by applying the land proportion of village tract to the whole polder area, respectively. The disaster prevention value is based on damage to humans, crops (paddy, pulses and oilseeds), livestock (buffalo, cattle, goat, pig, poultry and duck/goose), agricultural machinery (hand tractor), fishery equipment (medium sized fishnet and wooden boat), public facilities (library, RHC, school, water pond and temple), and water shortage.

i) Calculation Criteria for Anticipated Disaster Prevention Value

Human damage, affected assets comprising crops, livestock, agricultural machinery, fishery equipment and public facilities, and water shortage have been valued based on the criteria shown below.

Human damage

- Human damage was severely more acute in the coastal region (low-lying areas) where the majority of the polders are located than inland region; and victims have been calculated by number in terms of the proportion of the respective polder area to total township area. It is noted that calculation of the estimated number of victims is based on the assumption that 50% of the deceased persons and 100% of the missing persons officially recorded by TGC are the result of high tidal waves.
- Anticipated net incomes of the victims have been estimated if their remaining life span does not decrease, considering income differential by gender (25% lower for female) and the farm income survey results.
- Basic indicators for estimation of human damage value are shown in **Table 5.10-3**.

Table 5.10-3 Calculation Criteria for Human Damage

Item	No. of victims estimated by TCG* (No.)	Estimated no. of victims by high tidal waves (No.)			Anticipated net income in the predicted remaining life span (1,000 Kyats/person)		
Townships			Village tracts	Polders	Annual net income	Workable years	Total net income
Labutta	85,996	67,235	37,060	10,200	391	30	11,730
Bogalay	37,942	20,570	13,332	4,967	648	30	19,440
Phyapon	1,268	639	616	199	1,163	30	34,890
Daydaye	4,130	2,075	1,164	522	760	30	22,800
Kyaiklatt	12	6	2	2	386	30	11,580
Total	129,348	90,525	52,174	15,890	670 (average)		20,088 (average)

Note: * Including missing persons.
Sources: (1) "Post-Nargis Joint Assessment", TCG, July 2008.
(2) Farm income survey, 2010.

- To convert the anticipated net income in the predicted remaining life span from financial

terms into economic terms, calculation of human damage value in economic terms is assumed to comprise 50% of net crop income (CF 1.53 for rain-fed paddy cultivation area and CF 1.40 for irrigated paddy cultivation area) and 50% of net fishery income (CF 1.02) as shown in **Table 5.10-4.**

Table 5.10-4 Human Damage Value in Economic Terms

Township	Polder no.	Per capita annual human damage value in financial terms (Kyat)	Conversion factor	Per capita annual human damage value in economic terms (Kyat)
Labutta	1~10 & 12*	391,000	1.275	529,805
	11 & 13~14**	391,000	1.243	555,220
Bogalay	15~18*	648,000	1.275	878,040
Phyapon	19~20 & 23~25*	1,163,000	1.275	1,575,865
	21~22**	1,163,000	1.243	1,651,460
Daydaye	28 & 30-31*	760,000	1.275	1,029,800
	27 & 29**	760,000	1.243	1,079,200
Kyaiklatt	32~34**	386,000	1.243	548,120

Note: * Indicates rain-fed rice cultivation only, while ** implies a combination of rain-fed and irrigated rice cultivation.

Crops (monsoon paddy, summer paddy, pulses and oilseeds)

- Crop losses are assumed to be 50% in the first, 25% in the second and 10% in the third year as compared to normal season yields, due to saline water intrusions.
- Calculations for the estimated loss value, prices (2009) and damage rates as shown in **Table 5.10-5** are applied.

Table 5.10-5 Calculation Criteria for Crop Losses

Item	Paddy		Pulses (Green/black grams)	Oilseeds (Sunflower)
	Monsoon	Summer		
Price (Kyat/basket)	4,050~5,500	3,300~4,000	25,000~33,500	13,000
Damage rate (%)	50, 25, 10	50, 25, 10	50, 25, 10	50, 25, 10

Source: Damaged asset valuation survey, June 2010.

- The estimated crop loss value in economic terms has been computed based on **Table 5.10-6.**

Table 5.10-6 Crop Loss Value in Economic Terms

Crop	Price in financial terms (Kyat/basket)	Conversion factor	Price in economic terms (Kyat/basket)
Monsoon paddy	4,050~5,500	1.23	5,549~7,535
Summer paddy	3,300~4,000	1.23	4,521~5,480
Green/black grams	25,000~33,500	1.02	22,750~30,485
Sunflower	13,000	1.02	11,830

Livestock (buffalo, cattle, goat, pig poultry and duck/goose)

- In the case of the ages of affected animals, it is assumed across the board that half of their full breeding periods have elapsed due to the impossibility of precisely ascertaining the animal's age at death.
- Calculations for the estimated loss value, prices (2009), damage rates and breeding periods as shown in **Table 5.10-7** are applied.

Table 5.10-7 Calculation Criteria for Livestock Losses

Item	Buffalo	Cattle	Goat	Pig	Poultry	Duck/goose
Price (Kyat/head)	280,000	220,000	17,000	37,000	5,000	7,000
Damage rate (%)	100	100	100	100	100	100
Breeding period (years)	15	15	2	2	1.5	1.5

Source: Damaged asset valuation survey, June 2010.

- Livestock losses in economic terms have been calculated by applying an SCF of 1.02.

Agricultural Machinery (hand tractor)

- Assuming that half of the full depreciation period (15 years) for the affected hand tractor has elapsed with a damage rate of 100%, its assessed value (2009) has been computed at 525,000~575,000 Kyats/unit.
- The affected hand tractors have been valued in economic terms by applying an SCF of 1.02.

Fishery Equipment（medium sized fishnet, wooden boat）

- It is assumed that half of the full depreciation periods for affected fishery equipment such as medium sized fishnets and wooden boats have elapsed.
- Calculations of the estimated damage value, prices (2009), damage rates and depreciation periods as shown in **Table 5.10-8** are applied.

Table 5.10-8 Calculation Criteria for Fishery Equipment Damage

Item	Medium sized fishnet	Wooden boat
Price (Kyat/unit)	157,500	400,000
Damage rate (%)	100	100
Depreciation period (years)	5	15

Source: Damaged asset valuation survey, June 2010.

- The estimated damage value of fishery equipment has been computed by applying an SCF of 1.02.

Public Facilities (library, RHC, school, water pond and temple)

- It is assumed that half of the full depreciation period for affected public facilities such as libraries, RHCs, schools, water ponds and temples has elapsed respectively.
- Calculations for the estimated damage value, prices (2009), damage rates and depreciation periods as shown in **Table 5.10-9** are applied.

Table 5.10-9 Calculation Criteria for Public Facility Damage

Facilities	Price (Kyat/unit)	Damage rate (%)	Depreciation period (Years)
Library	400,000	100	3
RHC	2,000,000	100	3
School	21,600,000	50	5
Water Pond	170,000	50	15
Temple	300,000	50	10

Source: Damaged asset valuation survey, June 2010.

- The estimated damage value of public facilities has been computed by applying an SCF of 1.02.

Water Shortage

- It is reported that 70% of affected households suffered from severe water shortage with regard to potable water and cooking purposes, particularly during the two months immediately after Nargis. Subsequently, water supply assistance has been provided by donor countries.
- Water price has risen three-fold after Nargis.
- Basic indicators for estimation of human damage value are shown in **Table 5.10-10.**

Table 5.10-10 Calculation Criteria for Water Shortage Volume

Water demand (gallon/HH/2 months)	Water price (Kyat/gallon)	Water purchase cost (Kyat/HH/2 months)
308~368	10	3,080~3,680

Note: Per capita water consumption is estimated at 1.25 gallons.
Source: Township interviews, June 2010.

- The water price of 10 Kyats/gallon in financial terms has been converted into economic price by applying an SCF of 1.02.

ii) Calculation Criteria for Anticipated Disaster Prevention Value

Polder-wide annual anticipated disaster prevention values in financial terms are illustrated in **Table A12-7 ~A12-41**. The annual values have been computed based on the assumption that high tidal wave surges have a return period of 30 years (the previous disaster occurred in 1975). As a result, total disaster prevention value for 31 polders in financial terms has been estimated at about 221 billion Kyats (261 billion Kyats in economic terms) with an annual value of about 7.2 billion Kyats (8.8 billion Kyats in economic terms) (see **Table 5.10-11~5.10-12** for details). Human damage is predominant in total disaster prevention value, being 65% of the total in financial terms.

c) Financial and Economic Viabilities of the Project

In terms of the three criteria of Net Present Value, B/C Ratio and IRR, financial and economic viability indicators for the project are shown in **Table 5.10-11** (see **Table A12-42 ~A12-43** for each polder).

Table 5.10-11 Summary of Financial and Economic Viability Indicators

Net present value (12% discount rate)（1,000 Kyats）		B/C ratio		IRR (%)	
Financial	Economic	Financial	Economic	Financial	Economic
24,813,932	36,940,367	1.87	2.33	15.3	28.1

The above result shows that despite large fluctuations in EIRRs by individual polders the project as a whole is financially and economically viable, indicating an EIRR of 28%, with even greater benefit when indirect socio-economic ripple impact of the project such as agricultural land conservation, e.g. reduced crop damage due to saline water intrusions, and more stable living environment is considered. Annual project benefits in terms of beneficiary population and households have been calculated at 33,200 Kyats/person and 150,400 Kyats/HH indicating a high financial profitability.

d) Sensitivity Analysis

The following cases were assumed in analyzing the impact of economic uncertainty on the financial and economic viability indicators of the project.

Case 1: Total project cost increased by 10% due to increased prices of construction equipment, labour and unforeseeable factors.

Case 2: Total project benefit dropped by 10% due to low assessed values of lost properties and other negative factors.

Case 3: Combination of cases 1 and 2.

Results of sensitivity analysis on the basis of the above three cases are summarized in **Table 5.10-12.**

Table 5.10-12 Summary of Sensitivity Analysis

Case	Net present value (1,000 Kyats)		B/C ratio		IRR (%)	
	Financial	Economic	Financial	Economic	Financial	Economic
1	21,970,966	34,154,475	1.70	2.11	11.7	21.6
2	19,489,573	30,460,438	1.69	2.09	11.3	21.0
3	16,646,606	27,674,545	1.53	1.90	8.4	16.2

Although project economic viability is more sensitive and highly correlated to a decrease in project benefit rather than an increase in project cost, no significant negative effect on economic justifiability is anticipated.

2) Improvement of Farming

a) Project Cost

Costs of this project by polder comprise quality paddy seed production and supporting services for

MAS extension workers. The latter cost is shown in **Table 5.10-13** (see **Table A12-44** for details). The seed production cost which is included in the net return calculation will be discussed in the Section "Project Benefit" later.

Table 5.10-13 Annual Per Acre Supporting Cost for MAS

Year	Kyat/acre	Year	Kyat/acre
1st	200,105.88	4th	63,666.51
2nd	66,449.47	5th	70,601.83
3rd	63,635.38	10~20th	820.99

b) Project Benefit

This project aims at quality paddy seed production by land owned farmers. Anticipated project benefit can be interpreted as the differential between the net returns from the traditional paddy cultivation and new paddy seed production. Per acre crop budget for quality paddy seed production is shown in **Table 5.10-14**.

Table 5.10-14 Calculation Criteria for Quality Paddy Seed Production

Item	Local variety (Kyat/acre)	Improved variety (Kyat/acre)
Production cost	220,500	228,900
Gross return	424,000	444,000
Net return	203,500	215,100
Differential net return		
- Past paddy cultivation	140,952	118,074
- New seed production	203,500	215,100
- Differential	62,548	97,026

As a result of calculation based on the crop budget table, the differential between the net returns in the traditional paddy cultivation and the new paddy seed production has been computed at 62,548 Kyats/acre for local variety and 97,026 Kyats/acre for improved variety. Total net project benefits for 34 polders in a 20-year life span have been computed at 1,702 million Kyats (see **Table A12-44** for details).

c) Financial Viability of the Project

Evaluation of this project centers only on farm economy analysis and agricultural production loan due to its project nature characterized as a self-reliance project.

i) Farm Economy Analysis

Farm economy analysis aims to calculate the annual income increase for a typical paddy production farm as a result of project implementation. It is noted that off-farm income is not considered. The positive impact of implementation on increased farm income for households in the Project Area will be considerable for both rain-fed paddy production and quality paddy seed production as shown in **Table 5-10-15.**

Table 5.10-15 Farm Economy Analysis

Item	FW/O	FW	
		Local variety	Improved variety
Land holding size (acre)	11.0	11.0	11.0
Family size (no.)	4.5	4.5	4.5
Seed production area (acre)	0	2.0	2.0
Production cost (Kyat)	218,400* 210,000**	441,000	457,800
Gross income (Kyat)	500,304* 446,148**	848,000	888,000
Net income (Kyat)	281,904* 236,148**	407,000	430,200

Incremental income (Kyat)	-	125,096	194,052

Note: * and ** indicate rain-fed paddy cultivation figures for 2 acres of land for local variety and that for improved variety.

With project implementation, annual net farm income for 2 acres will increase from 281,904 to 407,000 Kyats for the local variety and from 236,148 to 430,200 Kyats for the improved variety. This indicates an increase in farm income by 44% for the local variety and 82% for the improved variety, thereby leading to a high degree of poverty alleviation, together with promotion of agro-businesses by the private sector.

ii) Agricultural Production Loan

Assuming a 6-month repayment period with interest rate of 17%/annum (short-term loan conditions of the Myanmar Agricultural Development Bank), the annual production cost repayment of farmers' loans and its incremental net farm income in the FW case are presented in **Table 5.10-16**, wherein the net farm income is calculated subtracting additional production cost from gross farm income.

Table 5.10-16 Agricultural Production Loan

Item	Local variety	Improved variety
Loan amount for additional production cost (Kyat)	222,600	247,800
Interest/6 months (Kyat)	18,921	21,063
Net income (Kyat)	388,079	409,137
Incremental income (Kyat)	106,175	172,989

As a result of analysis, the additional production cost repayment to be made by beneficiary farmers has been estimated at 15% of the incremental net farm income for local variety and at 11% of that for improved variety. Therefore, farmer's capability to repay the 6-month-loan would be high enough to cover the cost, and the bank interest is concluded to pose no heavy burden to their farm economies.

3) Income Generation

a) Project Cost

Costs of the project by polder comprise vegetables production and pig breeding/fattening, and supporting services for MAS and LBVD extension workers. The latter costs are shown in **Table 5.10-17**. The vegetables production and pig breeding/fattening costs, which are used in the net return calculation, are discussed in the next section "Project Benefit".

Table 5.10-17 Annual Supporting Costs for MAS and LBVD

Item	Vegetables production (Kyat/ac)	Pig breeding/fattening (Kyat/ac)
1st year	154,646,250	46,860,000
2nd year	94,451,500	15,620,000
3rd year	-	8,580,000
4th year	-	8,580,000
Total	249,097,750	79,640,000
Target households	4,023	2,080
Average cost/HH	61,918	38,289

Annual average supporting costs required for MAS and LBVD are computed at 61,918 Kyats/ HH and 38,289 Kyats/ HH, respectively.

b) Project Benefit

This project aims at opening up new income sources for landless households through vegetables production and pig breeding/fattening activities. Anticipated project benefit can be interpreted in

terms of net return. Budgets for vegetables production and pig breeding/fattening activities are shown in **Table 5.10-18~5.10-19**.

Table 5.10-18 Calculation Criteria for Vegetable Production per 0.025 Acre

Vegetables	Production cost (Kyat)	Gross return (Kyat)	Net return (Kyat)
Yard long bean	6,145	22,302	16,157
Okra	4,875	11,188	6,313
Roselle	2,771	6,419	3,648
Water cress	2,514	5,739	3,225

Table 5.10-19 Calculation Criteria for Pig Breeding/Fattening Activities

Item	Pig breeding (Kyat/HH)	Pig fattening (Kyat/HH)
Annual average cost	179,712	92,131
Annual average gross return	365,000	180,000
Annual average net return	185,288	87,869

As a result of calculation based on the above, yard long bean production is most profitable at 16,157 Kyats/0.025 acre. For the pig breeding and fattening activities, on the other hand, annual net returns have been computed at 185,288 Kyats/HH for pig breeding activities and 87,869 Kyats/HH for pig fattening activities. Total net project benefits for 34 polders in a 20-year project life span have been computed at 6,804 million Kyats comprising 1,640 million Kyats for vegetables production and 5,164 million Kyats for pig breeding and fattening activities (see **Table A12-45** for details).

c) Financial Viability of the Project

Evaluation of this project centers only on farm economy analysis and agricultural production loan due to its project nature characterized as a self-reliance project.

i) Farm Economy Analysis

Farm economy analysis aims to calculate the annual income increase from vegetables production during the dry season and pig breeding/fattening activities throughout the year for a typical landless household as a result of project implementation. It is noted that its principal source of income entirely depends on temporary labour wages throughout the year. The impact of implementation on the income increases for households in the Project Area will be considerable given the generation of new income opportunities as shown in **Table 5-10-20.**

Table 5.10-20 Farm Economy Analysis

Item	FW					
	Vegetables production				Livestock production	
Rental land size (acre)	0.025				-	
Family size (no.)	4.5				4.5	
	Yard long bean	Okra	Roselle	Water cress	Pig breeding	Pig fattening
Production cost (Kyat)	6,145	4,875	2,771	2,514	179,712	92,131
Gross income (Kyat)	22,302	11,188	6,419	5,739	365,000	180,000
Net income (Kyat)	16,157	6,313	3,648	3,225	185,288	87,869
Incremental income (Kyat/HH)	16,157	6,313	3,648	3,225	185,288	87,869

With project implementation, average annual household income will increase by 16,157 Kyats in the case of yard long bean, as well as 185,288 Kyats for pig breeding activities, thereby leading to a high degree of poverty alleviation.

ii) Agricultural Production Loan

Assuming a 6-month repayment period with interest rate of 17% per annum for vegetables production and a 1-year repayment period with the same interest rate (short-term loan conditions of the Myanmar Agricultural Development Bank), the annual production cost repayment of households' loans and its incremental net farm income in the FW case are presented in **Table 5.10-21**, wherein the net farm income is calculated subtracting production cost from gross farm income.

Table 5.10-21 Agricultural Production Loan

Item	Vegetables production				Livestock production	
	Yard long bean	Okra	Roselle	Water cress	Pig breeding	Pig fattening
Loan amount for production cost (Kyat)	6,145	4,875	2,771	2,514	179,712	92,131
Interest/6 months or one year (Kyat)	522	414	236	214	30,551	15,662
Net income (Kyat)	15,635	5,899	3,412	3,011	154,737	72,207
Incremental income (Kyat)	15,635	5,899	3,412	3,011	154,737	72,207

As a result of analysis, the production cost repayment to be made by beneficiary households has been estimated at 3~7% of the incremental net farm income for vegetables production and at 16~18% of that for livestock production. Therefore, beneficiary household's capability to repay the 6-month or one year loan would be high enough to cover the respective costs, and the bank interest is concluded to pose no heavy burden to their household economies.

4) Windbreak Mangrove Rehabilitation

a) Project Cost

Costs of this project by polder comprise planting costs of 3 species of mangrove, i.e. Ao and Sa having a replanting period of 15 years and Nypa which is assumed to have a replanting period of 50 years, as shown in **Table 5.10-22.**

Table 5.10-22 Breakdown of Project Cost for 1 km-long Windbreak Mangroves

Item	1st year			16th year		
	Cost (Kyat) (financial)	CF	Cost (Kyat) (economic)	Cost (Kyat) (financial)	CF	Cost (Kyat) (economic)
- Temporary nursery		-			-	
Materials	29,760	1.02	30,355	0		0
Labour	9,000	0.82	7,380	0		0
Sub-total	38,760	-	37,735	0		0
- Fencing						
Materials	2,150,700	1.02	2,193,714	2,150,700	1.02	2,193,714
Labour	430,000	0.82	352,600	430,000	0.82	352,600
Sub-total	2,580,700	-	2,546,314	2,580,700	-	2,546,314
- Planting						
Materials	1,209,740	1.02	1,233,935	1,003,490	1.02	1,023,560
Labour	633,000	0.82	519,060	443,100	0.82	363,342
Sub-total	1,842,740	-	1,752,995	1,446,590	-	1,386,902
- Transportation	480,000	1.02	489,600	300,000	1.02	306,000
- Supplemental planting	232,200	1.02	236,844	176,000	1.02	179,520
Total	5,174,400	-	5,063,488	4,503,290	-	4,418,736

As a result of calculation based on the above, conversion factors for planting costs of the 1st year and the 16th year have been estimated at 0.98 and 0.98, respectively.

b) Project Benefit

This project aims at reforestation of three species of mangrove (Sonneratia apetala, Avicennia officinalis and Nypa fruticans) on the coastal area damaged by Cyclone Nargis. The anticipated multiple functions of mangroves and Nypa are directly converted into marketable goods and services to calculate the benefits in monetary terms. Direct benefits comprise (i) fuelwood and log

production and (ii) Nypa roofing materials production. It is noted that mangroves protect or reduce the erosion of coastlines, thus preventing the loss of valuable agricultural land and property through the binding and stabilization of soil by plant roots and deposited vegetative matter, the dissipation of erosion forces such as wave and wind energy, and the trapping of sediments. However, the function of the above described coastal erosion and storm protection by mangroves is not included in the project benefits, because valuation of such effects in monetary terms is difficult to estimate compared to the cost of embankment generating the same effects as mangroves. Moreover, prevention of global warming is not included in the benefits.

Anticipated project benefit can be interpreted as returns from the production of fuel wood, logs and Nypa roofing materials as shown in **Table 5.10-23**.

Table 5.10-23 Breakdown of Project Benefit for 1 km-long Windbreak Mangroves

Species	5th year (Kyat)			10th year (Kyat)			15th year (Kyat)		
	Financial	CF	Economic	Financial	CF	Economic	Financial	CF	Economic
Ao	4,340,000	1.02	4,426,800	4,020,000	1.02	4,100,400	5,800,000	1.02	5,916,000
Sa	5,625,000	1.02	5,737,500	5,640,000	1.02	5,752,800	14,025,000	1.02	14,305,500
Nypa	937,500*	1.02	956,250	937,500	1.02	956,250	937,500	1.02	956,250

Note: * Harvested every year from the 3rd year.

As a result of calculation based on the above, annual returns in the 5th year for the production of fuelwood, logs and Nypa thatching have been estimated at 4,340,000 Kyats/km, 5,625,000 Kyats/km and 937,500 Kyats/km (4,426,800 Kyats/km, 5,737,500 Kyats/km and 956,250 Kyats/km in economic terms) respectively.

c) Financial and Economic Viabilities of the Project

i) Farm Economy Analysis

Farm economy analysis aims to calculate the annual income increase for a typical beneficiary household as a result of project implementation. The impact of implementation on the income increase for households in the Project Area will be considerable as a result of production of fuelwood, logs and Nypa thatch roofing material as shown in **Table 5-10-24.**

Table 5.10-24 Farm Economy Analysis (1 km-long windbreak mangroves)

Item	1 km-long windbreak mangroves
Beneficiary households (no.)	150
Annual planting cost (Kyat)	373,600
Annual gross income (Kyat)	6,780,100
Annual net income (Kyat)	6,406,500
Annual incremental income (Kyat/HH)	42,710

With project implementation, annual average net income per household will increase by 42,710 Kyats, which corresponds to about 68% of the annual net income for a rain-fed paddy farmer.

ii) Financial Economic Viability Indicators

In terms of the three criteria of Net Present Value, B/C Ratio and IRR (internal rate of return), financial and economic viability indicators for the project are shown in **Table 5.10-25** (see **Table A12-46~A12-47** for each polder).

Table 5.10-25 Summary of Financial and Economic Viability Indicators

Net Present Value (12% discount rate) (Kyat)		B/C ratio		IRR (%)	
Financial	Economic	Financial	Economic	Financial	Economic
4,508,920	4,633,205	6.14	6.38	26.8	27.7

The above result shows that despite large fluctuations in EIRRs by individual polder the project as a whole is economically viable indicating an EIRR of 28 %, associated with greater benefit

when indirect socio-economic ripple impacts of the project, such as global warming prevention and biodiversity conservation are considered.

d) Sensitivity Analysis

Results of sensitivity analysis on the basis of the three cases are summarized in **Table 5.10-26.**

Table 5.10-26 Summary of Sensitivity Analysis

Case	Net present worth (1,000 Kyats)		B/C ratio		IRR (%)	
	Financial	Economic	Financial	Economic	Financial	Economic
1	4,401,260	4,547,083	5.58	5.80	24.7	25.6
2	3,970,251	4,083,762	5.52	5.74	24.5	25.4
3	3,882,474	3,997,640	5.02	5.22	22.5	23.3

Although project economic viability is more sensitive and correlated to a decrease in project benefit rather than an increase in project cost, no significant negative effect on economic justifiability is anticipated.

5.10.3 Social and Natural Environmental Evaluation

(1) Social Environment Evaluation

1) Rehabilitation of Agricultural and Rural Infrastructure

- Resettlement

In Polder No.9 Labutta (North), for instance, 8 affected households losing huts by implementation of the embankment work had been illegally residing within the right of way of the old embankment. However, they have been able to recover their pre-project standard of living through their voluntary effort to reconstruct their huts. Additionally, 96 households have lost part of their farmland averaging 2.1 acres of land without any compensation. In full recognition of the above facts, acquisition of land and other assets, and resettlement of people are unavoidably affected. It is possible to avoid or minimize to the some extent the embankment planning and design stages in the D/P.

- Generation of employment opportunities

Implementation of the project will result in the need for construction labourers in each polder. The project can be expected to create approximately 210,000 person-days of labour opportunity. If this labour demand is supplied by the currently unemployed, this is equivalent to a total income generation of approximately 1.9 billion Kyats for construction day labourers. Therefore, this project will play a vital role in generating a great number of temporary job opportunities for the rural poor.

2) Improvement of Farming

- Promotion of quality paddy seed production

Use of high quality paddy seed will be expected in other neighbouring townships through out-going extension of quality seeds produced in the benefit area, resulting in higher farmers' awareness of the importance of high quality seeds than the use of inferior grain. Using the high quality seeds, paddy yield is also expected to increase by 10%, thereby leading to farm income increase in the benefit areas. Therefore, implementation of this project will be socially justified in terms of increased farm income for the whole Project Area and neighboring rural areas.

Other socially justifiable impacts, such as forward and backward related effects (e.g. income increase in the agro-industrial sector and private participation in seeds business), creation of employment and income opportunities, and improved standard of living, can be expected.

3) Income Generation

- Generation of income opportunities

With implementation of income generating activities, the rural poor who are socio-economically at the lower segment of the society will obtain new income opportunities during agricultural seasons for vegetables and mango production, for getting income throughout the year from pig breeding/fattening activities, thereby leading to poverty alleviation in the benefit areas. The agricultural component contribution is highly significant for the poor and very poor groups because of the possibility of generation of alternative income sources that the agricultural and non-agricultural labourers can get. As a result, this project indicates high social justification especially for the rural poor.

4) Windbreak Mangrove Rehabilitation

- Generation of income opportunities

With implementation of windbreak mangrove rehabilitation activities, the rural poor can get income opportunities every 5 years from Ao and Sa and annually from Nypa, thereby contributing to poverty alleviation in the benefit areas. Therefore, implementation of this project is deemed to be socially justified in terms of income generation opportunities in the benefit areas.

(2) Natural Environment Evaluation

1) Rehabilitation of Agricultural and Rural Infrastructure

- Conservation of natural environment

No significant post-project negative impact will be expected in terms of natural environment and pollution. However, appropriate mitigation measures for such probable negative environmental, but only temporary, impacts such as air and water pollution, construction waste, noise and vibration which are limited strictly during the construction period will be likely occur during the planning and construction phases. Therefore, this project is environmentally justified.

2) Improvement of Farming and Income Generation

- Minimization of agro-chemicals application

In the case of quality paddy seed and vegetables production, it is recommended that application of agro-chemicals is minimized as much as possible. Therefore, the cultivation techniques adopted under the D/P should be environment-friendly.

3) Windbreak Mangrove Rehabilitation

- Multiple functions of mangroves

The multiple functions of windbreak mangroves include (i) water purification, (ii) biodiversity conservation, (iii) source of forest products, (iv) coastal erosion prevention, and (v) global warming prevention. Particularly, the fact that mangroves play a valuable carbon sink role is well-known worldwide. Therefore, planting mangroves in damaged coastal areas is significant from an environmental point of view.

These four projects, therefore, are of great importance from socio-economic and environmental viewpoints by facilitating beneficial features for both of assurance the security of life and property in the polder areas, and poverty alleviation.

Table 5.10-27 Anticipated Disaster Prevention Value (Financial Terms)

No.	Polder Name	Damage induced by high tidal waves (1,000 Kyats)															
		Human		Crop		Livestock		Agricultural machinery		Fishery equipment		Public facilities		Potable water shortage		Total	
		Total	Annual	Total	Annual	Total	Annual	Total	Annual	Total	Annual	Total	Annual	Total	Annual	Total	Annual
1	Alegyun (1)	5,289,057	176,302	457,397	15,247	18,264	202	0	0	5,738	77	18,014	237	707,772	23,592	6,496,242	215,657
2	Alegyun (2)	11,426,897	380,897	1,193,699	39,790	83,548	743	0	0	2,600	12	19,676	257	1,760,053	58,668	14,486,473	480,367
5	Thingangyi	1,079,710	35,990	51,464	1,715	3,942	38	1,502	7	1,171	16	2,369	31	52,507	1,750	1,192,665	39,547
6	Zinywe	1,023,735	34,124	18,631	621	2,033	18	1,864	8	1,111	15	2,798	37	57,951	1,932	1,108,123	36,755
7	Leikkwin	1,206,665	40,222	8,600	287	2,396	21	2,197	10	1,309	17	0	0	68,068	2,269	1,289,235	42,826
8	Labutta (South)	9,076,909	302,564	871,257	29,042	50,278	447	12,933	57	9,848	131	20,048	265	729,998	24,333	10,771,271	356,839
10	U Gaungpu	1,159,159	38,639	51,682	1,723	4,638	41	2,890	13	1,258	17	4,959	66	34,729	1,158	1,259,315	41,657
11	Bitud Island (1)	5,203,539	173,451	337,518	11,095	6,298	315	7,557	34	5,645	75	8,087	106	198,988	6,633	5,767,632	191,709
12	Bitud Island (2)	8,478,352	282,612	2,210,484	73,683	40,122	357	18,182	81	9,198	123	23,804	313	1,186,826	39,561	11,966,968	396,730
13	Bitud Island (3)	6,765,220	225,508	1,431,543	47,198	22,683	202	12,313	54	7,340	98	16,355	217	446,718	14,891	8,702,172	288,168
14	Bitud Island (4)	6,307,685	210,256	1,464,232	40,175	32,485	289	9,898	44	6,843	91	19,997	265	527,985	17,600	8,369,125	268,720
15	Daunggyi	34,118,603	1,137,387	4,066,280	135,543	127,353	1,219	99,218	441	1,611	18	91,220	1,323	2,706,320	90,210	41,210,605	1,366,141
16	Daunggyi (East)	31,768,654	1,058,955	5,967,759	198,925	309,347	2,531	78,691	350	1,094	13	50,127	764	1,331,895	44,397	39,507,567	1,305,935
17	Daunggyi (West)	3,592,162	119,739	723,379	24,113	32,641	451	13,634	61	757	9	12,431	199	552,113	18,404	4,927,117	162,976
18	Daunggyi (Upper)	4,909,378	163,646	908,082	30,269	35,577	769	17,382	77	n.a.	n.a.	12,630	192	605,752	20,192	6,488,801	215,145
19	Daw Nyein	210,549	7,018	246,502	8,217	18,116	183	1,296	6	105	1	10,629	153	835,374	27,846	1,322,571	43,424
20	Myokone	373,893	12,453	715,477	23,849	27,396	271	4,259	19	283	3	14,844	221	579,996	19,334	1,716,148	56,150
21	Kyetphamwezaung	2,915,061	97,169	8,716,010	289,114	218,220	2,842	90,546	403	2,727	36	89,948	1,312	4,300,559	143,351	16,333,071	534,227
22	Banbwezu	1,264,553	42,152	1,665,145	34,510	157,438	2,457	36,538	162	327	4	61,617	932	1,895,427	63,181	5,081,045	143,398
23	Daydalu	247,990	8,266	437,433	14,581	10,073	102	2,517	11	129	2	6,717	104	455,340	15,178	1,160,199	38,244
24	Letpanbin	655,391	21,846	1,707,563	56,919	18,176	239	10,812	48	75	1	12,661	206	585,319	19,510	2,989,997	98,769
25	Zinbaung	612,857	20,428	1,741,902	58,064	57,080	839	14,494	65	826	11	24,063	362	739,247	24,641	3,190,469	104,410
27	Thandi	199,397	6,647	180,338	6,011	10,513	176	381	2	103	2	1,810	24	48,639	1,621	441,181	14,483
28	Suclubbaluma	1,424,859	47,496	1,326,709	44,223	177,663	1,817	4,736	21	1,950	13	26,284	358	539,141	17,971	3,501,342	111,899
29	Hleseikchaunggyi	663,206	22,107	720,478	24,016	59,039	750	2,898	13	2,523	18	10,920	149	327,376	10,913	1,786,440	57,966
30	Tamatakaw	2,623,473	87,449	2,252,183	75,073	170,668	2,223	10,572	47	3,035	21	31,890	449	1,156,133	38,538	6,247,954	203,800
31	Kyonsoat	40,214	1,341	31,714	1,057	1,351	21	0	0	7	0	355	5	11,133	371	85,774	2,795
32	Maubin Island (North)	10,700	357	3,784,822	126,161	10,763	436	126,312	561	1,155	3	202,183	2,953	2,400,794	80,026	6,536,729	210,497
33	Maubin Island (South)	4,484	149	1,384,927	46,164	7,205	241	82,991	369	6,764	24	81,217	1,199	829,009	27,634	2,396,597	75,780
34	Thonegwakyun	7,898	263	2,201,179	73,373	13,926	522	101,031	449	11,915	38	169,330	2,494	1,916,719	63,891	4,421,998	141,030
Total		142,660,250	4,755,433	46,874,389	1,530,758	1,729,232	20,762	767,644	3,413	87,447	889	1,046,983	15,193	27,587,881	919,596	220,753,826	7,246,044
% to total damage value		64.6		21.2		0.8		0.3		0		0.5		12.5		100.0	

Table 5.10-28 Anticipated Disaster Prevention Value (Economic Terms)

No.	Polder Name	Damage induced by high tidal waves (1,000 Kyats)															
		Human		Crop		Livestock		Agricultural machinery		Fishery equipment		Public facilities		Potable water shortage		Total	
		Total	Annual	Total	Annual	Total	Annual	Total	Annual	Total	Annual	Total	Annual	Total	Annual	Total	Annual
1	Alegyun (1)	664,212	222,140	552,604	18,420	18,629	206	0	0	5,853	78	18,375	242	721,927	24,064	1,981,600	265,150
2	Alegyun (2)	14,397,890	479,930	1,454,646	48,488	85,219	758	0	0	2,652	12	20,069	263	1,795,254	59,842	17,755,730	589,293
5	Thingangyi	1,360,435	45,348	60,367	2,012	4,021	36	1,532	7	1,195	16	2,416	32	53,557	1,785	1,483,523	49,236
6	Zinywe	1,289,905	42,997	19,625	654	2,074	18	1,901	8	1,133	15	2,854	38	59,110	1,970	1,376,602	45,700
7	Leikkwin	1,520,398	50,680	9,233	308	2,444	22	2,241	10	1,335	18	0	0	69,430	2,314	1,605,081	53,352
8	Labutta (South)	11,436,905	381,230	1,013,427	33,781	51,283	456	13,192	59	10,045	134	20,449	270	744,598	24,820	13,289,899	440,750
10	U Gaungpu	1,460,540	48,685	55,593	1,853	4,730	42	2,948	13	1,283	17	5,058	67	35,423	1,181	1,565,575	51,858
11	Bitud Island (1)	6,400,354	213,345	382,114	12,533	6,424	57	7,708	35	5,758	77	8,249	109	202,968	6,765	7,013,575	232,921
12	Bitud Island (2)	10,682,724	356,091	2,505,915	83,531	40,924	363	18,546	83	9,382	125	24,280	319	1,210,563	40,352	14,492,334	480,864
13	Bitud Island (3)	8,321,220	277,374	1,611,170	53,026	23,136	206	12,559	56	7,487	100	16,682	221	455,653	15,189	10,447,907	346,172
14	Bitud Island (4)	7,758,452	258,615	1,714,610	45,873	33,135	295	10,096	45	6,980	93	20,397	270	538,545	17,952	10,082,215	323,143
15	Daunggyi	42,989,440	1,432,982	4,977,438	165,915	129,900	1,243	101,202	450	1,644	19	93,044	1,350	2,760,446	92,015	51,053,114	1,693,974
16	Daunggyi (East)	40,028,504	1,334,283	7,322,381	244,079	315,534	2,582	80,265	357	1,116	13	51,129	780	1,358,533	45,284	49,157,462	1,627,378
17	Daunggyi (West)	4,526,124	150,871	883,825	29,461	33,293	460	13,906	62	772	9	12,680	203	563,156	18,772	6,033,756	199,838
18	Daunggyi (Upper)	6,185,816	206,194	1,114,119	37,137	36,289	785	17,730	79	n.a.	n.a.	12,883	196	617,867	20,596	7,984,704	264,987
19	Daw Nyein	265,293	8,843	303,197	10,107	18,478	187	1,322	6	106	1	10,842	156	852,081	28,403	1,451,319	47,703
20	Myokone	471,106	15,703	880,037	29,334	27,944	276	4,344	19	288	4	15,141	225	591,596	19,720	1,990,456	65,281
21	Kyetphamwezaung	3,585,524	119,518	10,707,812	355,072	222,584	2,899	92,356	411	2,782	37	91,746	1,338	4,386,570	146,219	19,089,374	625,494
22	Banbwezu	1,555,400	51,847	2,048,129	40,838	160,587	2,506	37,268	166	333	4	62,849	951	1,933,336	64,445	5,797,902	160,757
23	Daydalu	312,467	10,416	538,043	17,935	10,275	105	2,567	12	131	2	6,851	106	464,447	15,481	1,334,781	44,057
24	Letpanbin	825,793	27,527	2,098,143	69,938	18,540	244	11,028	49	77	1	12,914	211	597,025	19,901	3,563,520	117,871
25	Zinbaung	772,200	25,740	2,137,943	71,265	58,221	856	14,784	66	843	12	24,545	370	754,032	25,134	3,762,568	123,443
27	Thandi	245,258	8,175	219,300	7,310	10,723	179	389	2	105	2	1,847	25	49,612	1,654	527,234	17,347
28	Suclubbaluma	1,795,322	59,844	1,609,144	53,638	181,216	1,852	4,830	21	1,989	14	26,810	366	549,923	18,331	4,169,234	134,066
29	Hleseikchaunggyi	815,744	27,191	877,878	29,263	60,220	765	2,955	13	2,574	18	11,138	152	333,923	11,131	2,104,432	68,533
30	Tamatakaw	3,305,576	110,186	2,741,270	91,376	174,081	2,268	10,783	48	3,095	22	32,527	458	1,179,256	39,309	7,446,588	243,667
31	Kyonsoat	50,670	1,689	38,659	1,289	1,378	21	0	0	7	0	362	5	11,355	378	102,431	3,382
32	Maubin Island (North)	13,161	439	4,280,087	142,670	10,978	445	128,838	573	1,178	3	206,227	3,012	2,448,810	81,627	7,089,279	228,769
33	Maubin Island (South)	5,516	184	1,694,080	56,469	7,349	246	84,650	376	6,900	24	82,842	1,223	845,589	28,186	2,726,926	86,708
34	Thonegwakyun	9,715	324	2,703,851	90,128	14,205	532	103,052	458	12,154	38	172,717	2,543	1,955,053	65,168	4,970,747	159,191
Total		173,051,664	5,968,391	56,554,640	1,843,703	1,763,814	20,910	782,992	3,484	89,197	908	1,067,923	15,501	28,139,638	937,988	261,449,868	8,790,885
% to total damage value		66.2		21.6		0.7		0.3		0		0.4		10.8		100.0	

CHAPTER 6 TECHNOLOGY TRANSFER

6.1 Introduction

Technology transfer is one of the principal objectives of the Project as stated "the capacity of counterparts for project implementation and technical skills will be developed" in the Scope of Work (S/W) for the Project dated on 6 October 2009. In line with this, technology transfer for the counterparts personnel of the DAP, ID, MAS as well as farmers, landless households and village people was extended during the entire project period from December 2009 to May 2011 by the project team members through on-the-job training in various activities including the implementation of Pilot Projects, formulation of the D/P and so on.

6.2 Result of Technology Transfer

Technology transfer was conducted to three target groups during the project period through both the office work and field work as OJT. **Table 6.2-1** describes the result of technology transfer implemented by each JICA project experts.

1) Central level officers (C/Ps, DAP, ID, MAS at Naypyitaw and Yangon)
2) Site level officers (ID, MAS, FD, TPDC at district and township)
3) Site level farmers (owner farmers, landless farmers and village people)

One constraint observed was that technology transfer at the central level was limited due to massive transfer of government offices and officers from Yangon to Naypyitaw.

The number of participants from the government, farmers/villagers and NGOs in the technical workshops, seminars, field trainings, evaluation workshops and study tours in relation to the Pilot Projects were 1,113 in total (256 from government, 819 from farmers/villagers and 38 from NGOs) as presented in detail in **Table 6.2-2.**

6.3 Evaluation of Technology Transfer

Technology transfer conducted to the target groups during the project period mainly through the Pilot Project was evaluated. Target groups of the technology transfer were identified at three levels, namely 1) Central level officers for C/Ps, DAP, ID and MAS offices, 2) Site level officers for ID, MAS, FD and TPDC offices, and 3) Site level farmers and village people.

Evaluation was made on the target group basis through analysis of five assessment factors of efficiency, effectiveness, impact, relevance and sustainability. **Table 6.3-1** presents the result of evaluation, and conclusion and recommendations are presented below;

1) Technology transfer conducted during the Project was highly relevant to its technical level, implementation process and methodology. Technical / management capacities and understandings of the government officers and engineers involved in the Pilot Project for the preservation of farming area were sufficiently strengthened.
2) Technology transfer to farmers and landless people, particularly for the self-help project, shall be made closely, taking time and repeatedly.
3) For the implementation of the D/P schemes, government officers shall receive trainings prior to the implementation. Engineers and Officers of ID and MAS who were trained in the Pilot Project shall be mobilized as a trainer for the officers' training.

Table 6.2-1 Results of Technology Transfer conducted in the Project

Subject	Target Groups	Outputs / Methodologies	Description
1. Team Leader / Rural Infrastructure / Rural Development			
1st Field Work (Jan−July 2010)			
1) Present condition survey	1) Central level (C/Ps, ID, MAS)	1) Office work & discussion on survey forms	1) Survey forms were discussed and shared with C/Ps.
2) Formulation of draft D/P	2) Central level (C/Ps, ID, MAS)	2) Office work & discussion	2) Procedures and methodologies to formulate D/P were explained and discussed.
3) Planning, formulation & implementation of pilot project	3) Central level (C/ Ps, ID, MAS)	3) Office work & discussion	3) Discussed planning process, selection of pilot project, implementation method.
2nd Field Work (−May 2011)			
4) Implementation, monitoring and evaluation of pilot project	4) Central & site levels (C/Ps, DAP, ID, MAS)	4) Monitoring & evaluation reports through office & field OJT	4) Conducted pilot project implementation, work arrangement, progress monitoring, evaluation workshops and other related office & field works.
5) Finalization of D/P	5) Central level (C/Ps, DAP, ID, MAS)	5) Draft D/P through discussion in office work	5) Explained / discussed contents of D/P.
2. Sub-Team Leader / Polder and Gate Design			
1st Field Work (Jan−July 2010)			
1) Present condition survey	1) Central & site levels (C/Ps, ID)	1) Office & field work through discussion	1) Survey contents were discussed and shared, and survey was conducted with C/Ps.
2) Formulation of draft D/P	2) Central & site levels (C/Ps, ID)	2) Office work & discussion	2) Explained and discussed the contents of D/P with C/Ps.
3) Planning, designing & construction management of pilot project	3) Central & site levels (C/ Ps, ID)	3) Office & field work through discussion	3) Discussed planning policy, methodology of function survey, design standard and formula, construction planning and control, cost estimate, work supervision and arrangement.
2nd Field Work (−May 2011)			
4) Implementation, monitoring and evaluation of pilot project	4) Central & site levels (C/Ps, ID)	4) Monitoring & evaluation reports, study tour through office & field OJT	4) Discussed schedule control & quality control in focus of work progress, embankment material, compaction manner and soil water density control
5) Finalization of D/P	5) Central level (C/Ps, ID)	5) Draft D/P through discussion in office work	5) Explained / discussed contents of D/P.
3. Irrigation / Drainage			
1st Field Work (Jan−July 2010)			
1) Present condition survey	1) Central & site level (C/Ps, ID)	1) Office work & discussion.	1) Survey forms were discussed and shared with C/Ps. Discussion on existing drainage system and problems.
2) Formulation of draft D/P	2) Central level (C/Ps, ID)	2) Office work & discussion	2) Procedures and methodologies to analyze water level behavior of drainage canals were transferred to C/Ps. The problems on salinity in soil and water were explained.

2nd Field Work (−May 2011) 3) Finalization of D/P	3) Central level (C/Ps, ID)	3) Draft D/P through discussion in office work	3) Procedures of analyzing the relation of tides and water level and salinity of the drainage canal were discussed and transferred to the C/Ps. The results were compiled in the Draft Final Report.
4. Meteorology / Hydrology 1st Field Work (Jan−Feb 2010) 1) Analysis, planning & designing on meteorology & hydrology	1) Central level (C/ Ps, ID)	1) Office work & discussion	1) Discussed and transferred the planning procedure and design criteria for hydraulic analysis for the determination of design HWL and polder dike height.
5. Farm Management / Agriculture Support 1st Field Work (Jan−July 2010) 1) Present condition survey 2) Formulation of draft D/P 3) Planning & implementation of pilot project 2nd Field Work (−May 2011) 4) Implementation, monitoring and evaluation of pilot project 5) Finalization of D/P	1) Central level (C/Ps) 2) Central level (C/Ps) 3) Central & site levels (C/Ps, MAS) 4) Central & site levels (C/Ps, MAS, farmers) 5) Central level (C/Ps, MAS)	1) Office work & discussion 2) Office work & discussion 3) Office work, discussion, field work and workshops 4) Monitoring & evaluation reports, workshops through office & field OJT 5) Draft D/P through discussion in office work	1) Discussion and analysis of present situation of agriculture in project site. 2) Discussion and analysis of present situation of agriculture, especially, problem on quality of farming input such as seed. 3) Preparation of pilot project plan including detailed work schedule / implementation of technical workshop on pilot project / implementation of survey on pilot project such as seed quality survey, soil condition survey. 4) Implementation of field technical guidance, technical workshop on the pilot project / implementation of survey on pilot project / monitoring and evaluation of the pilot project. 5) Analysis of present situation of agriculture, especially about high quality seed. Preparation of D/P, Explanation and discussion on contents of D/P.
6. Windbreak 1st Field Work (Jan−July 2010) 1) Present condition survey 2) Formulation of draft D/P 3) Planning & implementation of pilot project 2nd Field Work (−May 2011) 4) Implementation, monitoring and evaluation of pilot project 5) Finalization of D/P	1) Site level (C/ P, FD) 2) Site level (C/ P, FD) 3) Central level (C/Ps, FD) 4) Central & site levels (C/Ps, FD, villagers) 5) Central level (C/Ps, FD)	1) Field observation with FD staffs 2) Field observation with FD staffs 3) Field observation with FD staffs 4) Monitoring & evaluation reports, workshops through office & field OJT 5) Draft D/P through discussion in office work	1) Observed and discussed regarding the situation of natural mangrove forest surround Labutta North Polder. 2) Observed and discussed regarding seedling production of the Thar Kone nursery 3) Observed and discussed regarding candidate place for the pilot project implementation. 4) Discussed operation and maintenance of mangrove by villagers, evaluation result and dissemination of mangrove windbreak. 5) Explained / discussed contents of D/P.

7. Rural Life Improvement			
1st Field Work (Jan−July 2010)			
1) Planning & formulation of pilot project	1) Central & site levels (MAS)	1) Discussion about activities	1) At central level, discussed on the vegetable selection and necessary volume of seed and fertilizer to be used in the income generation through vegetable production. At site level, discussed on the model farm of vegetable production.
2nd Field Work (−May 2011)			
2) Implementation, monitoring and evaluation of pilot project	2) Central & site levels (C/Ps, MAS, villagers)	2) Monitoring & evaluation reports, workshops through office & field OJT	2) Implementation of field technical guidance, technical workshop on the pilot project / monitoring and evaluation of the pilot project.
3) Finalization of D/P	3) Central level (C/Ps, MAS)	3) Draft D/P through discussion in office work	3) Explained / discussed contents of D/P.
8. Environmental Assessment			
1st Field Work (Jan−Feb 2010)			
1) Present condition survey	1) Central level (C/Ps, ID)	1) Office work & discussion	1) Discussion on contents of environmental impact study and review of present condition survey results.
2) Conducting initial environmental examination	2) Central level (C/Ps, ID)	2) Office work & discussion	2) Discussion on the result of IEE based on current natural and social condition of project area including land acquisition status for embankment works.
2nd Field Work (−May 2011)			
3) Conducting & finalizing initial environmental examination (IEE)	3) Central level (C/ Ps, ID, DAP, MAS)	3) Office work and visit to the affected people	3) Discussion on environmental consideration for the Pilot Project through monitoring results and review of the questionnaire survey regarding environmental impacts.
9. Cost Estimate / Irrigation & Drainage (B)			
1st Field Work (Jan−July 2010)			
1) Present condition survey	1) Central level (C/ Ps, ID)	1) Office work & discussion	1) Survey forms were discussed and shared with C/Ps.
2) Formulation of draft D/P	2) Central level (C/ Ps, ID)	2) Office work & discussion	2) Procedures and methodologies to formulate D/P were transferred to C/Ps.
3) Planning, designing & construction management of pilot project	3) Central/ site level (C/ Ps, ID)	3) Office work & field work	3) Discussed planning, designing and construction of polder dike embankment. Transferred construction method and construction supervision practice.
2nd Field Work (−May 2011)			
4) Implementation, monitoring and evaluation of pilot project	4) Central & site levels (C/Ps, ID)	4) Monitoring reports through office & field OJT	4) Conducted dike rehabilitation arrangement, quality/schedule control, joint site supervision and other related office & field works.
10. Project Evaluation			
1st Field Work (Jan−July 2010)			
1) Present condition survey	1) Central level (C/ Ps ID, SLRD)	1) Office work & discussion	1) Discussed and reviewed the result of present condition survey.
2) Analysis & conducting project evaluation	2) Central level (C/ Ps, ID, SLRD)	2) Office work & discussion	2) Discussed the procedure for project evaluation and disaster prevention analysis method.
2nd Field Work (−May 2011)			

3) Analysis and evaluation of pilot project and D/P	3) Central level (C/ Ps, DAP, ID)	3) Draft D/P through discussion in office work	3) Discussed economic cost-benefit analysis, centering on conversion factors, internal rate of return and other viability indicators.
11. Project Operation 2nd Field Work (−May 2011) 1) Implementation, monitoring and evaluation of pilot project	1) Central & site levels (C/Ps, ID)	1) Monitoring reports through office & field OJT	1) Discussed project operation manner, construction supervision and result of rehabilitation work

Table 6.2-2 Participants in Workshops, Seminars, Trainings and Study Tours

Category	Date / period	Attendants								Total
		C/P	ID	MAS	FD	SLRD	PDC	farmers/ villagers	NGOs/ Others	
1. Polder Dike Rehabilitation Pilot Project										
(2nd Stage)										
1) Engaged in dike embankment work	2.5 months (Dec 2010 to Feb 2011)	2	45	-	-	-	-	-	-	47
	1.5 months (Feb 2011 to Mar 2011)	2	70	-	-	-	-	-	-	72
2) Study Tour	25-27/3/2011	1	23	-	-	-	2	-	4	30
Total of 1		5	138	0	0	0	2	0	4	149
2. Seed Production Pilot Project										
(1st Stage)										
1) Introductory Meeting	30/3/2010	1	1	7	1	2	1	-	-	13
2) 1st Workshop (orientation)	7/4/2010	1	-	9	-	-	1	27	-	38
3) 2nd Workshop (technical training)	5-7/5/2010	1	-	3	-	-	3	27	-	34
4) 3rd Workshop (technical training)	1-2/6/2010	1	-	4	-	-	1	28	-	34
5) 4th Workshop (technical training)	9/7/2010	1	-	3	-	-	1	21	-	26
(2nd Stage)										
1) 5th Workshop (technical training)	27/10/2010	1	-	4	-	-	2	24	1	32
2) 1st External Seminar	2/12/2010	1	-	4	-	-	2	26	9	42
3) 6th Workshop (technical training)	21/12/2010	1	-	4	-	-	2	21	-	28
4) 2nd External Seminar	27/12/2010	1	-	1	-	-	-	25	4	31
5) 7th Workshop (technical training)	28/2/2011	1	-	1	-	-	-	18	-	20
6) Evaluation Workshop	18/3/2011	1	-	2	-	-	-	20	-	23
7) Extension Seminar	5/4/2011	0	-	3	-	-	-	20	9	32
Total of 2		11	1	45	1	2	13	257	23	353
3. Mangrove Rehabilitation Pilot Project										
(1st Stage)										
1) Introductory meeting	30/3/2010	1	1	7	1	2	1	-	-	13
2) 1st Workshop (orientation)	4/4/2010	-	-	-	-	-	2	11	-	13
3) 2nd Workshop (technical training)	12/5/2010	-	-	-	-	-	1	28	-	29
4) 3rd Workshop (technical training)	17-18/5/2010	-	-	-	-	-	1	53	-	54
(2nd Stage)										
1) 4th Workshop (technical training)	1/3/2011	1	-	-	1	-	0	66	1	69
2) 5th Workshop (technical training)	17/3/2011	-	-	-	1	-	1	82	1	85
3) Evaluation Workshop	31/3/2011	-	-	-	1	-	1	69	1	72
Total of 3		2	1	7	4	2	7	309	3	335
4. Vegetable Cultivation Pilot Project										
(2nd Stage)										
1) Preparation Workshop (at LS)	24/11/2010	-	-	1	-	-	1	37	-	39
2) Preparation Workshop (at KH)	25/11/2010	-	-	1	-	-	1	36	-	38
3) 1st Workshop (Technical training at LS)	9-10/12/2010	-	-	1	-	-	0	30	-	31
4) 1st Workshop (Technical training at KH)	11-12/12/2010	-	-	1	-	-	0	30	-	31
5) 2nd Workshop (Technical training at LS)	25/2/2011	-	-	1	-	-	1	25	-	27
6) 2nd Workshop (Technical training at KH)	26/2/2011	-	-	1	-	-	1	28	-	30
7) Evaluation Workshop (at KH)	28/3/2011	-	-	1	-	-	1	28	-	30
8) Evaluation Workshop (LS)	29/3/2011	-	-	1	-	-	1	27	-	29
9) Extension Seminar	5/4/2011	-	-	1	-	-	0	12	8	21
Total of 4		0	0	9	0	0	6	253	8	276
G-Total		**18**	**140**	**61**	**5**	**4**	**28**	**819**	**38**	**1113**

Table 6.3-1 Evaluation of Technology Transfer

Indicators		Efficiency	Effectiveness	Impact	Relevance	Sustainability
Overall Goal (1) To implement the D/P for preservation of farming area				(+) The D/P will be smoothly implemented from technical viewpoint since strengthening of technical and management capacity was observed at all levels.	(+) Highly relevant to the process & contents of capacity building including intensive field training done for polder dike, rice seed production and mangrove. (-) Medium relevant to the process & contents of capacity building done for the landless in vegetable cultivation. It needs repeatedly in longer time over plural seasons.	**(1)) Polder dike rehabilitation** (+) Will be highly sustainable with providing guidance and field OJT to government officers. **(2) Rice seed production** (+) Will be sustained with providing training to rice seed production farmers. (+) Technical manual will be fully used in the training. **(3) Income generation** (+) Will become sustainable with more support in training to be done repeatedly in longer time for landless people. **(4) Mangrove rehabilitation** (+) Will be highly sustainable with providing guidance to related village people.
Purpose of Technology Transfer (1) To strength the capacity of target group as to: 1) Central level (C/Ps, DAP, ID, MAS) 2) District & township level (ID, MAS, FD, PDC) 3) Site level (farmers, landless & village people)			(+) Process of technology transfer through pilot projects was effective as attained a total of 1,113 participants (256 officers, 819 farmers, 38 NGOs etc.). (+) Good attainment by all groups for polder dike rehabilitation.			
Outputs of Technology Transfer (1) D/P for preservation of farming area (2) Labutta North polder preserved as to polder dike, rice seed production, vegetable cultivation and mangrove windbreak through pilot project (3) Technical manual / guide on rice seed production, vegetable cultivation and mangrove rehabilitation		(+) Prepared comprehensive outputs as required. (+) Conducted efficient training, study tour, workshop for farmers and officers. (+) Attained well participation of civil and mechanical engineers and construction machines of ID in dike embankment work. (-) Limited time for pilot project that covered just 1 cropping season for rice seed production and vegetable cultivation. (-) Attained low participation at central level due to massive transfer of officers from Yangon to Naypyitaw. (+) Attained well participation by farmers in technical and evaluation workshops.			
Inputs **Japanese Government:** (1) 11 experts to project team - Team Leader/ rural development - Sub T/L /polder & gate design - Irrigation /drainage - Meteorology /hydrology - Farm management /agri-support - Windbreak - Rural life improvement - Environmental assessment - Cost estimate - Project evaluation - Coordinator /project operation (2) Conducted pilot projects for dike rehabilitation, rice seed production, vegetable cultivation & mangrove rehabilitation.	**Myanmar Government:** (1) Provision of C/Ps from DAP, ID, MAS and other related offices (2) Arrangement, coordination and OJT on various project activities					
Evaluation		Mostly high efficiency by all levels of target group except a few cases.	Fully attained to all target groups.	Generally highly positive except some negative cases observed in vegetable component.	Mostly highly relevant except vegetable cultivation component.	High for polder dike, mangrove and rice seed components.

CHAPTER 7 CONCLUSION AND RECOMMENDATIONS

1. Relevance of D/P on preservation of farming area

It is concluded that the Development Plan (D/P) on preservation of farming area would be technically applicable to Nargis affected-area, socially acceptable for rehabilitation of agricultural production and rural life, financially viable to the government of Myanmar and environmentally sound for the country. Thus, all components of the D/P could be implemented without much difficulty except income generation component which involves landless villagers under the self-help concept. Income generation projects would be concluded that they are technically and institutionally less sustainable unless government support is effectively extended.

2. Realization of preservation of farming area for rehabilitation of agricultural production and rural life through implementation of D/P

Upon implementation of the projects in the D/P, preservation of farming area shall be attained, agricultural production be restored then increased, and rural life be rehabilitated at 34 polders and embankments. More details are clearly explained below;

1) Polder dikes and embankments as the most essential structures proposed for farmland preservation and disaster prevention shall become safer from big cyclone with height and size. Sluice gates shall become more functional as it will drain excess water outside and will also prevent salt water intrusion from the river. Thus, farmland inside the polder shall be preserved, hence agriculture, the first important sustenance, will be developed.
2) Mangrove windbreak shall be planted along polder dikes and embankments to as protection from tidal surge and storms. Mangrove trees will be maintained by the village community and used for community's income generation activities.
3) With efficient technical support of MAS on farming improvement, production of quality rice seeds will be increased and widely disseminated in the area that will result to increase in their farm incomes. Other farmers who use such quality rice seed will also get increased farm income with increased production. MAS extension work will become active and efficient as the project is carried out at demo-farms with involvement of advanced farmers.
4) With efficient support of MAS, LBVD, local government and NGOs, small income generation activities, i.e. vegetable cultivation and pig breeding shall be practiced by landless. Moreover through self-expansion of the project, such activities will be expanded to other landless people. It is then ultimately expected rural life in the polder area to become active and be developed.

3. Acceleration of rehabilitation for polder dike and sluice gates

It is highly expected that rehabilitation of polder dikes and sluice gates would be accelerated as the D/P has been formulated based on the pilot project experience. Technical standards, construction method, implementation process and so on stated in the D/P shall be fully utilized as essential guide.

There are two ways of implementation for public civil works in the country, i.e. force account work by government and contracted work by contractors. As reconstruction of Nargis-affected area is urgent challenge, it will be practical to carry out the rehabilitation with force account work by ID using the ID-owned construction equipment from the viewpoint of quick and low cost implementation as compared with contracted work that usually takes long time. Only it will be required to maintain and repair of ID construction equipment as they are already very old, or to procure new equipment for the project.

4. Observation of mitigation measures on resettlement due to dike embankment rehabilitation

It is suggested that mitigation measures on resettlement and land acquisition as well as monitoring plans as recommended in the D/P in relation to dike embankment work shall be earnestly followed.

5. Village community involvement in rehabilitation of mangrove windbreak

The key to sustain the mangrove windbreak after plantation through government support will be how mangrove windbreak trees can be operated and maintained. The village community shall be involved in the project implementation and mangrove trees shall be maintained by them. For this purpose, a Mangrove Windbreak Administration Committee will be established by village people.

6. Expected wide spread of quality rice seed in Ayeyawady Delta

The D/P programme for quality rice seed production focuses on rice seed, the most basic and important farming material to be used every year. It would require neither much financial investment nor particular farming technology for farmers. On the contrary, it could benefit not only participated seed farmer producers but widely other farmers in the Ayeyawady Delta. Moreover, it is expected to increase efficacy of the Seed Law which has just newly issued in January 2011.

7. Support required in income generation projects

Expected supports to be rendered by the government / NGOs / international organizations to the landless people who will participate in the income generation projects such as vegetable cultivation and pig raising are;

1) Financial assistance to procure initial inputs such as seed, fertilizer, pesticide, watering can, piglet, vaccination and so on.
2) Provision of pre-implementation guidance as to role sharing, work responsibility, expected technical and management support, and budget involved.
3) Provision of technical training on vegetable cropping and pig culture through timely field visit.
4) Provision of market information for harvest control and preparation of transport and selling.

8. Way of initiatives between beneficiaries and government on self-help project under D/P

Among the projects in the D/P, the projects for quality rice seed production and income generation are self-help concept activities from which individual participant either farmers or landless people will be benefitted. In such self-help-natured projects, initiatives and responsibilities shall be basically taken by beneficiary (participant). However, for the success of the project in view of public interest, as participants are on very weak base in terms of technique, finance and marketing, the government from the union and/or region involved shall take initiatives in promotion of the project particularly in initial arrangement and orientation period.

9. Funds Procurement for the D/P

The total development cost for the rehabilitation of agricultural and rural infrastructure under the D/P is estimated at 39,662 million Kyats (equivalent to US$ 45.6 million), which the government of Myanmar needs to prepare. Therefore, the government of Myanmar shall make serious efforts to procure the development funds from possible financial sources such as government fund, donor countries, international development organizations, financial lending institutions, etc.