Ministry of Agriculture, Irrigation and Mahaweli Development
Democratic Socialist Republic of Sri Lanka

THE STUDY
ON
INCREASING THE CAPACITY
OF
INTEGRATED MANAGEMENT IN IRRIGATION SECTOR
IN
SRI LANKA

FINAL REPORT

MAIN REPORT

July 2006

JAPAN INTERNATIONAL COOPERATION AGENCY
NIPPON KOEI CO., LTD.

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PREFACE

In response to the request from the Government of Democratic Socialist Republic of Sri Lanka, the Government of Japan decided to conduct the Study on Increasing the Capacity of Integrated Management in Irrigation Sector and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent the study team headed by Mr. N. Morioka, Nippon Koei Co., Ltd. to Sri Lanka four times during the study period from October, 2005 to July, 2006.

The team held discussions with the officials concerned of the Government of Sri Lanka and conducted field surveys, investigations, and workshops in the study area and also held seminars. In succession, the Team made further study and the present report was prepared.

I hope that this report will contribute to the integrated management of the irrigation sector in Sri Lanka and to the enhancement of the friendly relationship that exists between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Sri Lanka for their close cooperation with the study.

July 2006

Yoshihisa Ueda,
Vice President
Japan International Cooperation Agency

July 2006

Mr. Yoshihisa Ueda
Vice President,
Japan International Cooperation Agency
Tokyo, JAPAN

Letter of Transmittal

Dear Sir,

We are pleased to submit to you the Final Report of the Study on Increasing the Capacity of Integrated Management in Irrigation Sector in the Democratic Socialist Republic of Sri Lanka. This report presents the capacity development plan for the government officials and Farmers' Organizations in management of irrigated agriculture in the Dry Zone of Sri Lanka.

The Government of Sri Lanka has accelerated the irrigation development in the Dry Zone since the 1970s and this resulted in improvement in self-sufficiency level of paddy in the 1990s. Then, O&M of irrigation facilities and water management at the field level have been handed over to Farmers' Organizations, however, O&M and water management are still largely dependent on the Government due to the low farm income caused by the stagnated paddy price. Further, tendency of decreasing rainfall due to the global warming effect may cause reduction of water resources for irrigation. Taking the above situation into account, agricultural productivity and farmers' income need to increase through efficient and fair utilization of water resources, and enhancement of the capacity is required for the government officials and Farmers' Organizations in integrated management of irrigation, agriculture and marketing.

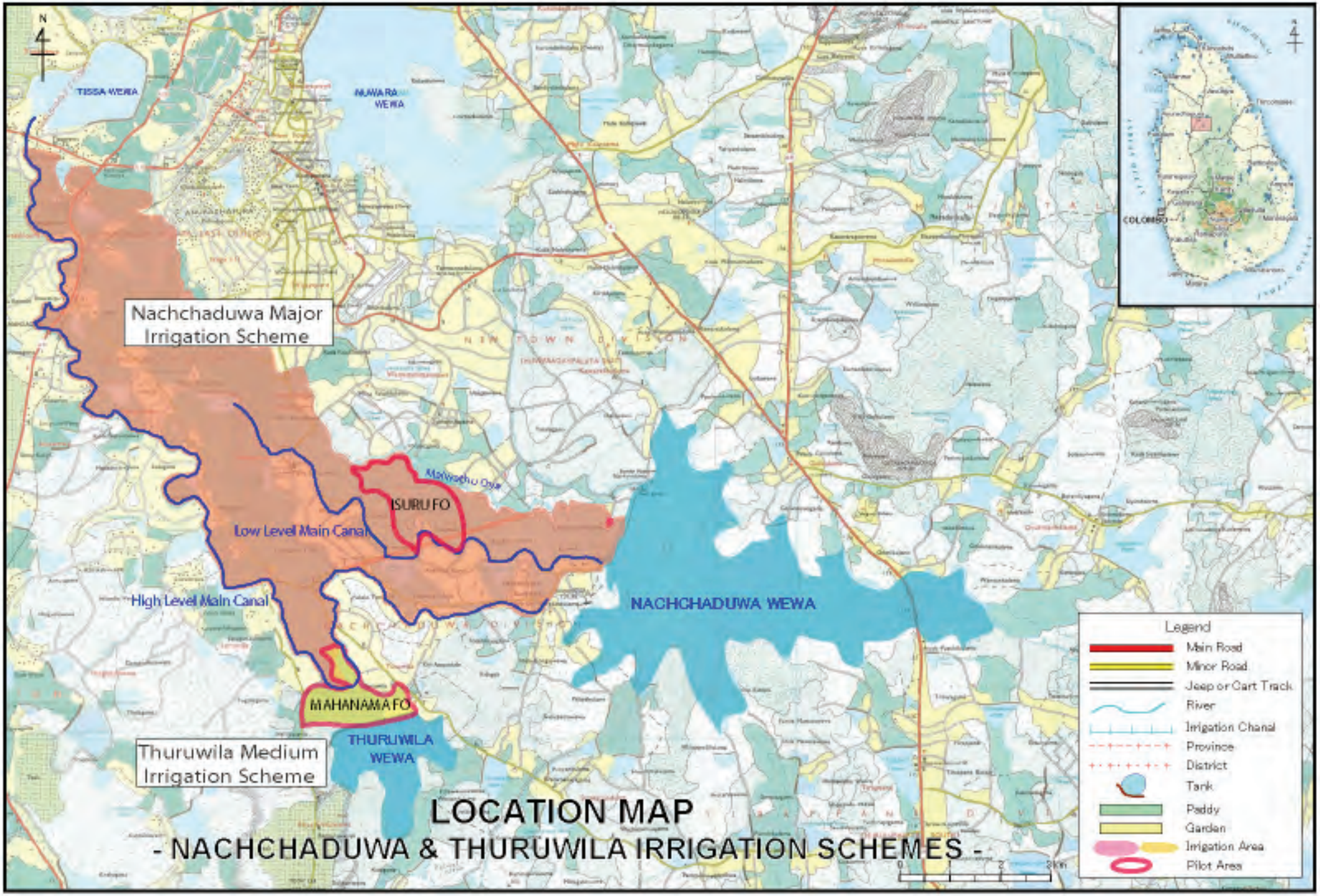
We believe that the capacity development plan will contribute to O&M of irrigation facilities and efficient water management by Farmers' Organization in self-dependent basis, and finally to increase of farmers' income through improvement of agricultural productivity and marketing of products. Moreover, through the joint effort made by the JICA study team and the counterpart team the procedures for plan formation are transferred to staff of the Irrigation Management Division and Irrigation Department. We hope that the plan will be implemented by utilizing the procedures transferred and will finally contribute to achieving sustainable irrigated agriculture in Dry Zone of Sri Lanka.

We wish to express our deep appreciation and sincere gratitude to the officials concerned of your Agency, the Ministry of Foreign Affairs, and the Ministry of Agriculture, Forestry and Fisheries of the Government of Japan for the courtesies and cooperation kindly extended to our team. We also express our hearty gratitude to the officials concerned from the Sri Lanka Office of JICA, the Embassy of Japan in Sri Lanka, the Ministry of Agriculture, Irrigation and Mahaweli Development of Sri Lanka, provincial and district governments, and also other departments represented as Steering Committee members for the close cooperation and various forms of assistance extended to our team during field investigations and studies in Tanzania.

Very truly yours,

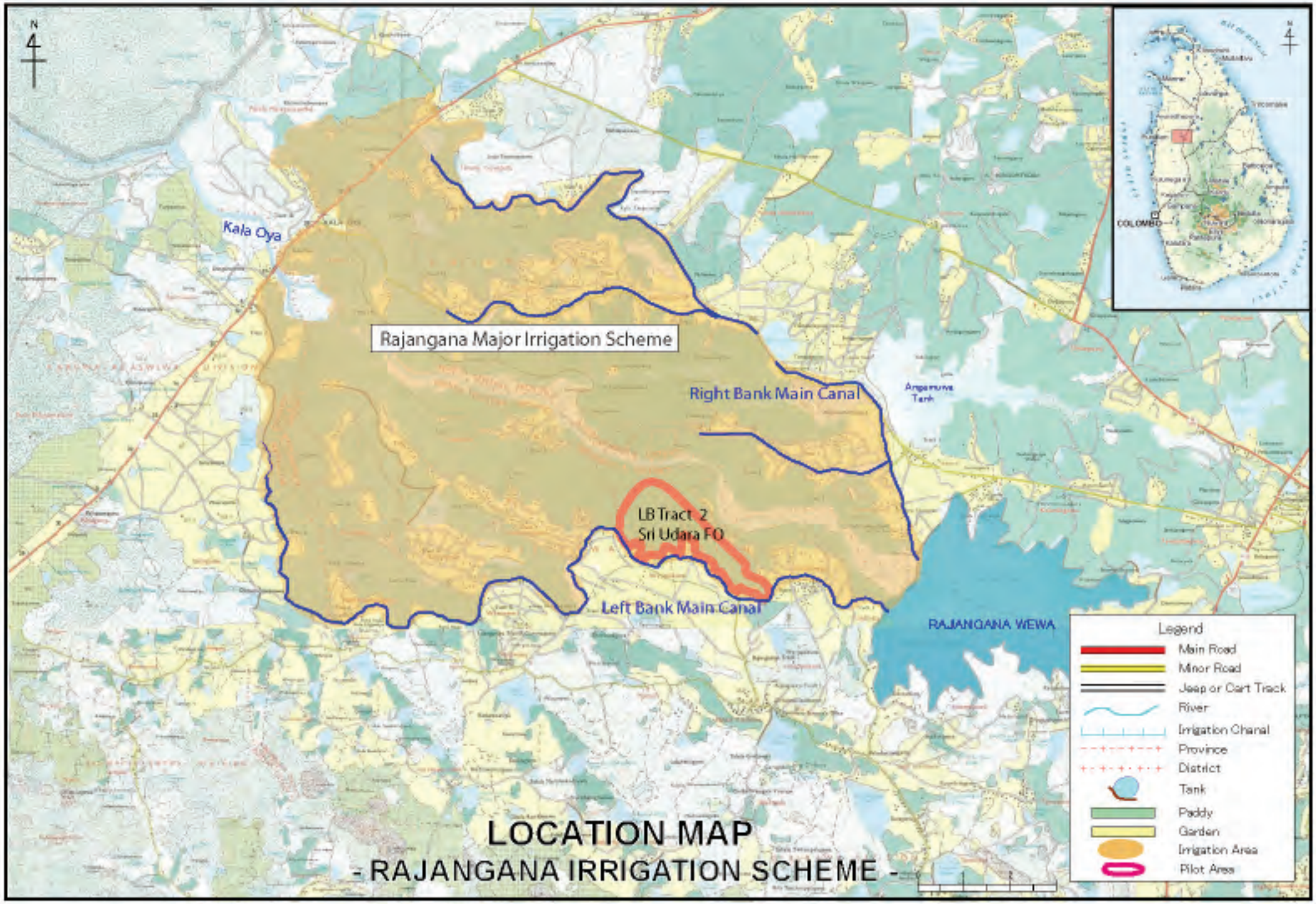
N. Morioka

Naoto MORIOKA
Team Leader of the Study Team for the
Study on the Increasing the Capacity of
Integrated Management in Irrigation Sector



LOCATION MAP

- NACHCHADUWA & THURUWILA IRRIGATION SCHEMES -



LOCATION MAP
- RAJANGANA IRRIGATION SCHEME -

I. Introduction

Authority

01. This is the Final Report on the Study on Increasing the Capacity of Integrated Management in the Irrigation Sector in Sri Lanka (hereinafter referred to as "the Study") prepared in accordance with the Scope of Work (S/W) agreed upon between the Ministry of Agriculture, Irrigation and Mahaweli Development, and the Japan International Cooperation Agency (JICA) dated July 6th 2005. The Report presents the results of all work performed in Sri Lanka and Japan during the Study period of 10 months from October 2005 to July 2006. *(section 1.1)*

Objectives of the Study

02. The dry zone is the granary of the country and paddy production is the main economic activity of small farm household in the rural areas. Paddy production in this Zone is heavily dependent on irrigation. The irrigated paddy cultivation in this area is characterized by three issues as follows: (i) Household income is still low due to low profitability of paddy cultivation, (ii) Although participatory irrigation management policy has been already promulgated, farmers are largely dependent on government's support for O&M of D- and F-canal level facilities and (iii) Effective water utilization is required because of the decrease of rainfall caused by the global warming. In considering the way of increasing rural household income ultimately contributing to poverty alleviation, it is important to prepare the plan to enhance the capacity of government officials and farmers to tackle those issues.

Based on the discussion above, the objectives of the Study were: (i) to formulate a plan to increase the capacity for integrated management of the officials belonging to the Irrigation Management Division (IMD), the Department of Irrigation (ID) and other relevant officials engaged in the irrigation sector (hereinafter referred to as "the Officials"), (ii) to formulate a plan to increase the capacity of Farmers' Organizations (FOs) for integrated management, and (iii) to strengthen the planning capacity of counterpart personnel engaged in the management of the irrigation sector in the process of the implementation of the Study. *(section 1.3)*

Study Area

03. The irrigation area in Sri Lanka is approximately 600, 000 ha, 73 % of which are occupied by major and medium schemes having more than 80 ha, and 27 % of which are categorized in minor irrigation scheme with less than 80 ha (see Table 4 in the main text). Most of minor schemes totalling about 18,000 have ancient simple facilities with multi-purpose tank, providing water not only for irrigation water but also for drinking. Such areas are maintained by the communities until now.

On the other hand, major and medium irrigation scheme is mainly located in the dry zone that are classified into two: (i) schemes operated before the independence (1948) and (ii) schemes developed, after the independence, in concurrence with the policy of food security. The latter schemes have been consistently managed by the government. After the participatory irrigation management policy was introduced in 1990s, O&M of D- and F-canal level facilities were handed over to FOs. However, O&M is still dependent on government's support. Corresponding to such situation, the Study area covers major and medium irrigation schemes, that are dominant in number in the dry zone , and that are necessary to be rehabilitated.

The Study area consisted of Nachchaduwa major scheme (2,904ha) and Thuruwila medium scheme (193 ha) located in Anuradhapura district and Rajangana major irrigation schemes (6,639ha) mainly located in Anuradhapura district and partially in Kurunegala and Puttalam districts.

In addition to the above-mentioned three schemes, the Study included minor irrigation schemes surrounding nearby, as references since minor schemes involve good lessons to be derived that are useful for the formulation of improvement approach in major and minor schemes.

In the Study area, three irrigation blocks were selected as the pilot areas for intensive survey: one block (125ha) under Isuru FO in Nachchaduwa located at a low level in the Main Canal, one block (181ha) under Sri Udala FO in Rajangana Left Band Tract No. 2, and the whole of the Thuruwila area under Mahanama FO. *(section 1.5)*

Basic Framework of the Study

04. The Study was carried out based on three steps: (i) Step-1: problem identification, (ii) Step-2: preparation of the basic approach to improve the present situation and (iii) Step-3: preparation of the plan to increase the capacity of integrated management. In Step-1, problems and issues were identified through field survey, data collection & analysis, GIS-based irrigation block mapping and problem analysis workshops by gathering stakeholders. Based on the problems and issues derived, an improvement approach was formulated for sectors of irrigation, agriculture and marketing as well as actors of the officials and FOs to counter such issues. In order to carry out this improvement approach, in Step-3, a plan was prepared to develop the capacity of integrated management required for Farmers' Organizations and the officials. Training items are identified for Farmers' Organizations to strengthen their activities, and for the officials to support Farmers' Organization. In order to conduct the systematic training, the capacity development mechanism is prepared taking into account the coordination of relevant agencies, monitoring & evaluation and role of training institutes. In conducting the systematic training through the capacity development mechanism, the plan will be firstly carried out in the pilot areas so as to demonstrate the performance of the training, then the experience will be extended to the surrounding areas.

II. National and Regional Background

Paddy Cultivation in the Study Area

05. The Dry Zone in which the Study area is located is the granary of the country in view of national food security, producing 2.1 million tons of paddy, 80% of the national production. Paddy production is the main economic activity of small farm households in the rural areas of the Dry Zone. Paddy production in this Zone is heavily dependent on irrigation since rainfall pattern shows wide fluctuation and paddy production is not stable under rainfed condition. Due to the effort of the government, irrigation development has been accelerated under assistance from such international donor agencies as World Bank, ADB and JBIC since the 70's, which resulted in improvement in the self-sufficiency level of paddy from 42% in 1950 to about 95% in the 1990s. *(section 1.2)*

06. Although paddy production reached at self-sufficiency level, the per capita consumption of rice is not increasing and likely to decrease in near future, due to the income increase of the people has been brought about changing food preference. Taking this situation into account, the government changed its policy from "increase of paddy supply" to "staple supply of quality paddy". At the same time, paddy productivity is not improved because unit yield has reached the ceiling level not responding according to dosage increase of fertilizer. Reflecting the changes, paddy has been subjected to the market economy, linking it with the global market. Since then, paddy prices have remained low, resulting in the profitability of paddy cultivation becoming quite low. *(section 1.2)*

07. This situation brought severe economic hardship to the small farmers in the Dry Zone, because their farm income is mainly derived from paddy production. Particularly, the rural population below the poverty line that is engaged in paddy cultivation finds it extremely difficult to earn a decent income from farming. *(section 1.2)*

General Situation of Irrigation

08. Irrigation is an age-old art in Sri Lanka and it has been the backbone of the civilization of the country. Ancient kings developed many irrigation systems and irrigation works were maintained by village communities under the "Rajakariya" system. However, the "Rajakariya" system was abolished in 1832 under the British administration, and this led to the degradation of irrigation works resulting in a negative impact, not only on irrigation works, but also on social cohesiveness. This reform was promoted based on plantation farming strategy without considering superiority inherent in traditional irrigation management in Sri Lanka. *(section 2.2.1)*

09. Since independence, the government institutions have managed the major and medium irrigation schemes, while the community has managed minor schemes. Since the early 1980s the management expenses of irrigation facilities including O&M became a heavy burden to the government and, corresponding to the advice from international organizations, handing over of O&M and water management of D-canals and below to

Farmers Organizations (FOs) commenced in the early 1990s under the participatory irrigation system management policy. However, O&M and water management of D-canals and below are still largely dependent on the government situation of which includes (i) low O&M fee payment from farmers, (ii) low farmers' participation in facilities' rehabilitation, (iii) insufficient planned water management by FOs themselves and so forth. Therefore, the situation remains to be improved if irrigated paddy production is to be sustained. *(section 2.2.1)*

10. In order to discuss future direction of irrigation development and management in Sri Lanka, whether irrigated areas are expanded or agricultural productivity is increased with keeping current areas etc., the availability of water resources is one of the important determinants. According to the long term trend of rainfall, based on comparison and analysis of the data between 1930-60 and 1961-1990, the entire country faces a remarkable shifting of the climate into drier conditions through decreasing rainfall particularly after 1970s. This may indicate that irrigation schemes would suffer shortage of water resources if this trend continues in concurrence with the global warming, and efficient water use will be required. *(section 1.2 & 3.2.1)*

11. One of the other major problems associated with Sri Lanka's irrigation systems is its high structural density causing a high degree of operational complexity. It is one reason for poor O&M by staff and farmers due to the difficulties involved. It has become therefore, timely and important to incorporate simple to operate and low maintenance, low cost devices in irrigation canals to control canal water head and flow, and for water measurement, especially in sub-systems which are farmer-managed. *(section 1.2)*

Present Legislation on Irrigation Management

12. The present legislation relating to O&M of irrigation facilities and water management principally consists of the following: (i) the Irrigation Ordinance issued in 1946 with subsequent amendments, (ii) the Mahaweli Authority Act and (iii) the Agrarian Development Act of 2000. *(section 2.2.2)*

13. In particular, the amended Irrigation Ordinance (1994) is to provide legal backing for the new concept in participatory irrigation management. Farmers had been previously paying irrigation tax to the government so that overall irrigation management had been consistently carried out by the government. The amended Irrigation Ordinance, however, stipulated that FOs are to take charge of O&M for D and F-canal level facilities. For this, they are exempted from irrigation tax. *(section 2.2.2)*

14. Issues related with present legislations include discrepancies. In addition, some regulatory functions are not necessarily implemented and are not working at the field level. The implementation of regulatory function is largely affected by social hierarchy. In particular, FOs' activities remain downturn at present. One of the reasons comes from oppositions of land owners toward tenant and lease farmers to be members of FOs although it can be possible in accordance with current regulations. Therefore, supporting mechanisms should be developed to particularly involve tenant and lease farmers into FOs' activities or at least

in product based sub-committees in FOs. *(section 2.2.2)*

Government Institutions Relating to Irrigation

15. The primary government institutions related with the irrigation sector include the Irrigation Department (ID), Irrigation Management Division (IMD), Mahaweli Authority of Sri Lanka (MASL), Department of Agrarian Development of the central government and local institutions such as the provincial irrigation department and organizations of individual institutions, the function of which are tabulated in Table S-1. *(section 2.2.3)*

Table S-1 Institutions Relating to the Irrigation Sector

Institutions	Major Functions/Activities
Department of Irrigation Development (ID)	Responsible for all inter-provincial irrigation works, to carry out water resources planning, research, construction, rehabilitation, O&M of irrigation facilities and training advisory services in major and medium irrigation schemes, promotion of participatory irrigation management policy based on WAHAULA Program)
Irrigation Management Division (IMD)	To implement Integrated Management of 55 Major Irrigation Schemes (INMAS) by appointing Resident Project Managers (RPM)
Mahaweli Authority of Sri Lanka (MASL)	To supervise the Accelerated Mahaweli Development Programme
Department of Agrarian Development (DAD)	To manage registration of FOs under the Agrarian Development Act and be in charge of the minor irrigation schemes with an irrigable area of less than 80 ha
Local Governments	Such as Provincial Irrigation Department or Provincial Engineering Department, to manage irrigation schemes, water sources of which are river confined in one province. Minor irrigation schemes under DAD are excluded.

Prepared by the Study Team

Remarks : Major irrigation scheme: More than 800 ha
Medium irrigation scheme: Between 80 ha and 800 ha
Minor irrigation scheme: Less than 80 ha

As clearly seed, different organizations are involved for different scale, location etc. It would be possible to achieve better irrigation performance if different organizations, for instance, ID in charge of "development" and IMD in charge of "management and institutional development" amicably collaborate for irrigation sector. Therefore, strengthening coordination among such agencies by mutually developing training program is the key to formulate the plan to enhance the capacity of integrated management in irrigation sector.

Brief Comparison with Asian Countries

16. As similar to Sri Lanka, Asian Monsoon countries have been implementing irrigated agriculture particularly paddy cultivation. Agricultural production has been increased primarily by the promotion of large scale development, however, focus is recently put on community participatory small-scale development instead of new large scale investment. In the Study, five countries having long history in paddy cultivation including Japan, Philippine, Thailand are selected as cases. Information on policies and legislation related with irrigation management was collected for those countries and compared with Sri Lanka so as to derive useful experiences and lessons.

A particular point identified through the analytical comparison is the unique function of farmers' organizations in Sri Lanka, which is that it is an irrigation-based multi-purpose

organization. On the other hand, other countries have such irrigation-based organization, but recently they are changing their activities into multi-purpose as what organization in Sri Lanka is carrying out. In this regard, Sri Lanka is superior to those counterparts. In order to activate FOs and small groups at farmers' level in Sri Lanka, it is important to introduce economic incentives through various income generation activities in addition to crop production and to gradually scale-up those activities. In this process, social support from the community can be a leverage. *(section 2.2.6)*

III. Present Condition of the Study Area

General Condition

17. The Study area is situated in the DL1b Agro-ecological Region (AER) which is characterized by 75% expectancy value of annual rainfall more than 900 mm, latitude less than 300 m and an undulating terrain of Reddish Brown Earth (RBE) – Low Humic Gley (LHG) soil association. The land use is for rainfed upland crops, paddy, scrub, mixed home gardens and forest plantations. The average monthly variation in the temperature is low, the lowest recorded in months of January (26.1 ℃) and highest in May (29.7 ℃). The principal crop in Anuradhapura district, in which the major part of the Study area is located, is paddy with nearly 10% of the total cultivated area nationally, in both the Yala and the Maha seasons. The region also contributes significantly to the national production of highland crops. *(section 3.1.2)*

18. The mean family size in the pilot area is between 4 and 5 members. The mean family labour contribution for farm work was 1.7. The average size of each operational holding varied with 1.10 ha in Nachchaduwa, 0.91 ha in Thuruwila and 0.65 ha in Rajangana. The annual household income in the survey area averaged Rs. 133,000, of which 72% is derived from agricultural operations. Of the other income sources, the highest contribution came from the earnings from labor. As for household expenditure, the highest expense incurred by an average family was for food and beverages, with transport, loan repayments and educational expenses next in order. The total average expenditure at Rs. 100,000 was about equal for all three surveyed locations. *(section 3.1.3)*

O&M of Irrigation Facilities and Water Management

19. Irrigation water in all the three schemes is provided by impounding water in ancient tanks. Irrigation networks generally consist of the main, D and F-canals with distribution facilities such as regulators and turnouts. The general features are shown in Table S-2. *(section 3.2.2)*

Table S-2 General Features of the Schemes

Scheme	Command Area (ha)	Water Source	Facilities
Nachchaduwa	2,904	Nachchaduwa reservoir supplemented by Kalawewa of Mahaweli system	- Two main canals: High level (HL) and low level (LL) - HL main canal cutting off the command of Thruwila
Thruwila	186	Thruwila wewa	- Concrete flume main and D-canals recently

Scheme	Command Area (ha)	Water Source	Facilities
			rehabilitated under NWS&DB - F-canal yet to be constructed
Rajangana	6,639	Rajangana reservoir constructed along the Kala Oya downstream	- Two main canals: right bank (RB) and left bank (LB) - Pumps irrigating upland

Prepared by the Study Team

20. The result of water productivity calculations show that the value in Nachchaduwa is higher than in other two schemes, particularly in the Yala cultivation season. This could be explained by the situation that the shortage of water resources in the Nachchaduwa scheme would encourage farmers to effectively utilize water resources for cultivation. In addition, the geographical location of Nachchaduwa, where the area is located near Anuradhapura and accessible to Dambulla market, would be gradually fostering a business mind among FOs through effective resource mobilization, including water resources. *(section 3.2.3)*

21. Although handing over policy has been officially declared, according to amended Irrigation Ordinance (1994), ID is still providing an O&M budget as shown in Table S-3.

Table S-3 O&M Budget at the Three Irrigation Schemes

No	Item to Compare	Unit	Nachchaduwa	Thuruwila	Rajangana
1	Operation Budget	Rs. (Rs./ha)	134,200 (46)	9,000 (46)	281,600 (42)
	a ID's Expenses	Rs.	67,100	9,000	84,480
	b FO Expenses	Rs.	67,100	0	197,120
2	Maintenance Budget	Rs. (Rs./ha)	874,600 (301)	58,500 (303)	1,835,900 (277)
	a Headworks	Rs.	174,920	No separate budget for Sub-items	555,700
	b Roads	Rs.	87,460		
	c Main & Branch Canal	Rs.	349,840		535,731
	d Distributory Canal	Rs.	262,380		377,286
	e Field Canal	Rs.	FO's Responsibility	FO's Responsibility	367,180

Source: Prepared by the Study Team

The budget allocated from the government is reported to be only 20 to 30 % of the actual requirement to maintain existing facilities. Consequently the facilities have been deteriorating. The fund could be used for main facilities' O&M if FOs were to accomplish those tasks by arranging budget by FOs' themselves and to reduce government's burden. O&M of D- and F-canal level facilities by FOs own effort requires mechanism of O&M fee collection within FOs through raising their awareness. Community participatory rehabilitation would be an effective tool to raise awareness and the sense of ownership among FOs. A part of income can be saved as O&M fund if community participatory rehabilitation is appropriately facilitated and implemented. *(section 3.2.4)*

22. The three schemes are defined as "supply-oriented systems" as the water issue schedule within the system largely depends upon the management schedule within the Mahaweli system prepared by the Mahaweli Water Management Committee (MWMC) before every cropping season. The water distribution schedule within the scheme is prepared by the Kanna meeting while the activities are monitored by the Project Management Committee (PMC). Issues related to the Kanna meeting and the PMC include: (i) limited farmer participation and (ii) insufficient function. The mandatory power of the PMC and Kanna

meetings seems to be questionable. *(section 3.2.5)*

23. Within the scheme, the water issue schedule for land preparation and the normal cultivation period is prepared in the Kanna meeting. In the normal period, water is continuously issued while rotational irrigation is scheduled in the normal cultivation period. Significant issues found in this micro-level water management are: (i) excessive water discharged into D-canals leading to facility deterioration due to unmeasurable discharge at the head of the D-canal and (ii) rotational irrigation not practiced thereby creating the perception of inequality between upstream and downstream. *(section 3.2.5)*

24. A performance evaluation of the long-crested weir and baffle distributor was carried out by comparing pilot and control areas in the Rajangana LB tract 2 so as to assess the effectiveness of such devices for water management improvement. Measurement revealed three points: (i) less variation of total issue between upstream and downstream, (ii) much more water diverted to control command areas and (iii) the necessity for careful consideration of user capability and acceptability toward new technologies. A combination using a long-crested weir would have possibilities for improving water management from technical and social viewpoints according to the experiment. A gradual scaling-up approach is recommended in order to expand this practice. *(section 3.2.5)*

25. Water quality analysis was conducted to clarify the impact over irrigation and drinking water through irrigated agriculture. The result indicates that the water quality in the study areas is within the suitable range for the designated use. However, some nutrient enrichment was observed though plot-to-plot irrigation and fertilizer application. Proper input of fertilizer and suitable farm level water management is recommended for farming practice improvement programmes. *(section 3.2.6)*

26. According to the Mahaweli Upgrading Project (MUP), the most futuristic and triumphant irrigation project, the following lessons can be derived for the preparation of the plan to increase integrated management: (i) the need for equal prioritization of both software (water management, FOs' capacity development etc.) and hardware (facilities) components of irrigation using a community participatory approach, (ii) outsider-oriented, overbearing and oppressing rehabilitation creates a poor outcome, (iii) the requirement for frequent on-the-job training and follow-up sessions as well as aftercare and (iv) the desirability of emphasizing the strengthening of FOs as a process. *(section 3.2.7)*

27. In the dry zone area, approximately 7,000 minor tanks are currently in use. Such minor irrigation is one of the traditional irrigation systems being rich in lessons for irrigation management. Significant points inherent in minor irrigation include: (i) a high level of FO ownership mindset, (ii) strong social cohesion among community members and (iii) active Kanna meeting operation. *(section 3.2.8)*

28. Special Program for Food Security (Special Program for Food Security: SPFS) is also showing a good guideline to improve major and medium irrigation schemes. The program aims at developing minor tank community through fostering FOs' initiative in development. The government officials continuously support FOs in the course of the program. As a result, it is observed that some FOs substantially empowered to be really active in farming. Particularly, various task forces are organized such as paddy cultivation, vegetable and

OFC cultivation, livestock, women's group activity promotion and micro credit operation to respectively energize those such thematic activities. *(section 3.2.8)*

29. According to the field survey, as well as the problem analysis workshop, the core problem in the irrigation sector is defined as "improper supply of irrigation water," which is caused by four primary categories of issues: (i) malfunctioning facilities at the main level, (ii) malfunctioning facilities at D and F-canal level, (iii) improper water management at the main level and (iv) improper water management at D and F-canal level. *(section 3.2.9)*

Agriculture

Table S-4 Type of Land Tenure

Unit: %

	Nachchaduwa	Thuruwila	Rajangana
Own land	44	60	89
Tenant& lease	52	32	11
Others	4	8	0

Source: Socio-economic Survey Carried by the Study Team

30. Table S-4 shows the type of land tenure in the three schemes. They have different characteristics: the Nachchaduwa scheme consists of descendants of the settlers from old village settlements and tenant & lease farmers; Thuruwila scheme consists mainly of descendants of the original "purana" villages; Rajangana scheme inaugurated in the 1960s is more an organized system of settlements based on a blocking-out plan, the operators of which consist of previous old village settlers. *(section 3.3.1)*

Table S-5 Summary of Paddy Yield

(Unit: ton)

Data source	Nachchaduwa		Thuruwila		Rajangana	
	Maha	Yala	Yala	Maha	Yala	Maha
IE Office ID		4.11			4.73	4.40
GAP/INMAS	5.98	4.76			5.78	5.00
FO Survey	4.12	4.12			4.33	4.33
Socio-economic Survey	4.85	4.76	5.20	5.40	4.22	4.20

1. IE's office, Nachchaduwa and Rajangana, ID,
2. Department of Census and Statistics
3. Central DOA, 4. Field survey of the JICA Study Team

31. A summary of paddy yield is given in Table S-5. The Nachchaduwa and Rajangana schemes remain 4.1 to 4.8 ton/ha while Thuruwila shows more than 5 ton/ha in both the Yala and Maha seasons. Demonstration trials under the Granary Area Programme (GAP), a package of farming support through irrigation, agrarian and institutional assistance, in Nachchaduwa and Rajanagana both significantly exceeded 5 ton/ha in the Maha season. Therefore, a potential yield increase can be observed if farming improvement support is appropriately carried out. *(section 3.3.2)*

32. Although such potential has been observed, crop profitability of paddy remains questionable. In accordance with the simulation, by comparing present conditions and projection, the net income increases in Nachchaduwa, Thuruwila and Rajangana are 27,500 Rs./ha, 43,100 Rs./ha and 33,100 Rs./ha respectively, which shows that the increment in the profitability level is not significant. Therefore, increasing farmers' income through the promotion of crop diversification is necessary. *(section 3.3.3)*

33. Approximately 30 to 40 % of the areas in Nachchaduwa and Rajangana schemes are dominated by well-drained reddish brown earth having potential for promoting crop diversification. However, OFC and vegetable cropping is currently limited, except for

energetic small vegetable farmer groups, particularly in Nachchaduwa. Insufficient information on land suitability would be one of the obstacles for the promotion of crop diversification. *(section 3.3.3)*

34. In order to promote crop diversification at Nachchaduwa and Rajangana schemes, the government should take initiative in supporting farmers for micro-zoning using information on land resources as well as suitability so as to orient current farming into more profitable one based on land suitability. *(section 3.3.3)*

35. On the other hand, the Thuruwila scheme is primarily covered by poorly drained soils in accordance with the soil survey, so more intensive paddy cultivation would be prioritized. *(section 3.3.3)*

36. Agricultural extension comes under the purview of central DOA through the inter-provincial office in Anuradhapura. Among the priority programmes for paddy extension, the tract demonstrations initiated in the 1996/97 Maha season are currently continued as a technology package under the GAP. The programme targets: (i) increasing the average paddy yield to over 6.5 ton/ha, (ii) increasing cropping intensity to 185 % and (iii) covering the total project area (271,000 ha covering 16 districts and 5 Mahaweli project areas) within 3 years. The activity under the GAP has been extensively implemented as shown in Table S-6 and the result is promising as already introduced in Table S-5. However, its sustainability of effect is not at a satisfactory level due to inadequate monitoring and follow-up for field demonstration. *(section 3.3.4, 3.3.5 & 3.3.6)*

Table S-6 Distribution of Yaya Demonstrations in Study Area: 2005/06 Maha

Location	No. of AI Ranges	No. of Demonstrations	Land Extent (ha)	No of Farmers
Rajangana RB	10	50	678	924
Rajangana LB	5	21	258	353
Nachchaduwa	2	17	232	272
Thuruwila	1	8	101	148
Total	18	96	1,269	1,697

Source: DOA

37. The core issue of the agricultural sector is “low farm income”, which is attributed to three sub-issues: (i) low profitability from paddy production, such as low productivity, high production cost, high land fragmentation, and low product price, (ii) weaknesses in agricultural extension indicating low sustainable effects of demonstrations and (iii) limitations to crop diversification caused by insufficient land resource information, legal regulation, low consciousness of market requirement and shortage of capital. *(section 3.3.7)*

Marketing

38. Most rice farmers sell their paddy immediately after harvesting, without adjusting delivery timing by checking the market prices, since they borrow cultivation funds in advance from middlemen. In order to settle such loans, farmers feel the need to rush to sell paddy to seek cash income. Under such unfavourable circumstances, however, some epochal trials have been observed, for instance, differing payment systems, forward sales contract systems, and rice processing villages promoted by the Institute of Post Harvest Technology (IPHT).

(section 3.5.1)

39. Unlike that for OFC, vegetables & fruit, no wholesale paddy market is available in Sri Lanka. Selling paddy directly to middlemen and rice millers creates: (i) improper price formulation (inaccurate weighing, moisture measuring and quality, (ii) no price information system and (iii) limited markets for producers. An Open Paddy Market (OPM) currently operates in Thailand in order for paddy to be actively dealt with every day by wholesalers/collectors and producers in the economic centres. These are a good reference providing the opportunity for producers as well as users to familiarize themselves with the market information for paddy in terms of price, quantity and quality. *(section 3.5.1)*

40. OFC production and marketing is still minor at present in the Study area. Warehousing or bulking activities for OFC have not yet been observed. IPHT is developing several types of processing equipment through appropriate technology. However, field adoption is presently insignificant. Government assistance needs to consider both aspects: hardware (facilities) and software (value added promotion, quality control, etc.) in marketing. *(section 3.5.2)*

41. Vegetable production in the Dry Zone is on the increase and the Study areas have not been left out. The main crops include tomatoes, eggplants, cucumbers, bitter gourds, etc. The channels and methods of vegetable marketing are different in the Study area. The most significant case can be observed in the Nachchaduwa scheme. Young farmers have successfully formed a working group for vegetable cultivation and they directly sell vegetables to Dambulla wholesale market utilizing their own transportation. Such new activity influences neighbouring farmers in Nachahduwa so that they imitate the activity, thereby gradually increasing the number of vegetable farmers. *(section 3.5.2)*

42. Comparing the rice price between Sri Lanka and Thailand, as shown in Table S-7, for the price formulation of paddy from farm-gate to the retailers' price paid by the consumer, shows that the profit margin accrued by wholesalers in Sri Lanka is very high. Such tendency is also observed in the transactions for OFC, vegetables & fruit. The price information relating to buying and selling, however, is not open to the public and the amount the wholesalers take is not clear. Transparency of reasonable price formulation is required. One of the countermeasures to increase farmers' income is to promote bulking, quality control and collective marketing instead of individual dealing, which needs enhancement of farmers' group capacity in marketing. *(section 3.5.3)*

Table S-7 Rice Price Comparison between Sri Land and Thailand

	Sri Lanka	Thailand
Paddy price (=1)	US$0.11/kg	US$0.17/kg
Wholesale price of milled rice (=2)	US$0.32/kg	US$0.28/kg
Consumers price at retail shops (=3)	US$0.42/kg	US$0.34/kg
Margin Ratio: Wholesale/Paddy (=2÷1)	2.94	1.68
Margin Ratio: Consumer/Paddy (=3÷1)	3.82	2.03

Prepared by the Study Team

43. In the Study areas most basic marketing facilities are available, including weekly markets (Pola), marketing centres (townships), storage facilities, and rice milling and food processing centres. Both government and non-government organizations are involved in supporting marketing activities. In particular, the government has intervened in paddy

purchase aiming to stabilize a floor price during the harvesting seasons since Yala in 2004/05. However, the intervention remains at 5% of national production due to budget limitation. Major road networks in the Study area are paved, but in Rajangana many places have pavement distress resulting in higher transport costs. Physical market accessibility also needs to be improved. *(section 3.5.4)*

44. The core problem in the marketing sector is "limited market access", which includes the following three issues: (i) poor marketing of paddy due to low farm gate prices, as a result of paddy being sold without adjusting the shipping period, (ii) poor marketing of OFC, vegetables & fruit because of price fluctuations, low prices of perishable products and high post harvest losses and (iii) inactive other income generation activities by reason of lack of value addition activity, including agro-processing, and inactive resource utilization. *(section 3.5.5)*

Farmers' Organization and Government Agencies

45. The committee of a Farmers' Organization (FO) generally consists of office bearers and representatives of all Field Canal Groups (FCGs). The office bearers consist of President, Secretary, and Treasurer along with Vice President and Vice Secretary elected at the FOs' annual general meeting. The term is generally supposed to be one or two years. In fact, the average service period of a President in the Nachchaduwa and Rajangana schemes is approximately 20 years. The generation shift, therefore, seems to lag behind. The number of FOs and FCGs in the three schemes is shown in Table S-8. *(section 3.4)*

Table S-8 Number of FOs and FCGs (As of February 2006)

Scheme	FOs	FCGs (under FOs)
Nachchaduwa	14	130
Thruwila	1	13
Rajangana		
- Gravity System	32	513
- Lift System	27	231

Prepared by the Study Team

46. The FOs' activities in the three schemes extend to D and F-canal level facilities O&M, group purchase, agricultural credit, storage management, group marketing and so forth. In particular, the handing over policy has already been promulgated. However, their activities are still limited, therefore, farmers do not feel any merits to participate in the activities and vice versa. Problems and issues related with FOs are: (i) poor participation (insufficient women, youth and tenant/lease farmers involvement, etc.), (ii) poor management (insufficiently transparent procedures, etc.), (iii) lack of unity (poor leadership, including a lack of awareness), (iv) poor support from government agencies (lack of coordination, M&E, etc.) and (v) external conditions (political interference). *(section 3.4)*

47. The "Farmer-Officer relationship" seems to be satisfactory, but it reflected features of an "administrative relationship" rather than that of a "participatory relationship." Officers provide necessary support to FOs but it often takes the form of issuing orders. The interview survey revealed that farmers have not realized their potential and capabilities, and that they continue to be dependent on government officers. Such farmers' attitudes have to be changed through being facilitated to get their work done by themselves. *(section*

3.6)

48. Another significant issue in government organizations relating to their support for FOs is their poor coordination. Many line agencies support FOs and farmers, but there is currently insufficient coordination. In order to improve the situation, coordination at the site level requires some innovative mechanisms, including support from a higher level. The agencies, such as GN under the DS office, ARPA under DO (DAD) and Sumurdhi animator, that work closely with farmers at the village level should work as a team to support the FO. Alternatively, personnel such as "village facilitators" need to work with FOs to bridge the gap in support from the agencies. *(section 3.6)*

Current Training System

49. ID is the key institution conducting training in the field of irrigation, particularly for major and medium irrigation schemes. MASL also carries out irrigation training for Mahaweli projects whereas DAD deals with training for minor irrigation. Some NGOs also organize training limiting to on-farm water management. Large numbers of training sessions have been implemented, mainly under donor-funded projects such as the Project for the Institutional Strengthening of ID and IMD, and the National Irrigation Rehabilitation Project (NIRP). The Irrigation Training Institute (ITI)/Galgamuwa has been in charge of training design, coordination and implementation. *(section 3.7.1)*

50. Current training programmes conducted by relevant agencies are described in Table S-9. *(section 3.7.2)*

Table S-9 Training Programmes under Relevant Agencies

Agency	Target Group	Course
ITI/Galgamuwa	ID staff members	In-service training on administrative works, CAD, GIS, computer application, office management, quality control for construction, water management, etc.
IMAC	Farmers	Awareness, O&M, financial documentation, demonstration, etc.
IMD	Field officers, farmers, water masters	Financial management, legal authority, leadership development, FO constitution, water management, and O&M.

Prepared by the Study Team

51. Although various training sessions have been conducted for farmers and officers related with the irrigation sector, changes have not been taking place as expected. Major issues for the training are: (i) training sessions have been carried out based on supply orientation, not demand orientation, (ii) primarily class room training sessions have been conducted while on-the-job training is rare, (iii) no follow up training sessions have been conducted based on evaluation of past training, (iv) training materials are not properly accumulated at the relevant institutions for re-utilization and updating (v) there is inadequate support by senior officers for the implementation of training, and (vi) training sessions are focused on FO leader level, so the effect does not reach the individual farmer level. *(section 3.7.3)*

GIS-based Irrigation Block Mapping

52. The objective of the GIS-based irrigation block mapping is to construct an irrigation database as a source of basic data in sample blocks as shown in Table S-10 so as to: (i) clarify the present condition of the target areas, and (ii) propose an alternative methodology of irrigation development and management. Through the course of the Study, it is verified that the GIS-based maps are an effective tool for consensus building among stakeholders. It is, therefore, expected that the database will be utilized for various purposes, particularly for irrigation asset management and land use planning as a first step and accordingly developed for future expansion. *(section 3.8)*

Table S-10 Target Area of GIS-Based Irrigation Block Mapping

Scheme	Block	FO name
Nachchaduwa	HLMC	Tissa
	LLMC	Isuru
Thruwila	Thruwila entire area	Mahanama
Rajangana	RB Tract No.4	Saliya Gama
	RB Tract No.8	Mahasen
	LB Tract No.2	Sri Udara

Prepared by the Study Team

53. The database consists of: (i) function evaluation of canals and related structures with pictorial information and (ii) land and FO activities assessment consisting of type of land tenure, current land use, FO membership, payment of O&M fees and attendance at shramadana. *(section 3.8)*

54. GIS database clearly shows current type of land ownership, land use and land fragmentation. In addition, entire soil characteristics in the target blocks and areas suitable for crop diversification are identified. Those collected data have been utilized for the formulation of an improvement approach as well as for preparation of a plan to increase the capacity of integrated management. *(section 3.8)*

IV. Improvement Approach of Each Sector

55. Taking current conditions into consideration, farmers in the Dry Zone need to change the present paddy cultivation to more profitable irrigated agriculture, and they are also required to achieve sustainable O&M and efficient water management. The farmers and FOs are the main actors for irrigation management, crop production and marketing at the farm level, and the government officials are another main actor to support and facilitate the farmers. The basic approach for proposing directions for the particular schemes includes: (i) community participatory rehabilitation as an "entry point" activity, (ii) increased profitability of paddy, (iii) expand operation size, (iv) more profitable irrigated agriculture, (v) promotion of group activities for production and marketing, and (vi) facilitation and follow-up by government officers. Consequently, approaches targeting sectors and actors are explained as follows. *(section 4.1)*

56. Irrigation sector improvement focuses on: (i) facilities' function improvement (main facilities rehabilitation by the government with on-the-job training of the officials, and community participatory irrigation rehabilitation at D and F-canal level), and (ii) water management improvement (as with the facilities' function, water management at the main

level by the government while D and F-level improvement is by FOs). *(section 4.2.1)*

57. Agriculture sector improvement deals with: (i) paddy production improvement (increased productivity using improved farming techniques, product quality improvement by the introduction of post harvest technology, decreased production cost through improved farming practice, fertilizer and chemical purchasing promotion), (ii) OFC, vegetables and fruit production promotion and (iii) Other agricultural activities such as livestock. *(section 4.2.2)*

58. Marketing sector improvement aims to: (i) improve storage, handling, shipping and processing for different agricultural products for value-addition, and (ii) promote cooperative marketing to increase market access and bargaining power of farmers. *(section 4.2.3)*

59. Important points on capacity development of the FO as an actor for the sector-based approach proposed above are to: (i) foster social capital through promoting participation of farmers, the younger generation and women in FO activity as well as maintaining transparent organizational management and (ii) attempt to materialize tangible benefit (increase income) to support FO incentives: strengthening agriculture and marketing activities, based on promoting participation by farmers in PMC and Kanna meetings, O&M of irrigation facilities and strengthening the F-canal group. *(section 4.2.4)*

60. According to the field survey, issues such as poor coordination among agencies, the necessity of institutional training and insufficient monitoring and evaluation after training have been identified. Therefore, relating to another important actor, as well as providing a catalyst for farmers' initiatives in irrigated agriculture, the capacity development of officials should consider changing the attitude and role from "administration" to "facilitation" and create an environment where top level administrators and policy makers encourage such a process. *(section 5.1.1)*

IV. Main Features and Improvement Direction of the Three Schemes

Nachchaduwa Major Irrigation Scheme

Main Features under the Present Conditions

61. Available water resources for irrigation fluctuate significantly every year. Therefore, Yala season cropping intensity remains unstable. With an average 44% of the maximum area, water management improvement is necessary to effectively utilize available resources to ensure Yala season cultivation. In addition, water in the Nachchaduwa tank is supplied to Anuradhapura for drinking water. Considering future prospective population pressure, establishment of an effective water utilization system is expected. At the field level, especially, there is insufficient maintenance of irrigation facilities by FOs and this results in inefficient water management at D & F-canal level. Strengthening of FOs in water management is required for effective resource utilization. *(section 4.3.1)*

62. More than 50% of irrigation facilities at D & F-canal level are not functioning well due to insufficient maintenance, and their rehabilitation is urgently required. *(section 4.3.1)*

63. The scheme is located near Anurahdapura town, and the socio-economic analysis shows low engagement in agriculture, 37% of total employment, well below the district average of 52%. Due to this, the small and marginal farm households are dependent on their off-farm activities. Some land-owners are not cultivating and their farm land is tenanted or leased to other farmers. *(section 4.3.1)*

64. 56% of farm land is cultivated under tenant and lease, and the average operation size of farms is about 1 ha, relatively larger than the other schemes. This indicates that farmers have made an effort to expand the operation scale through tenant and lease from land-owners who have left cultivation. *(section 4.3.1)*

65. Farm income from paddy cultivation is lower than in the Thuruwila area located nearby, due to a lower unit yield, higher production cost, and low quality of products. *(section 4.3.1)*

66. Well-drained Reddish Brown Earth (RBE) extends over the area and enables crop diversification to cultivate mainly other field crops (OFC). Crop diversification is in progress, and the main crops are vegetables and bananas. In part of the area, a group of young farmers is conducting commercial vegetable production (about 22 ha), a scheme which cannot be found in the other schemes. *(section 4.3.1)*

67. There are 24 commercial rice mills operating in the area, and in many cases farmers sell their paddy directly to the commercial rice mills. *(section 4.3.1)*

68. The activity and capacity of FOs and Field Canal Groups (FCGs) are low due to limited participation of members, poor record keeping and financial management. A water-master has been appointed in 7 FOs, out of the total 14 FOs. Tenant and lease operators are not members of the FO, due to objections from the land owners. *(section 4.3.1)*

Direction for Improvement of the Present Conditions

69. Irrigation water management needs to be urgently improved to better utilize water resources in order to ensure sustainable irrigated agriculture. In particular, discharge measurement at the head of D-canals is a priority to equally distribute water throughout the entire system. *(section 4.3.1)*

70. Recovery of function in irrigation facilities is imperative to support efficient water management, and the participatory rehabilitation approach at the D & F-canal level may increase the capacity of FOs for sustainable O&M and water management. *(section 4.3.1)*

71. The average farm size may expand further by tenant and lease of farm land, but improvement in this situation cannot be estimated due to the difficulty in estimation. In this situation, farm income under the improvement approach can be increased only by improvement of paddy cultivation. The present unit yield of paddy (4.3 ton/ha) will increase through improvement of such farming practices as use of quality seeds, balanced dosage of fertilizers, proper application of pest control, and utilization of high capacity threshing machines. Improvement of farming practices will minimize the increase of production costs. *(section 4.3.1)*

72. At the same time, crop diversification can be expanded on the well drained RBE,

particularly in the Yala season. Vegetables are assumed to be the main crops in the diversification since the city markets are located at Anuradhapura and Dumbulla near to the scheme. Bananas are, however, restricted in their expansion in paddy fields, and the area under bananas is expected to retain the same coverage as at present. *(section 4.3.1)*

73. Farm income will be increased and stabilized through such marketing improvement of paddy and vegetables (improvement in bargaining power and market opportunity) as (i) facilitation of farmers to reduce debt with shops and middlemen, (ii) operation of multi-purpose storage facilities and an Open Paddy Market at FO level, (iii) minimization of post-harvest loss, (iv) group activities in bulking and marketing to increase bargaining power, and (v) processing, hygiene and quality. *(section 4.3.1)*

Thuruwila Medium Irrigation Scheme

Main Features under the Present Condition

74. The function of irrigation facilities at D & F-canal level is relatively good due to recent rehabilitation. Irrigation coverage is 100% in the Maha and Yala seasons. Water is also utilized for domestic water supply to Anuradhapura town, with a maximum allocation of 25,000 tons per day. *(section 4.3.2)*

75. The socio-economic conditions are similar to the Nachchaduwa scheme, showing low engagement in agriculture. 60% of farm land is cultivated by owner-operators, and 76% of farmers are small scale, less than 0.8 ha. *(section 4.3.2)*

76. The area is specifically oriented to paddy cultivation in both the Maha and Yala seasons, and farmers' efforts for better unit yields and lower production costs bring higher profitability of paddy cultivation than with the other two schemes. Crop diversification has not progressed, due to the poorly drained soils (Reddish Brown Earth) extending over the entire area. *(section 4.3.2)*

77. Marketing of paddy in the Thuruwila irrigation scheme is in the same situation as Nachchaduwa since the schemes are neighboring each other. Commercial rice mills are operating in the area, and in many cases farmers directly sell their paddy to commercial rice mills. *(section 4.3.2)*

78. The scheme is covered by 1 FO consisting of 24 FCGs. However, the activities and capacity of the FO and FCGs are low due to limited participation of members, poor record keeping and financial management. A water-master has been appointed. *(section 4.3.2)*

Direction for Improvement of the Present Conditions

79. Irrigation facilities are functioning and are in a better condition because rehabilitation is in progress. Immaturity in water use by farmers could, however, jeopardize the functioning of facilities in the future. In order to sustain the function and to improve water management at D & F-canal level, therefore, it is necessary to increase the capacity of the FO and FCGs, particularly with espect to discharge measurement at the head of F-canals. *(section 4.3.2)*

80. Due to the poorly drained soils, potential for crop diversification is quite limited. By

utilizing sufficient irrigation water available in this scheme, farmers will continue paddy cultivation in both the Maha and Yala seasons. Crop diversification is not expected due to the poorly drained soils. *(section 4.3.2)*

81. The present unit yield of 5.3 ton/ha in paddy cultivation is expected to increase to 6.0 to 6.5 ton/ha through improvement of farming practices, judging from the results of demonstrations and adaptable research conducted in the surrounding area. Increase of unit yield will also be associated with quality improvement of the harvest. Principally, the same market improvement as in the Nachchaduwa scheme is expected. *(section 4.3.2)*

Rajangana Irrigation Scheme

Main Features under the Present Conditions

82. Irrigation discharge is not measured at main and D-canal levels. Excessive discharge tends to be released, and as a result facilities are widely affected by such poor water management practice. As mentioned for Nachchaduwa and Thuruwila, discharge measurement at the head of D-canals is a focus for this activity. *(section 4.3.3)*

83. Rehabilitation at D & F-canal level is required to recover the function of irrigation facilities for 17% of canals and 24% of related structures. Facilities are relatively in better condition than those in Nachchaduwa, but some important facilities, such as turnouts, need to be repaired. *(section 4.3.3)*

84. The average irrigated area was 5,660 ha in the Maha season during the period from 1990 to 2003, and the maximum irrigation area of 6,640 ha was recorded in the 1996/97 Maha season. The average irrigated area in the Yala season was 83% of the average irrigated area in the Maha season, with slight fluctuations during the same period. Therefore, water management improvement would save water use in the Maha season thereby increasing the Yala season cultivation area. *(section 4.3.3)*

85. The socio-economic conditions show higher engagement in agriculture, 55% of total employment, above the district average of 52%. Population below the poverty line is 18.8% of the total population, and a higher poverty incidence has been observed in the tail end tracts. *(section 4.3.3)*

86. About 90% of the farm land is cultivated by owner-operators, and the farm household size is 0.7 ha on average. The proportion of small farm households less than 0.8 ha (2 acres) is 78%. Therefore, the majority of farmers are owner-operators of small-sized farms. *(section 4.3.3)*

87. Paddy cultivation is the main income source of the farm households. However, income from paddy cultivation is lower than with the Thuruwila scheme, due to the lower unit yield and higher production costs. *(section 4.3.3)*

88. Crop diversification is in progress in about 10% of the area, and the main diversification crops are banana and papaya. Unless other annual crops are introduced, diversification will not expand since banana and papaya annual crops are legally restricted. *(section 4.3.3)*

89. There are only two commercial rice mills with limited milling capacity. Due to this, farmers

sell their marketable surplus to middlemen, resulting in a lower farm gate price for farmers. *(section 4.3.3)*

90. The local wholesale market is located at Tambuttegama, 10 km to 15 km from the scheme. However, this market is not very active and the prices of agricultural products are low due to limited transactions. *(section 4.3.3)*

91. The scheme is covered by 32 FOs consisting of 513 FCGs and the activity and capacity of the FOs and FCGs are low due to limited participation of members, poor record keeping and financial management. 29 FOs or 91% of the total number of FOs have appointed a water-master. *(section 4.3.3)*

Direction for Improvement of the Present Condition

92. Water management improvement is required for both government officials and FOs to ensure sustainable irrigated agriculture. *(section 4.3.3)*

93. Rehabilitation at D & F-canal level is also required to recover the functionality of irrigation facilities. In order to avoid further deterioration of facilities, the capacity of FOs is required to be strengthened for maintenance of facilities. *(section 4.3.3)*

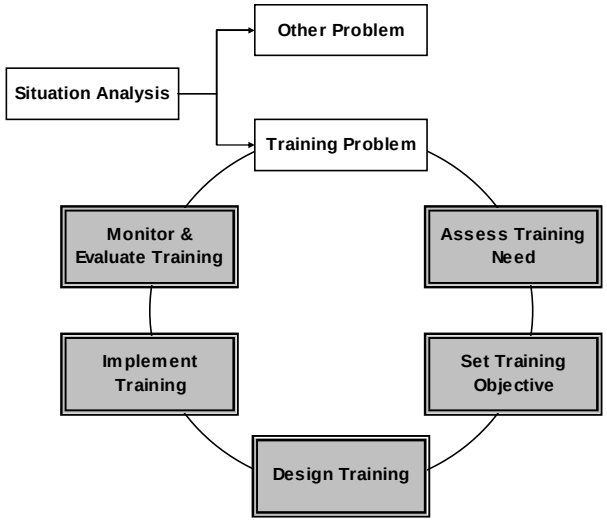
94. Profitability of paddy cultivation can increase the unit yield from about 4 ton/ha to 5.5 - 6.0 ton/ha by such improvement of farming practices as use of quality paddy seed, balanced dosage of fertilizers, proper application of agrochemicals, and utilization of high capacity threshing machines, associated with minimization of production costs. *(section 4.3.3)*

95. In the long-term perspective, vegetable, OFC and fruits production is the effective approach based on group production, and promotion of livestock for an increase of farm household income. *(section 4.3.3)*

96. In the short-term, improvement in marketing is conceivable through the organization of farmers groups in production and marketing of paddy and other crops, to enhance the bargaining power and betterment of market opportunities. Construction and operation of multi-purpose storage at FO level, having been successful in other areas, is an effective measure to increase farm household income. *(section 4.3.3)*

V. Plan to Increase the Capacity of Integrated Management

97. Issues considered related to the preparation of capacity development for Officials include: (i) changing the role from "administration" to "facilitation", (ii) the necessity for officials to be well acquainted with the legal backing in addition to technical knowledge and skills, and (iii) the need for properly planned M&E. On the other hand, issues for FO capacity development involve: (i) a participatory approach based on facilitation, (ii) enhancing of social capital through activities, (iii) necessity of a properly planned awareness programme, and (iv) preparation of needs-based training content. *(section 5.1.1)*



Prepared by the Study Team

Figure S-1 Training Process

98. The proposed training process, illustrated in Figure S-1, starts from the situation analysis and isolating the real training problem. Conducting training needs assessment, setting training objectives, designing training, implementation of training and monitoring & evaluation of training are the other steps in the training process. *(section 5.1.2)*

99. Six training curriculum topics, including 28 training courses and 82 training modules are proposed to support the improvement approach and direction as tabulated in Table S-11. *(section 5.2.1)*

Table S-11 Training Courses

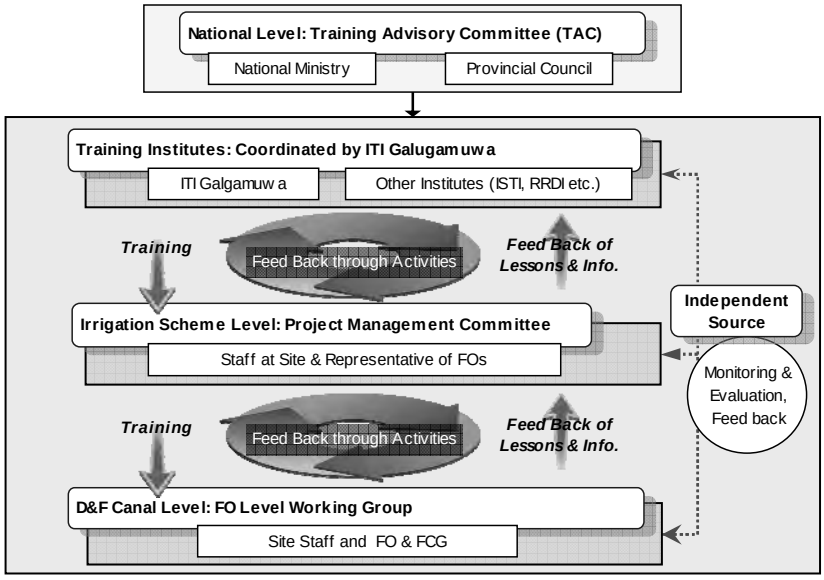
Training Curriculums	Training Courses	Training Modules
A Basic Awareness	1) Awareness of Training, 2) Facilitation Training, 3) Training Management	9 Modules
B Strengthening of FO	1) Awareness Programme for Participatory Community Development, 2) Preparation of Community Development Plan, 3) Institutional Management, 4) Financial Management	9 Modules
C Improvement of Maintenance at FO Level	1) Assessment of Facilities Function, 2) Community Participatory Rehabilitation, 3) Transfer of O&M	12 Modules
D Improvement of Water Management at FO Level	1) Water Management, 2) Water Management Sub-Committee, 3) Coordination for Water Management at Scheme Level	12 Modules
E Activation of Agricultural Production	1) Procurement, 2) Tract Demonstration, 3) Seed Production, 4) Post Harvest, 5) Crop Diversification, 6) Other Farm Income, 7) Monitoring & Evaluation	21 Modules
F Activation of Marketing & Processing	1) Group Activities, 2) Paddy Marketing & Processing, 3) Open Paddy Market, 4) Market	19 Modules

Training Curriculums	Training Courses	Training Modules
	Information, 5) Zoning Policy, 6) Post-Harvest Loss, 7) Economic Center, 8) Other Income Generation	
6 Curriculums	28 Courses	82 Modules

Prepared by the Study Team

100. In conducting training, there are several points to be focused on: (i) importance of coordination among line agencies, (ii) feedback through monitoring and evaluation, (iii) setting-up of a coordination body, (iv) the coordination role of Galgamuwa ITI and other training institutes and (v) activities-associated training.

Particularly, community participatory rehabilitation is utilized as the tool for the entry point activities to enhance the capacity of the FO and the site officials. Since many aspects of institutional development are included in this activity, the activities will contribute to enhancing ownership, motivation and social cohesion within FOs leading to further agriculture and marketing activities. On the other hand, government officials are expected to reorient their role and attitude from "administration" to "facilitation" so that they support farmers through farmers' self-dependent basis. The proposed project implementation mechanism is illustrated in Figure S-2. *(section 5.2.2)*



Prepared by the Study Team

Figure S-2 Project Implementation Mechanism

101. The figure S-2 shows realistic procedures in order to organize training courses based on proposed training process as described as follows: (i) for better coordination among the agencies concerned, it is proposed to set-up such coordination bodies as Training Advisory Committee (TAC) at the central level, and FO level Working Group at the site level, in addition to the Project Managemetn Committees (PMC) at the scheme level, (ii) Galgamwa ITI undertake the necessary overall coordination with other training institutes, (iii) community participatory rehabilitation and water management is utilized as a tool for capacity development, and in-class training and practical field exercise are combined with those activities, (iv) activities are expanded into various subjects such as upgrading and

intensifying of paddy cultivation, promotion of crop diversification and livestock after participatory rehabilitation, (v) monitoring and evaluation is periodically implemented at the pilot area so as to feed back lessons for subsequent cropping season and (vi) lessons obtained from the field and training session is accumulated at Galgamwa ITI to continuously improve training contents and materials *(section 5.2.2)*

102. The trial and error approach is important in practice in implementing the plan as the experience gained and lessons learned need to be utilized to accelerate training through the feed back in the process. The plan will, therefore, be carried out in the Pilot Areas of Nachchaduwa, Thuruwila and Rajangana first, to demonstrate the performance of the training and then expanded to the outside, particularly in the areas of the Pro-poor Economic Advancement and Community Empowerment (PEACE) Project. *(section 5.2.3)*

VI. Strengthening the Planning Capacity of Counterpart Personnel in the Course of the Study

103. Many staff personnel from central and local offices in various organizations such as ID, IMD and DOA participated the survey during the course of the Study. They carried out basic data collection regarding irrigation, land use and a part of socio-economic survey. In addition, they positively observed how such data were analyzed, discussed among the members of JICA Study Team and incorporated into the plan.

104. Those data collection and analysis is basic and fundamental knowledge necessary for integrated management in irrigation sector. It is expected that the experiences such personnel obtained will be effectively utilized in order to prepare agriculture development plan in the future.

VII. Conclusion

105. The Study has presented a plan to increase the capacity of integrated management for government officials and farmers on the basis of the analysis of sectors related with irrigated agriculture (irrigation, agriculture and marketing) and actors (government and FOs). The Study identified current problems and constraints with the sector and actors; formulated an improvement approach; prepared a plan to increase the capacity of integrated management, and studied the implementation mechanism. *(section 6.1)*

106. The main components of the basic approach are: (i) FO strengthening, (ii) recovery of irrigation facilities and proper handing-over of maintenance responsibilities to FO through community participation, (iii) irrigation water management improvement, (iv) energizing of paddy productivity and crop diversification and (v) improvement and activation of marketing and processing. *(section 6.1)*

107. The most important issue for government officials is “changing their role from administration to facilitation” while, that for FOs is the participatory approach based on facilitation. *(section 6.1)*

108. It is impossible to implement all the wide-ranging activities instantly and simultaneously. Community participatory rehabilitation is therefore proposed as an "entry point" activity since it includes various aspects of institutional development leading to agriculture and marketing activities. *(section 6.1)*

109. Demand oriented training is essential to support the execution of the basic approach on the basis of training needs assessment and feedback through monitoring and evaluation. In order to effectively implement the project, the implementation mechanism pays attention to the organization to be established respectively at national level, scheme level and field level with the hub-function of ITI/Galgamuwa. This mechanism is effective to reorient previous supply-oriented into demand-oriented training and agricultural support. *(section 6.1)*

110. By taking current hardships observed in the dry zone into consideration, the proposed Project is expected to be commenced soonest. The Project needs to be implemented first in the pilot areas with a scaling-up approach so that the synergy effects with the PEACE project in surrounding areas can be expected. *(section 6.1)*

VIII. Recommendation

111. Various recommendations are derived from the Study. As for those related with follow-up of the Study, three recommendations can be listed up including: (i) continuation of survey on farmers' water management and socio-economic condition, (ii) further study to formulate a plan for developing marketing and processing activities and (iii) monitoring of water quality. On the other hand, nine recommendations regarding successful Project implementation are listed as follows. *(section 6.2)*

112. (i) Rainfall decrease in dry zone is recently apparent due to the global warming, therefore, effective irrigation water use is really required. To do so, together with efficient water management in the catchment as well as the main systems, FOs' water management at D- and F-canal level should be improved through introducing devices that are simple to operate with low investment and O&M cost. *(section 6.2)*

113. (ii) Institutional and legal constraints are also observed which encumber crop diversification in paddy cultivation dominated area in the dry zone. Such constraints are further analyzed in details to prepare and carry out improvement measures. *(section 6.2)*

114. (iii) Participation by extensive stakeholders is required in order to activate FOs. However, one of the issues for FOs to remain downturn is insufficiency of tenant/lease farmers' participation to FOs' activity due to the objection from land owners. Therefore, supporting mechanisms should be developed to particularly involve tenant/lease farmers, women and youth into FOs' activities or at least in product based sub-committees in FOs. *(section 6.2)*

115. (iv) O&M of D- and F-canal level facilities by FOs themselves requires mechanism of O&M fee collection within FOs through raising their awareness. Community participatory rehabilitation would be effective devices to raise awareness and ownership mind among FOs. Part of income can be saved as O&M fund if community participatory rehabilitation is appropriately facilitated and implemented particularly focusing on maintaining transparent

financial management. *(section 6.2)*

116. (v) Information on land suitability specifically for OFC and vegetable cultivation is not available at the farmers' level, which is one of the reasons why crop diversification is not well promoted. Therefore, in parallel with quality seed provision, farming improvement assistance, O&M fund establishment, marketing improvement and livestock promotion, the government should take initiative in supporting farmers for micro-zoning through using information on land resources as well as its suitability so as to orient current farming based on land suitability. *(section 6.2)*

117. (vi) Dissemination of GIS application in irrigation management is promising since the technology is identified as effective and alternative tools. It can be utilized for O&M of irrigation facilities and promotion of crop diversification. In addition, consensus building for regional agricultural policy, farming schedule etc. among stakeholders are facilitated by the use of this database. *(section 6.2)*

118. (vii) In Sri Lanka, FOs are under development as multifunctional organizations, activities of which include irrigation management, agricultural production and marketing. At present, however, level of empowerment in FOs is still challenging. The government are required to facilitate farmers' participation through maintain this policy direction. In the future, policy and institutional framework should be reformed accordingly based on the progress of FOs' development. *(section 6.2)*

119. (viii) Situation surrounding agriculture sector is continually changing so that not only the capacity development of FOs but also that of government officials is essential. In accordance with various experiences in irrigation project in Sri Lanka, the government support to FOs as well as FOs' participation tend to get into inactive after projects are completed. Therefore, with the aim of developing capacity of both FOs and the government officials, appropriate and comparatively advanced technology should be introduced and disseminated based on the coordination among relevant institutes with the hub-function of Galgamwa ITI. *(section 6.2)*

120. (ix) Coordination among relevant agencies is imperative to tackle problems and constraints at the field level. Especially, agencies in charge of irrigation, agricultural extension, institutional development that are closely with FOs at the village level should work as a team to support FOs. *(section 6.2)*

THE STUDY
ON
INCREASING THE CAPACITY OF INTEGRATED MANAGEMENT
IN
IRRIGATION SECTOR
IN
SRI LANKA

FINAL REPORT

MAIN REPORT

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CHAPTER 3 PRESENT CONDITION OF THE STUDY AREA

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Abbreviation

ADB	Asian Development Bank
ADC	Agrarian Development Committee
AER	Agro-ecological Region
AI	Agricultural Instructor
AO	Agricultural Officer
ARPA	Agricultural Research and Productivity Assistant (former ADPA)
ASC	Agrarian Service Centre
BC, B-Canal	Branch Canal
CAP	Construction Arrangement Phase
CBO	Community-based Organization
CCB	Coconut Cultivation Board
CHP	Construction & Handing-over Phase
CPP	Community Preparation Phase
CRB	Cooperative Rural Bank
CWE	Cooperative Wholesale Establishment
DAD	Department of Agrarian Development
D-Canal	Distribution Canal
DDS	Death Donation Societies
DO	Divisional Officer
DOA	Department of Agriculture
DOAP&H	Department of Animal Production and Health
DOFP	Department of Food Production
DS	Divisional Secretariat
EA	Engineering Assistant
EARP	Extension and Adaptive Research Project
FAO	Food and Agriculture Organization of United Nations
FC	Farmer Company
F-Canal	Field Canal
FCG	Field Canal Group
FET	Field Extension team
FO	Farmers' Organization
FSC	Forward Sales Contract
FTA	Free Trade Agreement
GA	Government Agent
GAP	Granary Area Programme
GB	Govigana Bank
GDP	Gross Domestic Products
GN	Grama Niladhari, Village-level government officials
GOJ	Government of Japan
GOSL	Government of Sri Lanka
HL	High Level (Main Canal in Nachchduwa Scheme)
IA	Irrigators' Association
ID	Irrigation Department
IDO	Institutional Development Officer
IDA	International Development Association
IMAC	Irrigation Management Cell

IMD	Irrigation Management Division
INMAS	Integrated Management of Irrigated Agriculture Settlement (IMD)
IP DOA	Inter Provincial Department of Agriculture
IPHT	Institute of Post-Harvest Technology
IPM	Integrated Pest Management
ITI	Irrigation Training Institute
IWMI	International Water Management Institute
JBIC	Japan Bank for International Cooperation
JICA	Japan International Cooperation Agency
KVS	Krush Vyapthi Sevaka
LB	Left Bank
LID	Land Improvement Division
LDI	Livestock Development Instructors
LHG	Low Humic Gley
LKR	Sri Lanka Rupee
LL	Low Level (Main Canal in Nachchduwa Scheme)
LLDC	Livestock Development Officer
MAIMD	Ministry of Agriculture, Irrigation, and Mahaweli Development
MANIS	Management of Irrigation Systems
MASL	Mahaweli Authority of Sri Lanka
M/M	Minutes of Meeting
MRRP	Mahaweli Restructuring and Rehabilitation Project
MUP	Mahaweli Upgrading Project
NACS	New Agricultural Credit Scheme
NCP	North Central Province
NCRCS	New Comprehensive Rural Credit Scheme
NECORD	North East Community Restoration and Development Project
NEIAP	North East Irrigated Agriculture Project
NH4-N	Ammonium-N
NIRP	National Irrigation Rehabilitation Project
No3-N	Nitrate-N
NWP	North Western Province
NWS&DB	National Water Supply and Drainage Board
O&M	Operation and Maintenance
OFC	Other Field Crops, meaning all field crops other than paddy rice
PC	Provincial Council
PDAP&H	Provincial Department of Animal Production & Health
PDCA	“plan”, “do”, “check”, and “action”
PDOA	Provincial Department of Agriculture
PEACE	Pro-poor Economic Advancement and Community Empowerment Project
PID	Provincial Irrigation Department
PIR	Participatory Irrigation Rehabilitation
PMC	Project Management Committee
PRA	Participatory Rural Appraisal
PTWG	Provincial Technical Working Group
RB	Right Bank
RBE	Reddish Brown Earth

RPM	Resident Project Manager
RRA	Rapid Rural Appraisal
S/W	Scope of Works
SAARC	South Asia Association for Regional Cooperation
SAPTA	SAARC Preferential Trading Association
SAEP	Second Agricultural Extension Project
SDC	Swiss Agency for Development and Cooperation
SMO	Subject Matter Officer
TOR	Terms of Reference
T&V	Training & Visit
UNDP	United Nations Development Programme
US $	United States Dollar
USAID	U. S. Agency for International Development
VB	Veterinary Surgeons
WAPHAULA	New Programme replaced from MANIS (Management of Irrigation System) under ID
WB	World Bank
WHO	World Health Organisation
WM	Water Management
WS	Work Supervisor
WUA	Water Users' Association
WUG	Water Users' Group

Ande	Share cropping arrangements in which smallholders without animals herd and manage a flock on behalf of a larger farmer and in return retain half the offspring.
Anicut	A diversion weir to abstract water from a natural channel
Attam	Labour exchange between farmers
Asswedumized	Bunded and puddled (of land for paddy cultivation)
Chena	Slashing, burning, and shifting cultivation
Ela	Canal (Feeder Canal)
Ganga	River
Grama Niladhari (GN)	Village-level government officials
Jayapalaka	Water Master appointed by FO
Kanna	Season, Maha Kanna: Maha season, Yala Kanna: Yala season
Maha	North-east monsoon season (appox. Oct -Mar.)
Oya, Ara	River
Pola	Weekly fair
Pradeshiya Sabha	Local elected council (at divisional level)
Purana	Old or ancient
Shramadana	Self help / shared labour
Tank	A reservoir storing water for irrigation
Thattumaru	Land tenure system operated on rotation basis
Wewa	Water tank
Yala	South-west monsoon season (approx. Apr. - Sept.)
Yaya	Paddy field

Measurement Unit

Extent

cm^2 = Square-centimetres (1.0 cm x 1.0 cm)
m^2 = Square-meters (1.0 m x 1.0 m)
Km^2 = Square-kilometres (1.0 Km x 1.0 Km)
a. = Acre or Acres (100 m^2 or 0.1 ha.)
ha. = Hectares (10,000 m^2)
ac = Acres (4,046.8 m^2 or 0.40468 ha.)

Length

mm = Millimetres
cm = Centimetres (cm = 10 mm)
m = Meters (m= 100 cm)
Km = Kilometres (Km = 1,000 m)
Inch = 2.54 cm
ft = foot (0.3048 m)
mile = 1,609.34 m

Currency

US$ = United State Dollars
J¥ = Japanese Yen
Rs. = Sri Lankan Rupees

Volume

cm^3 = Cubic-centimetres (1.0 cm x 1.0 cm x 1.0 cm or 1.0 m-lit.)
m^3 = Cubic-meters (1.0 m x 1.0 m x 1.0 m or 1.0 K-lit.)
lit. = Litre (1,000 cm^3)

Weight

gr. = Grams
Kg = Kilograms (1,000 gr.)
ton = Metric tonne (1,000 Kg)
MCM = 1,000,000 cu-m = 810.68 acre-ft
ac-ft = 1,233.83 m3

Time and Others

sec. = Seconds
min. = Minutes (60 sec.)
hr. = Hours (60 min.)
cusec. = 28.32 lit/sec
cu-m/s = 35.31 cu-ft/sec

Exchange Rate

As of July, 2006
US $ 1.00 = ¥ 116.32
LKR 1.00= ¥ 1.120

CHAPTER 1 INTRODUCTION

1.1 General

This is the Final Report on the Study on Increasing the Capacity of Integrated Management in the Irrigation Sector in Sri Lanka in accordance with the Scope of Work (S/W) agreed upon by the Government of Sri Lanka (GOSL) and the Japan International Cooperation Agency (JICA) on July 6, 2005. This report presents the results of all the works performed in both Sri Lanka and Japan to formulate a plan to increase the capacity of integrated management of government officials and Farmers' Organizations (FOs).

1.2 Background of the Study

(1) Paddy Cultivation in the Dry Zone

The agriculture sector in Sri Lanka contributes about 18% to the GDP and provides 34% of the total employment[1]. About 85% of the population resides in rural areas where agriculture is the main economic activity.

The Dry Zone is the granary area and produces 2.1 million tons of paddy, 80% of the national production, and paddy production is the main economic activity of small farm households in the rural areas. Paddy production in this Zone is heavily dependent on irrigation, enabling stable production in the Maha season and expanding the cropped area in the Yala season. Due to the effort of the government, irrigation development has accelerated since 70's which resulted in improvement in the self-sufficiency level of paddy from 42% in 1950 to about 95% in 1990s to 2000s.

Under this situation, the role of the paddy production sector from the macro-economic view point has been changing from "increase paddy supply" to "provide a stable supply of quality paddy" in the national food security policy. At the same time, through introduction of the open-market policy reflecting role change in the food security policy, the government procurement system was also abolished and paddy is handled in the market economy, linking with the global market. Since then, paddy prices have remained low compared to costs of farm inputs and labour resulting in profitability of paddy cultivation to become quite low.

From the micro-economic view points, this situation brought severe economic hardship to the small farmers in the Dry Zone, because their farm income is mainly derived from paddy production. Particularly, the portion of the rural population below the poverty line engaged in paddy cultivation find it extremely difficult to earn a decent income from farming.

[1] Central Bank of Sri Lanka (CBSL) Website, Annual Report 2004.

(2) Handing over of Irrigation Management

The government institutions had traditionally been managing the major and medium irrigation schemes and management expenses of irrigation facilities became a heavy burden to the government. Since the early 1990s, the government has been handing over the irrigation management at the D & F canal level to the Farmers Organizations (FOs) with the objective of sustainable O&M of irrigation facilities and efficient water management at the farmers' level while reducing the government burden for irrigation expenses. However, O&M and water management are still largely dependent on the government, and the situation needs to be improved if irrigated paddy production to be sustained.

Performance of the irrigation sector significantly depends upon the availability of water resources. In accordance with the analysis of long term rainfall trends, the climate of the entire country is becoming drier. The Anuradhapura district, in which the major part of the Study area is located, is included in this long term trend. Annual rainfall in the Anuradhapura district has decreased by nearly 150 mm between 1930 and 1990. Although forecasting future rainfall is a difficult task, the irrigation schemes around Anuradhapura district will suffer a shortage of water resources if this trend continues.

One of the other major problems associated with Sri Lanka's irrigation systems is their high density of structures compared to those in countries like India due to Sri Lanka's topography and terrain. This is associated with a high degree of operational complexity and is one reason for poor O&M by staff and farmers due to the difficulties involved. It has therefore become timely and important to incorporate simple to operate and low maintenance low cost devices in irrigation canals to control canal water head, flow and water measurement, especially in sub-systems which are farmer managed.

(3) Agricultural Policy and Paddy Cultivation in the Dry Zone

Taking the above situation into account, the government announced the National Policy on Agriculture and Livestock: 2003 – 2010, focusing on: (i) increasing productivities, (ii) minimizing food import, (iii) removal of the dependency mentality, (iv) bringing in capital, management and technological skills for agriculture, and (v) attainment of a 6% annual growth rate as the specific growth expectation in the policy.

In this regard, the future paddy production in the Dry Zone would be focused on:

i) Improvement of paddy productivity by increase of unit yield and reduction of production cost as well as diversification for increase in farm income,
ii) Stable supply of paddy with quality improvement as well as supply of other field crops (OFC) to promote national food security,
iii) Sustainable and efficient irrigation management through reduction of farmers' dependency on the government,
iv) Utilization of public and private resources as support for input supply, work force, funding, processing and marketing, and
v) Contribution to the national economy through increase of crop production.

In order to fulfill these tasks, integrated measures should be taken. Particularly, in the irrigated agricultural sector, productivity and income have to be enhanced by increasing the cropping intensity, by improving productivity of crops and through efficient and fair usage of water resources. Appropriate information systems covering all these aspects will also be vital as a planning and management tools. Thus, increasing the capacity of government officials and farmers, including FOs, in integrated management has become an essential and an urgent need.

In response to a request made by GOSL in June 2003 to conduct a study to increase the capacity of the individuals involved in the irrigation sector, JICA dispatched a mission to Sri Lanka in March 2005 for preparatory work. After deliberations between both parties and taking into account the GOSL policy on irrigated agriculture and the current issues and needs, the present Study on Increasing the Capacity of Integrated Management in the Irrigation Sector was proposed and the Scope of Work for the study was accordingly agreed upon by GOSL and JICA on 6 July 2005 (refer to **Attachments 1 to 3**).

1.3 Objectives of the Study

The objectives of the Study are:

i) To formulate a plan to increase the capacity of integrated management of the Officials of the Irrigation Management Division (IMD) of the Ministry, the Irrigation Department (ID) and other related government officials engaged in the irrigation sector (hereinafter referred to as "the Officials").
ii) To formulate a plan to increase the capacity of integrated management of FOs.
iii) To strengthen the planning capacity of Counterpart Personnel engaged in the management of the irrigation sector in the process of the implementation of the study.

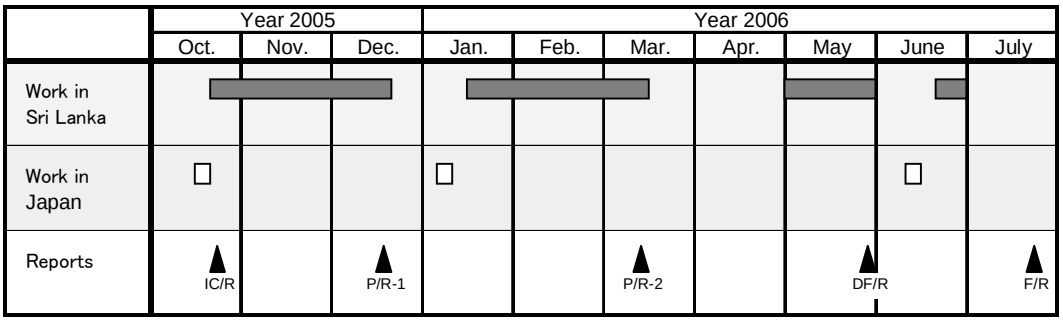
1.4 Study Area

The Study areas are Nachchaduwa and Rajanagana major irrigation schemes as well as Thuruwila medium irrigation schemes, mainly located in Anuradhapura district and partially in Kurunegala and Puttalam districts. Minor irrigation schemes are included in the Study to identify and learn the best practices available at present.

1.5 Scope of the Study and Study Items

The Study was carried out over 10 months from October 2005 to July 2006 as outlined in the schedule below.

Figure 1 Overall Study Schedule



The basic framework of the Study is illustrated in Figure 1.5.1 and described as follows:

Problem Identification: (i) to conduct a survey to grasp the present situation and activities of the Officials and relevant FOs, (ii) to collect data and information to analyze the following items: (a) operation and maintenance of irrigation facilities, (b) water management, (c) farming practices, input supply and agricultural machinery, (d) value added, (e) credit to farmers, (f) marketing of agriculture products, and so on, (iii) to organize problem analysis workshops by gathering counterparts and other stakeholders and (iv) to identify the constraints through a participatory approach,

Preparation of Basic Approach to Improve the Present Situation: (v) to formulate a sector-wise improvement approach: irrigation, agriculture and marketing and (vi) To formulate an actor-wise improvement approach: government officials and FOs,

Plan to Increase the Capacity of Integrated Management: (vii) to formulate a plan to increase the capacity of integrated management of the relevant Officials and FOs and (viii) to study the implementation framework and mechanisms

1.6 Study Organization

The Ministry of Agriculture, Irrigation and Mahaweli Development (MAIMD) is the Executing Agency and the counterpart agencies for the Study are IMD and ID. A National Steering Committee consisting of members from the relevant agencies of GOSL and GOJ has been set up under MAIMD for the smooth and effective implementation of the Study, while a Regional Steering Committee and Working Groups have been set up at the regional and project levels.

1.7 Study Progress

1.7.1 Preparatory Work in Japan

Before starting the field work in Sri Lanka, the Study Team conducted the preliminary collection and analysis of information, study on background, approach to the Study, and the plan of operation in early to middle October 2005. These results were complied in the Inception Report in late October 2005.

1.7.2 First Field Work in Sri Lanka

The Study Team commenced the first work in Sri Lanka over the period of two months from October 23rd to December 21st 2005. The work mainly consisted of: (i) explanation and discussion of the Inception Report to the Steering Committee on November 2nd, 2005 (refer to **Attachment 4**), (ii) survey to grasp the present situation and activities of the Officials and Farmers' Organizations, (iii) collection and analysis of data and information on O&M of irrigation facilities, water management, farming practices, input supply, agricultural machinery, value added, credit to farmers, marketing of agricultural products, and other relevant matters, (iv) preparation of Progress Report 1 by compilation of the results of the First Field Work, and presentation of 1) the results of analytical comparison of policies and legislation related to irrigation management, and 2) study progress in the first seminar held on December 14th 2005 and (v) explanation and discussion of the report to the Steering Committee on December 19th, 2005 (refer to **Attachment 5**).

1.7.3 Second Field Work in Sri Lanka

The Study Team conducted the second work in Sri Lanka over the period of two months from January 17th to March 17th 2006. The work mainly consisted of: (i) identification of problems and issues based on the study results on the present condition and the problem analysis workshops with the Counterpart personnel, Steering Committee members, Working Groups, and FO members, in order to identify the problems and issues and to share that understanding among the stakeholders, (ii) survey of the Farmers' Organizations and Officials, (iii) preparation of a basic approach to improve the present condition in the sectors of irrigation, agriculture and marketing as well as the Officials and FOs as the main actors of the sectors, (iv) preparation of the draft plan to increase the capacity of integrated management and study on implementation of plan and (v) preparation of Progress Report 2 by compilation of the results of the second field survey, and explanation and discussion on the report to the Steering Committee on March 15th, 2006 (refer to **Attachment 6**).

1.7.4 Third Field Work in Sri Lanka

The Study Team conducted the third field work in Sri Lanka over the period of one month from May 2nd to May 31st 2006. The work mainly consisted of: (i) examination of the draft plan to increase the capacity of integrated management through site workshops for explanation and discussion with stakeholders at the field level, trial training sessions, that is, training on water flow measurement and study tour to System C, and workshop for discussion on training mechanisms, (ii) preparation of the plan to increase the capacity of integrated management based on the results of the examination, (iii) preparation of a manual for the study procedure to describe the planning procedure to develop the plan to increase the capacity of integrated management, (iv) a seminar at the Department of Agriculture (DOA) to present the study results and explain GIS based Irrigation Block Mapping and (v) preparation of the Draft Final Report by compilation of the results of the

Study, and explanation and discussion on the report to the Steering Committee on May 29th, 2006 (refer to **Attachment 7**).

1.7.5 Fourth Field Work in Sri Lanka

The Study Team carried out the fourth field work in Sri Lanka over the period of twelve days from June 19th to June 30th, for presentation of the plan to increase the capacity of integrated management in the irrigation sector in the second workshops held in Anuradhapura and Colombo.

1.8 Composition of the Report

The report consists of six chapters. Chapter 1 has given the study introduction including its objective, background and general framework of the study. Chapter 2 deals with national and regional background surrounding irrigated agriculture. Agriculture and water resource policy, general set-up of irrigation-related organization, past experiences and analytical comparison with other Asian countries are discussed. In the Chapter 3, present condition of sector and actor plus other related activities is described. Sectors related with irrigated agriculture and exercised under the study consist of irrigation, agriculture and marketing while actor includes FO and government officials. Current training system, GIS-based irrigation block mapping and problems analysis workshop gathering stakeholders is also explained in this chapter. Through such studies, current problems and constraints in irrigated agriculture are derived.

Based on the problems and the constraints given in chapter 3, improvement approach is firstly prepared for sectors and actors in Chapter 4. Direction to improve the present conditions meeting the particular condition in the Study area, Nachchaduwa, Thuruwila and Rajangana schemes are also discussed. In order to carry out improvement approach presented in chapter 4, capacity development of actors, FOs and government officials, are essential. Therefore, in chapter 5, training program and courses as well as capacity development mechanism are prepared for the implementation of improvement approach. In addition, step-wise implementation process through learning and feed-back approach starting from the pilot toward surrounding areas especially the areas covered by Pro-Poor Economic Advancement and Community Empowerment (PEACE) Project is given. Finally, in Chapter 6, conclusion and recommendation, gives summary of the study result and thought-provoking recommendation obtained from the study.

1.9 Acknowledgement

The Study Team would like to express their sincerest appreciation to IMD and ID for their kind assistance and cooperation. The Study Team also expresses their gratitude to relevant organizations such as the Department of Agriculture (DOA), Department of Agrarian Development (DAD), North Central Province and North West Province.

CHAPTER 2 NATIONAL AND REGIONAL BACKGROUND

2.1 Socio-Economic Condition

2.1.1 Land and Population

Sri Lanka is an island country and has a total land area of 65,610 km^2 and net land area of 62,705km^2 when inland waters are excluded. Total population is estimated at 19.5 million as of 2004[1] with a density of 310 persons/km^2. The population had increased at an average growth rate of 1.3% per annum during the period from 2000 to 2004[2].

Total labor force is estimated at about 7.9 million as of 2004. Of the 7.3 million employed, 34.0% are engaged in agriculture, 16.9% in manufacturing, and 49.2% are in other sectors. The high unemployment rate, which was 8.1% in 2004, is a long-standing problem in the country. The unemployment rate in the urban areas is higher than that of the rural areas, and the unemployment rate of females, which constitutes one third of the total labor force, is also high compared with that of males.

2.1.2 National Economy

In the late 1970s, Sri Lanka began the transformation to a market economy based on liberalized trade, foreign exchange and investment. Gross domestic product (GDP) has been growing at around 5 percent annually for over two decades even during the conflict years. GDP and the growth in recent years are shown below:

Table 1 GDP Growth by Industry

	2000	2001	2002	2003	2004
GDP at current market prices (million Rs.)	1,257,636	1,407,398	1,581,885	1,761,161	2,029,441
GDP constant at 1996 prices (million Rs.)	857,035	843,794	877,248	930,057	979,925
Annual Change in GDP(%)					
Agriculture	1.8	-3.4	2.5	1.6	-0.7
Industry	7.5	-2.1	1.0	5.5	5.2
Services	7.0	-0.5	6.1	7.9	7.6
Total	6.0	-1.5	4.0	6.0	5.4

Source: Central Bank of Sri Lanka (CBSL) Website, Annual Report 2004.

In 2001, Sri Lanka experienced negative growth for the first time since independence, though positive growth resumed the following year. GDP in 2004 is estimated to have been Rs.2,029 billion at current prices and the per capita GDP was approximately Rs.104,000 (US$ 1,030). GDP in 2004 was comprised of 18% in the agricultural sector, 27% in industry and 55% in the service sector.

[1] Statistical Abstract of the Democratic Socialist Republic of Sri Lanka, Department of Census and Statistics
[2] Central Bank of Sri Lanka (CBSL) Website, Annual Report 2004.

2.2 Water Policy and Irrigation Management

2.2.1 Brief History of Irrigation in Sri Lanka

Irrigation is an age-old art in Sri Lanka and it had been the backbone of the civilization of the country. Ancient kings developed many irrigation systems including trans-basin diversion and those kings laid down the rules and regulations on water management and agricultural activities. Maintenance of irrigation works was carried out by village communities under the "Rajakariya" system, which could be explained as compulsory service required to be performed by the community for the king in accordance with the feudal system of government prevailing at the time. Rules and regulations laid down by the kings came to be accepted social customs and traditions continuously followed by the communities under the "Rajakariya" system. However when the country came under British administration, the "Rajakariya" system was abolished in 1832, which resulted in nobody being officially responsible for maintaining irrigation works for several years until the British rulers became aware of its necessity. This situation led to the degradation of irrigation works in Sri Lanka resulting in a negative impact, not only on irrigation works, but also social cohesiveness.

Once the British rulers understood the necessity to introduce appropriate regulations for the management of the irrigation systems they prepared the 1st irrigation ordinance along with other agriculture related legislations. Relevant legislation during the British time and after independence and the year enacted are listed as follows:

Table 2 Changes of Irrigation and Agriculture Related Legislation

	Name of Legislation	Year Enacted
1	Paddy Land Irrigation Ordinance,	1856
2	Paddy Land Irrigation Ordinance,	1861
3	Paddy Cultivation Ordinance	1867
4	Irrigation and Paddy Cultivation Ordinance	1889
5	Irrigation Ordinance, Amendment	1901
6	Irrigation Ordinance, Amendment	1906
7	Irrigation Ordinance, Amendment	1917
8	Irrigation Ordinance, Amendment	1946
9	Paddy Land Act, No.01	1958
10	Irrigation Ordinance, Amendment	1968
11	Agricultural Productivity Act,	1972
12	Mahaweli Authority Act	1977
13	Agrarian Services Act	1979
14	Irrigation Ordinance, Amendment	1983
15	Irrigation Ordinance, Amendment	1990
16	Agrarian Services Act, Amendment	1991
17	Transfer of Powers to Divisional Secretaries	1992
18	Irrigation Ordinance, Amendment	1994
19	Agrarian Development Act,	2000

Source: compiled by the JICA Study Team.

The Irrigation Department was established in 1900 to develop and manage major irrigation systems, while village based minor irrigation systems continued to be managed by the communities. The Irrigation Department has contributed immensely towards the increase

of paddy production through the restoration of ancient tanks and construction of new schemes both before and after independence. The Department of Agrarian Services (DAS, presently Department of Agrarian Development: DAD) was established in 1958, and while it looks after the minor irrigation schemes and FOs, it is also involved in providing inputs and marketing of paddy etc. In 1979, Mahaweli Authority of Sri Lanka (MASL) was established and under the Act, and all development activities related to irrigated agriculture in the Mahaweli area were carried out in an integrated manner under one umbrella, MASL.

The government institutions have traditionally managed the major irrigation schemes including Mahaweli schemes, while the communities have managed minor schemes. Since the early 1980s, after the government lost a court case relating to introduction of water tax, the management expenses of irrigation facilities, including O&M, have become a heavy burden on the government and it was planned to hand over O&M and water management (WM) of D canals and below to FOs. Commencing in the early 1990s, the government took a series of initiatives effectively handing over the O&M and WM for at least the D canal system of each irrigation scheme to the relevant FO, at the same time engaging in efforts to develop a "water resources policy" to meet the increasing demand for water requirements other than irrigation.

2.2.2 Prevailing Policy and Legislation

(1) Water Resources Policy

The "water resources policy" discussed and prepared by the Water Resources Council and Secretariat in late 1990s and early 2000s, has not received the approval of the government. Further, the Water Resources Act, which empowers implementation of the policy, has not been presented in Parliament, since the public is critical of the policy as they are against commercialization of water, which they consider to be a publicly owned commodity. The policy consists of the following four (4) components: (i) water rights and allocation, (ii) demand management, (iii) groundwater management, and (iv) information management.

(2) O&M and WM of Irrigation Facilities

Before the 1970s, all the (i) major, those commanding over 800 ha, and (ii) medium, those with between 80 and 800 ha, irrigation schemes in the country were intensively managed by the government. Budgeting for the management of those schemes was arranged from general government revenues while no irrigation fee was collected from farmers.

The participatory irrigation management policy was introduced in the 1970s in Sri Lanka. Although specific and practical guidelines were not prepared, the government initiated participatory irrigation system management policy in 1988 as declared in a Cabinet Paper, which mentioned that full responsibility for O&M and resource mobilization of D & F canal level facilities are to be taken by FOs. Based on this concept, a policy decision has finally been made that O&M of the tertiary irrigation facilities such as D & F canals are to be handed over to farmers' organizations (FOs) in accordance with the Irrigation Ordinance

(Amendment in 1994). Under the Act, collection of a fee to cover O&M expenses required for the works shall be determined.

The main purpose of the Irrigation Ordinance (1994) was to provide a legal basis for the new concepts in participatory irrigation management. Previously, farmers had been paying irrigation tax to the government so that overall irrigation management had been consistently carried out by the government as discussed above. However, the amended irrigation ordinance evidently stipulated that FOs are to take charge of O&M activities for D & F canal level facilities instead, therefore, they are exempt from irrigation tax.

(3) Present Legislation Relating to O&M and Water Management (WN)

The present legislations relating to O&M and WM of irrigation facilities consist of the Irrigation Ordinance in 1946 and subsequent amendments (the latest in 1994), the Mahaweli Authority Act, and the Agrarian Development Act of 2000. Main components of the Irrigation Ordinance, which include periodic amendments, are stated below;

(a) District Agricultural Committee should be set up under chairmanship of GA, (1946)
(b) "Irrigation rates" and "maintenance rates" should be assessed by a Government Agent (1946)
(c) The Cultivation Committees to carry out activities connected with O&M & WM of irrigation facilities are established (1968)
(d) The Agricultural Productivity Committees to supersede the Cultivation Committees came into operation (in Agricultural Land Law, 1973)
(e) "Cultivation Committee" was replaced by "Farmers Organization" (1994)
(f) "Project Management Committee" was established for the irrigation schemes specified. (1994)

In the case of the Mahaweli areas, all Government acts relating to lands, agriculture, and irrigation were integrated under the Mahaweli Authority Act, and the authority for applying these acts in Mahaweli area was rested with MASL.

The Agrarian Development Act was introduced in 2000 to supersede the Agrarian Services Act in 1979. The main components of this Act are outlined below:

(a) Provision for the establishment of Farmers' Organizations (FOs) and to grant them powers regarding cultivation and irrigation,
(b) Establishment of Agricultural Development Councils, which is not practiced yet.
(c) Introduction of Agrarian Tribunals to handle irrigation offences (the Magistrate Court is defined under the Irrigation Ordinance, which is adopted in the field),
(d) Defining of Registration of farmers organizations, and three tier federations,
(e) Relaxation of the Registration and membership conditions of FOs so that tenants, and people marketing agriculture inputs and products are also eligible as members of FOs,
(f) Devolution of certain functions of irrigation works and WM to FOs,
(g) The authority exercised by the Commissioner General of DAD in relation to prescriptions in the Act.

The Amended Irrigation Ordinance (1994) and the Agrarian Development Act (2000) are as mentioned above, the two main pieces of legislations related to irrigated agriculture. There are, however, many duplications covering the same functions in those regulations. In addition, some regulatory functions are not necessarily implemented and not working at the field level. Supporting mechanisms should be developed to particularly involve tenant and lease farmers into FOs' activities or at least in product base sub-committees in the FOs.

2.2.3 Government Institutions Relating to Irrigation

The government institutions relating to irrigation are the Irrigation Department (ID), Irrigation Management Division (IMD), Mahaweli Authority of Sri Lanka (MASL), Department of Agrarian Development (DAD) of the central government and local government institutions such as provincial irrigation departments, provincial engineering departments, etc.

Functions and organization of individual institutions are described as follows:

(1) Irrigation Department

The Irrigation Department (ID) was established in 1900. The ID is responsible for all inter-provincial irrigation works. The Institute is headed by the Director General and there are several Directors in charge of different subjects. Fourteen Regional Offices, which cover one or more Districts, are located in major cities in Sri Lanka. Figure 2.2.1 shows the structure of the organization. Attached to regional offices are over 50 Irrigation Engineer's Offices and a number of project offices have been established as required.

The major functions of the ID are water resources planning, research, development and construction, rehabilitation and upgrading, O&M of irrigation facilities, water management, training advisory services and Implementation of Participatory Irrigation Management in schemes not covered by the INMAS programme of IMD, which is called the WAPHAULA programme.

Engineering Assistants, in addition to their normal duties, function as the Project Managers of these schemes. Responsibilities are similar to those RPMs of IMD but the extent covered by one officer is generally smaller but scattered except in the North East.

In addition, the Department is also responsible for other water resources/ irrigation related functions such as flood control, drainage and salt water exclusion etc.

(2) Irrigation Management Division

The Irrigation Management Division (IMD) was established in 1984 under a special cabinet decision, to implement Integrated Management of Major Irrigation Schemes (INMAS). The IMD is directly under the purviews of the Ministry of Agriculture, Irrigation and Mahaweli Development (MAIMD) headed by a Director. The IMD appoints 37 Resident Project Managers (RPM) to the 55 INMAS projects.

The RPM has to be either the chairman or the secretary of the Project Management Committee (PMC) meetings but in usual practice it is the RPM who chairs. The PMC consists of the RPM, ID representative, Department of Agriculture (DOA) representative, Divisional Secretary (DS) as well as representatives of FOs. The PMC has monthly discussions on water management issues relating to agriculture. The organization chart of IMD and RPM office are presented in Figure 2.2.2.

(3) Mahaweli Authority of Sri Lanka

The Mahaweli Authority of Sri Lanka (MASL) was established in 1979 to implement the Accelerated Mahaweli Development Programme. The MASL is headed by a Director General and the policy decisions are made by a Board of Directors under the Ministry of Agriculture, Irrigation and Mahaweli Development. As stated above, the Mahaweli Authority Act integrated 25 work-related Acts, including those applicable to land, agriculture and irrigation and all authorities and responsibilities under those Acts were delegated to the MASL.

Under the MASL, the RPM in-charge of each project is responsible for all activities in the project including land and settlement, agriculture, O&M of irrigation, etc. The organization chart of RPM, MASL is shown in Figure 2.2.3.

(4) Department of Agrarian Development

In 2000, the Department of Agrarian Services (DAS) was renamed the Department of Agrarian Development (DAD) consequent to the enforcement of the Agrarian Development Act. Functions of the DAD relating to irrigation are registration of FOs under the Act and looking after the minor irrigation schemes with an irrigable area less than 80 ha. The organization chart of DAD is shown in Figure 2.2.4.

(5) Local Governments

If a river, which is a source of irrigation, is confined in one province, the Provincial Irrigation Department or Provincial Engineering Department is responsible for management, except for minor irrigation schemes under DAD.

A province consists of a few Districts. A District is headed by a District Secretary (Government Agent). A District is comprised of several Divisions, each headed by a Divisional Secretary (DS). Each Division is a core government institution in the field, where all relevant government agencies assign respective field workers s shown in Figure 2.2.5. In the DS Office, various officers are involved in PMC and other rural development activities.

2.2.4 Irrigation Development

(1) Irrigation Development and Self Sufficiency in Rice

The government allocated a very high ratio of funds in the budgets to the irrigation sector after independence in 1948 to increase the production of rice, which is the staple food of the people in the country, with the ultimate goal of reaching self-sufficiency in rice. The following table shows the changes in irrigated area, paddy harvested area and production, unit yield, self-sufficiency ratio, population and per capita consumption:

Table 3 Changes in Irrigation Area and Rice Consumption

Year	Irrigable Area	Paddy			Rice Self-Sufficiency Ratio	Population	Rice Per Capita Consumption
		Production	Harvested Area	Unit Yield			
	(1000ha)	(1000ton)	(1000ha)	(Ton/ha)	(%)	(Million)	(kg/person)
1950	236	456	456	1.0	42	7.5	97
1960	290	864	554	1.6	54	9.9	109
1970	338	1,409	685	2.1	73	12.5	104
1980	411	2,065	822	2.5	89	14.7	107
1990	487	2,362	788	3.0	88	17.0	106
2000	509	2,795	832	3.4	95	19.4	102

Source: Agriculture & Forestry of Sri Lanka, AICAF, Japan, March, 2004

Irrigation development was accelerated in the 70's with the commencement of the Mahaweli Development programme in the early 70's. The self-sufficiency ratio was only 42% in 1950 and it increased to more than 95% in 2000 by the increase of irrigated area and improvement of cultivation technology as well as adopting high yield variety although population has increased approximately by 2.6 times over this period. Rice per capita consumption is stable or even currently in the gradual decrease trend, therefore, rice self-sufficiency can be kept ensured. Instead, "provide a stable supply of quality paddy" as a purpose of rice production mentioned in the national food security policy is confirmed.

(2) Irrigation Extent of Different Institutions

As discussed in the preceding sub-sections, in Sri Lanka, there are different institutions engaged in the irrigation sector. The number of schemes and extent of irrigated area under each of these institutions as of 2005 are summarized as follows:

Table 4 Irrigable Area under Each Institution

Definition of Irrigation Schemes	Institution Responsible	Schemes	Extent Irrigated
Major & Medium (80 ha and above)	Irrigation Department	360	289,000 ha
Major & Medium (80 ha and above)	Provincial Irrigation Department	167	55,000 ha
Mahaweli	Mahaweli Authority	7	97,000 ha
Minor (less than 80 ha)	Department of Agrarian Development	18,000	160,000 ha
Total			601,000 ha

Source: Irrigation Department

As of 2005, major and medium irrigation schemes under the central and provincial Irrigation Department cover 344,000 ha and 57% of total irrigated area in the country. As

similar to other Asian rice-growing countries, development of irrigation with large and/or medium scale basis has been contributing to rice-self sufficiency in the country.

2.2.5 Lessons Learnt from Past Irrigation Projects

After the series of large scale irrigation development in Sri Lanka, the need for beneficiary participation in irrigation management is realized. Then, several rehabilitation and restoration projects have been implemented in the irrigation sector using the "participatory approach" in full or partly. The "National Irrigation Rehabilitation Project" (NIRP), "Mahaweli Upgrading Project" (MUP) and "Mahaweli Rehabilitation and Restructuring Project" (MRRP) are among them. All of them have attempted to increase the agricultural production and thereby increase farmers' income to ensure sustainability of irrigation schemes through rehabilitation, improved O&M and strengthening of FOs. The approaches differ, however, among those schemes. A brief comparison from various view points is described below:

Table 5 Comparison of Past Irrigation Projects

Item	NIRP	MRRR	MUP
Community Contract	Not all the construction activities of D&F canal were given to FO.	Not all the construction activities of D&F canal were given to FO.	All the contract packages of D&F canals were given to FO.
Farmer Voluntary Contribution	10% of contribution was achieved by 50% of FO.	Fairly successful.	Fairly successful.
Training Programs	Trainings covered the common areas (awareness, construction management, water management, financial management, strengthening of FO, etc.).	Trainings cover business development training programs in addition to the common areas.	Trainings covered small group formation and strengthening in addition to the common areas
Handing over of Facilities	Handing over of D-canal level only.	Handing over of D-canal level only.	Handing over of D&F-canal levels.
O&M Fund	Establishment of O&M fund at FO level started in 2004. under the Aftercare Program	O&M Fund was established at FO levels.	O&M Fund was established at FO levels.
Agricultural Production	No conclusive evidence of agricultural production increase.	Cropping intensity increased from 150% to 165%, and production increased from 191,000 ton to 262,000 ton	Not evaluated yet.
Sustainability of Project Outputs	FO dropped their interest on the activities after the project period, and Aftercare program was implemented.	FO dropped their interest on the activities after the project period, but no follow-up program was implemented.	The project has not completed yet.

Source: completion reports and evaluation reports of the projects, and review by the JICA Study Team.

NIRP, MRRP and MUP have provided useful learning experiences in the field of irrigation rehabilitation. Based on the achievements under these three projects, some important lessons could be derived which may useful for future irrigation rehabilitation projects.

- Strengthening of FOs is not a single activity; it is a process mainly dealing with human beings. The strengthening process should continue even after the project period and hence, FOs may need external assistance until they reach a certain level, which should be defined before the project implementation. During the project period FOs are mainly involved with physical rehabilitation works and after that the time should be allocated to ***institutionalize operation & maintenance of irrigation systems alone with the self-sustaining agricultural input service.*** Generally, responsible agencies pay very poor attention to continuation of the activities conducted during the project period.
- ***Over loading and pressing FOs to accomplish a task in a given time frame decided by an outsider may result in poor quality outcome***. Considering the carrying capacity of the organizations and other social commitments, both contractors (FOs) and clients together should decide the contract period and the value of contract. ***As many community organizations are not experienced in construction activities, frequent on the job support should be provided to complete the job and provide a sense of ownership, but not as a professional contractors.***
- Before physical rehabilitation starts, ***adequate lead-time*** should be provided for preparation of community and relevant government officers towards a participatory approach and for creating ***well-motivated FOs.***
- Changing irrigation management policies and implementing such changes practically in the field, ***should not be restricted to only donor funded special projects.*** It should be implemented as a ***national program***. In this regard, top-level political commitment for irrigation management is required.
- Farmers are more concern about the sustainability of irrigation systems and they are in the process of ***becoming more liberal in O&M and trying to recover from the dependency*** they had. This is a positive development and an indication of an increased level of sustainability. In this connection, relevant government agencies should provide necessary assistance as a National program and not as an interest of individuals.
- For a successful agricultural credit program with a remarkable recovery rate, considerable attention should be given to credit management. Credit management should include ***changing the attitudes of borrowers*** and a systematically planned follow-up program. Furthermore, ***a technical package, which leads to significant yield increase, should be introduced along with the credit program.***
- The communities have a lot of ***latent capabilities*** and they have to be inspired by an outsider in the correct way with properly planned activities.

2.2.6 Brief Comparison with Asian Countries

The countries selected for the comparison are Sri Lanka, Japan, the Philippines, Thailand, Indonesia, and India, which are (i) all paddy-producing countries primarily through large scale irrigation development and (ii) for which certain study reports under JICA or other institutions are readily available.

The items to be taken up for the comparison are 1) general information of the agricultural aspects, 2) water policy and legislation, 3) irrigation policy and legislation, and 4) irrigation management & O&M.

(1) Water Policy and Legislation

Water policy law is already available or under preparation in all countries at present. Water rights are clearly defined in Japan and the Philippines and indirectly defined in India. Water rights are ready to be defined in Sri Lanka and Indonesia. Water rights are defined or to be defined in connection with costing or commercializing water. In all countries, irrigation is the main consumer of water and there is excessive pressure to allocate water to other sectors.

(2) Irrigation Policy and Legislation

All countries agree that irrigation is essential for food production and accept the need to improve irrigation efficiency. All countries consider that participation of farmers' organizations, water users' associations, and irrigators associations for O&M of irrigation facilities are essential and various activities have been carried out including preparation of relevant legislation.

There appears to be a general tendency to shift irrigation policy from construction to rehabilitation & O&M, and from supply driven to demand driven.

In the most of these countries, irrigation is under the Agriculture Ministry. In Indonesia, irrigation is under public works, and in India, irrigation is an independent Ministry.

(3) Irrigation Management and O&M

In most of these countries, surface water and ground water are handled by different organizations. As an issue on O&M & water management (WM), all countries pointed out the inadequacy of the available budget to carry out appropriate O&M and WM work. This may be one of the reasons for promoting the introduction of participatory management.

As for the farmers' organizations relating to O&M of irrigation, they are called Land Improvement Districts (LID) in Japan, Irrigators Associations (IA) in the Philippines, Water Users' Associations (WUA) in Indonesia and India, and Water Users' Groups (WUG) in Thailand. These organizations have been established having irrigation as their main objective. Only in Sri Lanka, is the organization called the Farmers' Organization and this name has been registered under the Agrarian Development Act, 2000, which covers not only irrigation aspects but overall agricultural aspects.

Eligibility of membership is for both owner farmers and tenants except in India, where only owner farmers are eligible for membership. In order to establish an organization, it is compulsory for all farmers of the area to be members in Japan, the Philippines and India, while in Sri Lanka, Thailand, and Indonesia it is optional. This could perhaps be a reason why the collection rates of water charges of the former countries are higher than the latter ones.

Collection of the irrigation fee varies from one country to another. It is nearly 100% in Japan, but only about 10% in Indonesia. In other countries, it varies from one project to the other. An irrigation fee is charged in all countries through the WUA or FO to cover O&M of tertiary irrigation systems. In Japan, recovery of a part of investment costs is also collected through irrigation fee collection. The irrigation fee in most of the countries is not adequate to cover all expenses to the extent that is necessary. It differs from US$1.0/ha per annum in Thailand to US$270/ha per annum in Japan.

Since irrigation is defined as socio-technical process manifested in the interaction of physical (facilities) and social (human beings) sets of activity, role of farmers' organization is quite important in order to ensure its sustainability. Analytical comparison shows that an irrigation based multi-purpose FO is unique to Sri Lanka. On the other hand, other countries have such organizations as cooperatives; however, they are not as active as expected. In order to activate FO and small groups at the farmers' level in Sri Lanka, it is important to introduce economic incentives through various income generation activities with social support from the community in addition to crop production. In this process, the key factor is to strengthen FCG and other small groups to be aware of the linkage among facilities O&M, water management and other activities.

2.3 Agricultural Policy and Extension

2.3.1 Government Policy

(1) Government Policy

The agricultural policy aim at developing a viable and sustainable agricultural sector capable of competing with competitor countries as well as successfully sustaining the farmers engaged in agriculture. Immediately after becoming independent, the Government paid emphasis on rice production for which rehabilitation or reconstruction of old irrigation tanks. Large scale new settlement has been also considered during these period such as large & medium irrigation development under ID and provincial irrigation department and Mahaweli Accelerated Development Program. As discussed previously rice self-sufficiency has been almost achieved through such efforts while more profitable agriculture is recently expected through transforming the domestic agriculture and livestock industry into a sustainable and vital economic drive and, above all things, so as to alleviate poverty in rural farming communities.

The National Policy on Agriculture and Livestock: 2003 – 2010, promulgated in 2003, identified specific growth expectations towards development of the agriculture sector as follows: a) increase productivity of agriculture and livestock production, b) minimize outflow of foreign exchange for food imports, c) removal of the dependency mentality which has plagued the entire agriculture and livestock industry, d) bring in the capital, management and technological skills and resources present in the medium and large scale private sector production sphere into agriculture, and e) maintain the annual growth rate of the agriculture and livestock sector at around 6 percent.

The Policy envisages mobilization of state and private sector investments and human resources on planned action to transform the domestic agriculture and livestock industry to a sustainable strong economic force for the development of the country supplying the consumer needs from the output of the farming community and the agricultural and livestock production process. Policy statements on 18 sub-sectors are presented with policy goals/objectives and indicators of progress.

The national policy on seeds and planting materials, as stated in the 'Policy of the Government of Sri Lanka on the Seeds and Planting Materials Industry:1997', restricts government activities implemented through the DOA to: a) developing and releasing varieties, b) provision of basic seeds and planting materials, and c) seed certification and quality promotion.

(2) Legislation

The Agrarian Development Act No. 46 of 2000 is of particular interest as it promulgates, under section 30, that all paddy land which can be cultivated with paddy shall be utilized for cultivation of paddy. However, under sub-section 29 (5), provision exists for crop diversification if sufficient production can be obtained by cultivating other agricultural crops, subject to prior approval by the Commissioner General of Agrarian Development.

2.3.2 A Brief History of Extension in Sri Lanka

Agricultural extension service in Sri Lanka evolved over time from the late 19th century and the Department of Agriculture (DOA) was established in 1912 to resuscitate agriculture in the peasant sector. The extension service under DOA was re-organized and strengthened in 1964 as a separate division, and the district level organizations with District Agricultural Extension Officers (DAEO) as the head were set up. The district was divided into sectors, ranges and village levels under the Segment Agricultural Officers (AO), Agricultural Instructors (AI) and Krushi Vyapthi Sevakas (KVS), respectively.

In the 1970s, Agricultural Service Centers (ASC) were established in all Divisional Secretary areas by the Department of Agrarian Service. The ASC housed officers of all agencies providing services to farmers and included the bank, Coconut Cultivation Board (CCB), Cashew Corporation, Department of Animal Production and Health as well as the AI of DOA. The district offices of DOA were strengthened with a new cadre, the Subject Matter Officers (SMO). Even though the extension services achieved a notable success in increasing the agricultural production during this period, supported largely by the introduction of new high yielding paddy varieties along with a package of recommended farm practices, there were many inadequacies and weaknesses in the system.

Under the World Bank funded Agricultural Extension and Adaptive Research Project (EARP), implemented between 1979 and 1986, extension functions of DOA underwent a significant expansion. The training and visit (T&V) system was instrumental in

establishing research-extension linkages, systematic scheduling of farm visits by extension workers, and preparation of seasonal extension programs along with monitoring and training of staff. The project helped to strengthen the infrastructure facilities, staff mobility, program funds and staff development at all levels.

With the termination of EARP, the paddy yields had tended to stagnate and the single crop approach was no longer adequate. Further, cost of operating the extension system became prohibitively high. Following enactment of the amendment to the constitution in 1989, the extension functions of the DOA, except in the inter-provincial major irrigation areas, were devolved to the Provincial Councils. Further, the KVSs were absorbed by the Ministry of Public Administration creating a vacuum in the extension system at the village level.

The World Bank funded Second Agricultural Extension Project (SAEP) was implemented from 1993 to revitalize the disrupted extension service. The strategy was based on a farmer centered holistic farming systems approach with the integration of extension services of a number of agencies. It was a 'bottom up' participatory approach where the farmer's needs were identified through application of problem census, problem analysis and problem solving techniques. An integrated agricultural extension work plan for the area was prepared and the extension agent served as a facilitator in addressing farm problems that were more general in nature. SAEP was implanted through Provincial Extension Teams (PET), District Guide Teams (GT) and Field Extension Teams (FET) established with officers from different agencies at relevant levels. SEAP strategy failed to deliver the expected output due to a number of reasons as follow.

a) FET being a provider of technology in the form of extension failed to address some of the core issues that came to light at problem analysis, e.g., irrigation, marketing, etc.
b) Members of the Team were attached to different line agencies resulting in conflicts in work priorities.

As the performance of the SEAP was not satisfactory, the project was terminated in 1998, one year ahead of the scheduled completion.

2.3.3 Agricultural Extension Organizations

Many institutions in the public and private sectors and NGOs are involved in providing extension services to the farm community with the state organizations continuing to play the major role. Services provided by DOA, both central and provincial, are most extensive as far as the food sector is concerned.

(1) Central Department of Agriculture (DOA)

The Training and Extension Division of central DOA is supported by three specialized research institutes as well as Plant Protection, Seed & Planting Materials and Economic Planning Divisions. The agricultural extension service of the DOA is confined to inter-provincial major irrigation areas (IP DOA) and includes Ampara, Anuradhapura, Polonnaruwa, Hambantota, Moneragala and Kandy districts. The organization structure of DOA is shown in Figure 2.3.1.

(2) Provincial Department of Agriculture (P DOA)

Extension services in minor irrigation and rain-fed areas, which fall outside the inter-provincial areas, are provided by the respective provincial DOA which is headed by a Provincial Director of Agriculture. The organization arrangement of the P DOA is shown in Figure 2.3.2.

(3) Provincial Department of Animal Production and Health (P DAP&H)

Extension functions on livestock development are fully vested with the provincial councils under the P DAP&H headed by the Provincial Director who is assisted by Assistant Directors at the district level.

(4) Other State Agencies

The extension service of the CCB and Cashew Corporation is somewhat limited to administration of subsidy schemes and to distribution of seedlings to growers. The district offices provide the services through field officers, but their activities are more concentrated on the established growing areas of the country.

(5) Private Sector Organizations

Private sector agricultural initiatives cover a range of activities and their advisory services are largely product related and market oriented. Some organizations provide advice to farmers along with input packages on specific commodities, often on forward contract agreements. In general, the private sector extension services are confined mostly to areas where the potential for marketing the products or commodities is high, thereby yielding a reasonable return for their effort and investment.

(6) Non Governmental Organizations

A major objective of the activities of NGO is to facilitate the up-lifting of the socio-economic status of the poorer sections of the society. Agricultural training and extension services are components often taken up under such programs for development, either directly or in collaboration with relevant training/extension agencies.

2.4 Marketing Sector

In order for irrigated agriculture to be sustainable as well as contribution to alleviating rural poverty in dry zone, attention should be given not only to production side but also to post-harvesting and agricultural marketing sides. General background of marketing sector in Sri Lanka is, therefore, explained in this section.

The Government emphasized the agricultural policy to achieve self-sufficiency in rice through paddy-land development by means of the development of irrigation systems since the independence. In the mid-1980's, the target of rice self-sufficiency was almost achieved then the government's agriculture policy has shifted to the crop diversification from rice cultivation.

The self-sufficiency target of rice supply was practically achieved but a sudden increase in rice imports was observed in 1996, 1997, 1999 and 2004, which was mainly caused by abnormal weather conditions. The government has intervened in paddy purchase aiming at lifting the floor price at the farm-gate through a national paddy purchasing program since 2004/05 Maha season. The government should create a stockpile system against emergencies in conjunction with this paddy purchase program.

The crop diversification cannot progress unless products can be brought to markets with reasonable profits to farmers. The marketing system, market information dissemination system and handling, transporting and storing facilities for crops to be diversified such as OFC, vegetables and fruit are under-developed.

The farm-gate price of Samba paddy/rice was Rs.12/kg in Nachchaduwa in May 2006 and the milled rice price in Colombo was Rs.43/kg. The simple price comparison between these two prices shows that the consumer price is 3.6 times higher than that at the farm-gate (Rs.43 / Rs.12). In Bangkok, the same calculation showed 2.03 times and in Tokyo it was 2.18. Though additional costs for the parboiling process are incurred in Sri Lanka, this price difference is ridiculous.

Similar to this case, the farm-gate price of maize is Rs15/kg but the consumer price is Rs.45/kg in Colombo. The difference is 3 times. In case of bitter gourd, the farm-gate price is Rs.30/kg in Nachchaduwa but Rs.60/kg in Colombo. The difference is 2 times. Modernization of the marketing system and the transparency of the price formulation system should be opened to the public.

The marketing structures in the Study areas are dominated by the private sector. The role of the government sector is limited to providing the necessary advice and facilitation of marketing channels, except the intervention in the national paddy-purchasing program. However there are a lot of activities and supports required of the government sectors.

CHAPTER 3 PRESENT CONDITION OF THE STUDY AREA

3.1 General Condition

3.1.1 Location and Local Administration

The Study area, Nachchaduwa, Rajanagana, and Thuruwila irrigation schemes are located in the Dry Zone of Sri Lanka, covered by two provinces; the North Central Province (NCP) and the North Western Province (NWP). Nachchaduwa and Thuruwila irrigation schemes are located in Anuradhapura Districts, while Rajangana irrigation scheme extends over three Districts; Anuradhapura, Kurunegara, and Puttalam. The Study area covers, in total, four Divisional Secretariats (DSs), more than 58 Gurama Niladari (GN) Divisions and 121 villages. Local administrative status of the Study area is shown below:[1]

Table 6 List of Local Administrative Units in the Study Area

Scheme		Province	District	DS's Division	GN	Villages
Nachchduwa		North Central	Anuradhapura	Nachchaduwa	15	39
Thuruwila		North Central	Anuradhapura	Nachchaduwa	1	3
Rajangana	Right Bank	North Central	Anuradhapura	Rajangana	21	44
	Left Bank	North Western	Kurunegala	Giribawa	21	35
			Puttalama	Karuwalagaswewa	-*	-
Total		2 Provinces	3 District	4 DS's Division	58**	121**

*Data under GN level was not available. **Numbers without Puttalama district
Source: Interview to the DS Offices by the JICA Study Team, January 2006.

Anuradhapura, in which the major part of the Study area is located, is distant from Kurunegala by 120km, Dambulla 70km, Kandy 140km and Colombo 210km. Paddy production and average unit yield in Anuradhapura district were at the 8th to 10th ranking among the 17 districts of the Dry Zone in 2004[2]. In Anuradhapura district, about 93% of the total population is in the rural area, and 53% of the labour force is engaged in agriculture, mostly in the paddy production sector. However, employment by age group shows low engagement of the younger generation and high involvement of older groups in agriculture (46% of the age group of 10 to 39 years old, but more than 60% in the age group of 40 years and over).

3.1.2 Natural Condition

The Study area has 75% probability rainfall of greater than 900 mm per annum, ground elevation less than 300 m MSL and an undulating terrain of Reddish Brown Earths (RBE) - Low Humic Gley (LHG) soil association. The land use consists of rain-fed upland crops, paddy, scrub, mixed home gardens and forest plantations.

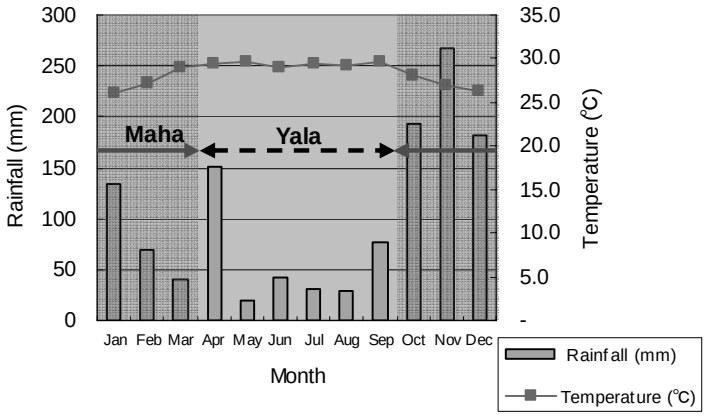
[1] Divisional Secretariat (DS) is an administrative demarcation within a district. 1 DS division comprises of several village clusters or Grama Niladhari (GN) division. Village under GN indicates traditional social cohesion, generally called purana (old) village.
[2] Annual Report 2004, Central Bank of Sri Lanka.

(1) Rainfall and temperature

Rainfall and temperature in Anuradhapura is illustrated as below.

The Study area receives an annual rainfall of 1000 – 1500 mm which is distributed in a well expressed bi-modal pattern. Seasonal monsoon influence two distinct season, Maha from October to March and Yala from April to August. The north east monsoon period occurs from November to January, therefore, approximately 70% of the rainfall is concentrated in Maha. On the other hand, the south-west monsoon occurs from March to May giving significant rainfall only in April but not in other months. The convectional rain experienced during the inter-monsoonal periods is unstable but combined with depressional rains, the October – November period is more balanced.

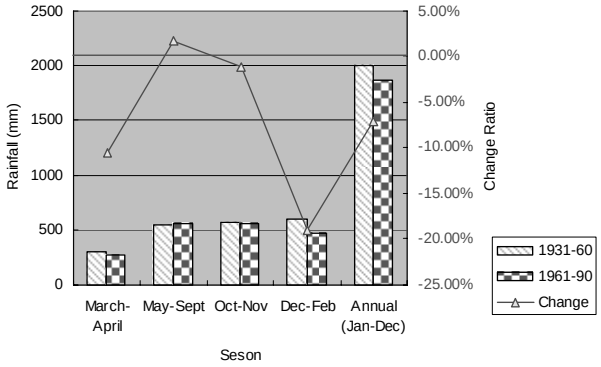
On the other hand, the average monthly temperature recorded in the Study area ranges between 25.3 and 29.2°C and shows that the variation is low. The mean diurnal temperature in the area is about 10°C. The range of temperature experienced in the area is not a limiting factor for agriculture.



Source: Statistical Abstract – 2004, Department of Census and Statistics

Figure 2 Monthly Average Rainfall and Temperature

Rainfall is the main impetus of variability in the water balance over irrigation practice; therefore, its changes in the long term trend have very important implications and assumptions for the formulation of capacity development plans in the irrigation sector. The long term trend of rainfall in Anuradhapura Region is reviewed by referring to the existing research papers. [3]



Prepared by the Study Team based on Jayatillake et al. (2004)

Figure 3 Rainfall Long Term Trend Seasonal Basis (Periods: 1931-60 & 1961-90)

As for the entire country, analysis was made using the data of annual rainfall for the period from 1880 to 2003. One of the distinguishing characteristics of rainfall patterns

[3] This analysis result is derived from Jayatillake et al. (2004). Jayatillake, H M, Lalith Chandrapala, B. R. S. B. Basnayake, and G. H.P. Dharmaratne. 2004. *Water Resources and Climate Change*

in the country is its high year-to-year variability. In addition, the result clearly shows alternating dry and wet periods till about 1970, but a significant change is recognized during the period from 1970 where the average annual rainfall has been below average throughout, except during only three years over a total period of over 30 years. In order to clarify more changes of rainfall pattern in the long term, such a comparison of changes and variability in terms of different rainfall seasons was analyzed. A comparison of the mean seasonal rainfall during these two recent 30 year reference periods of 1931-60 and 1961-90 is illustrated above.

The analysis result shows an average annual rainfall decrease of 7% from 2005 mm in 1931-60 to 1861 mm in 1961-90. Cleary seasonal disparity is also observed where May-Sept actually increased while Dec-Feb, the middle of Maha cultivation season, significantly decreased by nearly 20 %. Overall, a tendency of rainfall decrease for the entire country with seasonal analysis disparity is recognized.

Such an analysis was made on a district-wise basis. It has been found through the analysis that the average annual rainfall has decreased in differing degrees in all the districts other than Colombo and Matara. Anuradhapura district is not an exception from this long term trend. The analysis on district-wise change in annual mean rainfall from 1931-60 to 1961-90 shows a decrease of nearly 150 mm per annum.

(2) Soil

Soil in the region occurs in a catenary sequence with well drained RBE in the upper and mid slopes of undulating terrain and LHG in the lower slopes and valley bottoms. The bottomlands remain poorly drained while the mid slopes of the valley are imperfectly drained during the greater part of the year.

3.1.3 Socio-economic Condition

In order to grasp the present socio-economic condition in the Study area, a questionnaire interview survey was carried out in 3 selected pilot areas, namely 'Isuru' Farmer's Organization (FO) in Nachchaduwa and 'Sri Udara' FO in the Rajangana major irrigation schemes and 'Mahanama' FO in the Thuruwila medium irrigation scheme. The tabulated raw data are presented in Tables 3.1.1 to 3.1.6. The findings of this study are summarized below.

(1) Family Size

Average family size and farm labour force is summarized in the following table.

Table 7 Average Family Size and Farm Labour Force

Item	Nachchaduwa	Thuruwila	Rajangana
Average Family Member	4.8 persons	4.1 persons	4.3 persons
Farm Labour Force	1.4 persons	1.9 persons	1.7 persons

Source: Socio-economic survey by the JICA Study Team, refer to Table 3.1.1.

The average number of family members varies between 4 and 5 persons contributing 1.7 labour units for farm work. Average family size and labour force for farm work in Nachchduwa shows largest family members and lowest farm labour units, and this indicates that off-farm employment opportunity is high due to location near Anuradhapura.

(2) Land Tenure and Farm Size

Average farm size, land tenure and distribution of irrigated paddy land by size are shown below:

Table8 Average Farm Size and Distribution of Irrigated Paddy Land by Size

Item		Nachchaduwa	Thuruwila	Rajangana
Average Irrigated Paddy Land per Household		1.1 ha	0.9 ha	0.7 ha
Tenure:	Own land	44%	60%	89%
	Lease & Tenant	52%	32%	11%
	Thattumaru*1	4%	8%	0%
Farm Size:	0.4 ha or less	36%	58%	28%
	0.4 ha to 0.8 ha	20%	18%	50%
	0.8 ha to 1.2 ha	36%	8%	16%
	More than 1.2 ha	8%	16%	6%

Note 1*: Thattumal is the land operated on seasonal operation basis.
Source: Socio-economic survey by the JICA Study Team, refer to Tables 3.1.1 and 3.1.2.

The above tables indicate that majority of farm households are small scale operator less than 0.8 ha in the Study area, and particular point in each scheme are:

(a) Average farm size in Nachchaduwa is 1.1 ha, the largest in the Study area, and 52% of farmers are cultivating under lease and tenant. This indicates that farmers have been making effort to expand their operation scale.

(b) In Thuruwila, about 60% of farmers are small owner operators less than 0.4 ha. However, 16% of farmers are operating more than 1.2 ha and this show the large gap in operating size.

(c) In Rajangana, majority of farmers are owner operators with small scale less than 0.8 ha. According to the GIS irrigation mapping data, fragmentation is in progress.

(3) Average Annual Household Income

Average annual household income and its distribution in the Study area is tabulated as follows:

Table 9 Average Annual Household Income and its Distribution

Income Class (household)		Nachchaduwa	Thuruwila	Rajangana
Annual Income:	Farm Income	Rs.123,900	Rs.94,400	Rs.73,800
	Off-Farm Income	Rs.39,400	Rs.30,800	Rs.36,300
	Total	Rs.163,300	Rs.125,200	Rs.110,100
Agriculture Income	Rs.50,000 and less	39%	44%	40%
	Rs.50,000 to Rs.75,000	19%	16%	21%
	Sub-total	58%	60%	61%
	Rs.75,000 to Rs.150,000	30%	21%	30%

Income Class (household)		Nachchaduwa	Thuruwila	Rajangana
	More than Rs.150,0000	12%	19%	9%
Total Income	Rs.50,000 and less	23%	13%	27%
	Rs.50,000 to Rs.75,000	12%	32%	21%
	Sub-total	35%	45%	48%
	Rs.75,000 to Rs.150,000	42%	26%	31%
	More than Rs.150,0000	23%	29%	21%

Source: Socio-economic survey by the JICA Study Team, refer to Tables 3.1.3 to 3.1.5.

The main income source of average farm household is the farm income in the Study area, however, 24% to 33% of the total income is derived from such off-farm income as labour, remittance, employment, trading, etc. Employment opportunity in Anuradhapura contributes to increase household income, particularly in Nachchaduwa.

The poverty line in Anuradhapura district is the monthly income of Rs.1,683 per person, and the poverty line in annual household income is estimated at Rs.107,300 per family in Nachchaduwa, Rs.91,700 in Thuruwila, and Rs.96,100 in Rajangana. Taking into account the situation that farm households obtain food from their own products, total annual income less than Rs.75,000 is considered as the below poverty line and the susceptible to poverty. This means that 35% of farm households in Nachchaduwa, 45% in Thuruwila and 48% in Rajangana are categorized into the below poverty line and the susceptible to poverty.

(4) Paddy Profitability

Income from paddy for average farm households is estimated on the basis of the operation scale, unit yield, home consumption, farm gate price, and production cost, assuming that paddy is cultivated in the all the irrigated land, as shown below:

Table 10 Income from Paddy Cultivation per Farm Household

Items	Nachchaduwa	Thuruwila	Rajangana
Average Size of Irrigated Land	1.1 ha	0.9 ha	0.7 ha
Annual Production of Paddy	10,560 kg	9,650 kg	5,470 kg
Home Consumption, Reserve, Loss, etc.	1,400 kg	1,800 kg	1,180 kg
Marketable Surplus	9,160 kg	7,850 kg	4,290 kg
Gross Income (paddy farm gate price: Rs.15/kg)	Rs.137,400	Rs.117,700	Rs.64,400
Production Cost	Rs.114,600	Rs.75,600	Rs.51,900
Net Income from Paddy per Household	Rs.22,800	Rs.42,100	Rs.12,500

Source: Socio-economic survey by the JICA Study Team, refer to Table 3.1.6.

Annual net income from paddy per household estimated in the above table is quite low, particularly, Rs.22,800 in Nachchaduwa and Rs.12,500 in Rajangana. Taking the current farm gate price of paddy (Rs.12-13/kg), profitability of paddy become less, and farmers are not able to rely on paddy cultivation only, and require to introduce higher profitable crops along with improvement of paddy profitability.

3.2 O&M of Irrigation Facilities and Water Management

3.2.1 Irrigation Facilities

(1) Nachchaduwa Major Scheme

Villagers under the Nachchaduwa scheme originally settled in the 1930s. Site reconnaissance, investigation and construction for the irrigation scheme were subsequently carried out from 1932 to 1939. The irrigation network, including main, D & F canals were gradually extended during the 1960s by Irrigation Department.

The Nachchaduwa reservoir is one of the ancient tanks in Sri Lanka. It receives water augmentation from the Mahaweli System through the Kalawewa Feeder Canal in addition to the water from its own catchments. The spillway of the Nachchaduwa tank is located at the right bank. There is no command area on the right bank though there are two feeder canals to Nuwalawewa, one of which is the natural stream with gate facilities, and the sluice of the other is attached to the spillway.

There are two Main canals on the left bank, one is the High Level (HL) Main Canal and the other is the Low Level Main Canal. There is only one LB sluice, which is divided into two canals just downstream of the sluice. At the station 14.5 km of the HL Main Canal, the Tissawewa Feeder Canal from Kalawewa RB Canal joins and the HL Main Canal functions as the feeder canal. The maximum command area of the Nachchaduwa scheme is 2,904 hectares in accordance with the available cultivation records on paddy. Since the canals are single band canals, the HL Main Canal alignment follows the contour line of the landscape, which has necessitated many curves.

The HL Main Canal cuts off the command area of the Thuruwila scheme, causing drainage problems as the section of a siphon crossing the HL Main Canal may not be adequate.

Turnout on D-canal Missing Gate (Nachchaduwa Major Scheme)

There are many irrigation structures that require rehabilitation and improvement. Since maintenance of earthen canals has not been properly carried out, sediments, vegetation and erosion are widely observed. It too, therefore, needs to be rehabilitated. Facilities evaluation through an irrigation block mapping survey, details of which are explained in section 3.6, identified that nearly 60% of the canal and the structures in the pilot area (Isuru FO) need to be rehabilitated.

(2) Thuruwila Medium Scheme

The Thuruwila scheme is an old scheme in the area. The scheme is currently being rehabilitated in connection with the installation of pumps to convey water for the Anuradhapura water supply scheme implemented under the National Water Supply and Drainage Board (NWS & DB). The construction supervision has been entrusted to ID since 2004.

The scheme has never faced any water shortage before and had fully depended on the flow from the own catchments. Water augmentation from the Mahaweli system at Mawatawewa of the Nachchaduwa feeder canal commenced after the decision was made for water intake for Anuradhapura water supply to satisfy Anuradapura water supply needs

Rehabilitation has been carried out from the feeder canal to the irrigation canals. The main canal and D canals are constructed using concrete U-flume canals. Rehabilitation of the F canals with structures has been started in some places; however, the work is far behind the original schedule. In addition, insufficient farmers' participation in the work is one of the issues to be addressed. According to the field survey, farmers expressed that the rehabilitation was carried out with limited consultation with them.

Left Bank Main Canal Recently Rehabilitated under NWS&DB (Thuruwila Medium Scheme)

The result of the facilities inventory survey are detailed in section 3.6 showing that almost 80% of the canals and appurtenant structures are in better condition thanks to the above-stated rehabilitation works.

(3) Rajangana Major Scheme

The Rajangana reservoir was constructed across the Kala Oya downstream of the command area of the Mahaweli System H, and collects its return flow. The maximum command area of the Rajangana scheme is 6,639 hectares as per the paddy cultivation records, while other data, including information concerning the pumping scheme shows 3,673 ha on the right bank (RB) and 3,450 ha on the left bank (LB). There are several pumping stations on both the right and left bank canals covering 352 ha and 1,029 ha respectively.

D-Canal 1 in LB Tract 2 Sedimentation and Vegetation inside (Rajangana Major Scheme)

The Main Canals are both single bank canals, and pump stations are constructed beside the Main and Branch Canals taking water directly from those canals for delivery to irrigated upland areas. Pumping schemes are not so popular in Sri Lanka except for some schemes in the North such as Vavunikulan, Akkarayankulam, etc. A pumping scheme is, however, appropriate to promote irrigation for OFC and perennial crops.

The irrigation facilities, both structures and earthwork, have not been rehabilitated since the Major Irrigation Rehabilitation Project (MIRP) in late 1980s; therefore, they require rehabilitation and improvement. Particularly, because the initial 300 m of LB are not well formed, water issuing from the tank is extensively inundating the area upstream causing high water losses. The downstream tracts such as RB tracts 16 to 18 have been facing serious water shortages. In addition, the roads along the LB and RB main canals and

Branch Canal (BC) 2 are highly deteriorated, which constrict market access by farmers. The RB BC 3 runs along the boundary of the Manel Wewa scheme, and it causes drainage problems in the Manel Wewa command area even though spillways are provided in two places.

The result of the facilities evaluation carried out in the pilot area (Isuru FO in LB tract 2) through irrigation block mapping is detailed in section 3.6. This pilot area is in better condition with nearly 80% of the F canals and related structures need no further rehabilitation since this area was selected as an experimental areas for water management improvement demonstration thereby being intensively managed by ID after MIRP. Although this exception is found, overall, facilities on the main, D and F levels are not in good condition.

(4) Irrigation tank

Nachchaduwa and Thuruwila tanks have multi-functions. The water is not only for irrigation, but also for drinking water through NWSDB. Therefore, water from the tank from each scheme for irrigation and water supply is specifically mentioned in this part, the amount of which is tabulated below.

Table 11 Tank Water for Irrigation and Water Supply

Scheme	Purpose	Water Quantity (MCM)		
		Irrigation	NWS & DB	Other Tanks
Nachchaduwa	Irrigation and supply water to Nuwarawewa, Anuradapura	Yala – 25.03 MCM Maha – 24.65 MCM		20 MCM per year*
Thuruwila	Originally for irrigation. From 2005 supply water to NWSDB for drinking water	Yala – 4.38 MCM Maha –3.94 MCM	10,000 CM per day from October 2005 and it will increase to 25000 CM per day by year 2020	
Rajangana	Irrigation	Yala – 141.7 MCM* Maha- 141.13 MCM		

Note: * 10 year average
Source: prepared by the Study Team based on the data collected from RDI Office Anuradhapura

Currently, water rights are clearly controlled; however, it will become more critical when population growth in the future places pressure on water use for irrigation.

3.2.2 Irrigation Performance

The water consumption of each scheme is calculated based on the amount of water supplied and the harvested area. Based on this, water productivity for paddy was also analyzed, which expresses the relationship of total water supplied and production, meaning how effectively water is utilized for agricultural crop production. The analysis is summarized below.

Table 12 Water Duty and Water Productivity in the Study Area

Scheme	Season	Water Supplied (MCM)	Area Harvested (ha)	Water Duty (mm)	Production (kg/ha)	Water Productivity (kg/m^3)
Nachchaduwa	Yala	22.8	1,622	1,411	4,566	0.322
	Maha	27.6	2,635	1,116	5,133	0.630
Thuruwila	Yala	4.4	1,92.9	2,325	5,004	0.216
	Maha	3.9	1,92.9	2,075	5,004	0.242
Rajangana	Yala	152.0	5,508	2,681	4,796	0.186
	Maha	126.6	5,658	2,518	5,135	0.282

Note: Period of Data utilized is not same throughout. Production in Thuruwila is assumed.
Source: Prepared by the Study Team

Although the period of the data utilized for the analysis is not the same throughout, the result shows that water productivity of the Nachchaduwa major scheme is higher than the other two schemes, particularly in the Yala cultivation season. This could be explained by the fact that the shortage of water resources in Nachchaduwa scheme would encourage farmers to utilize available water resources for cultivation effectively. In addition, the geographical location of Nachchaduwa is near a large city, Anuradhapura, and access to the Dambulla market would gradually be fostering a business mentality among FOs through effective resource mobilization including water resources. In addition, banana cultivation, which necessitate higher water requirement, is observed in increasing trend in Rajangana, therefore, Rajangana scheme has a potential to reduce water consumption through appropriate land use planning and agricultural extension services.

3.2.3 Operation and Maintenance

(1) O&M Practices

The responsibility for O&M of major and medium irrigation schemes can be summarized as below and explained afterward:

Table 13 Responsibilities for O&M

Work item	Major scheme (Nachchaduwa and Rajangana)	Medium scheme (Thuruwila)
Decision-making for O&M	Farmers meetings PMC Kanna Meetings	Farmers meetings PMC Kanna Meetings
Gate Operation		
- Tank Sluice	ID (Jalapalaka)	FO assisted by ID (Jalapalaka)
- Main and branch canals	ID (Japapalaka)	FO (Japapalaka)
- D-canals' head gate	ID (Japapalaka)	FO (Japapalaka)
- F-canals' head gate	FO (FO Water master/Jalapalaka)	FO (Jalapalaka)
Maintenance		
- Tank	ID	ID
- Main and branch canals	ID	ID
- D-canals	FO	FO
- F-canals	FO	FO

Source: Modified based on Dry Zone M/P.

Operation

In the major schemes, the ID carries out operation of the portion from the head sluice of the tank down to the turnout gates on the main canal where it diverts to each of the D canals by assigning gate masters or Water Issue Laborers (WIL or ID Jalapalaka). Operation of the D & F-canals, along with related facilities are, on the other hand, implemented by the FO by nominating a D-canal level Jalapalaka, called the FO Jalapalaka.

Maintenance

The budget provided by the ID for maintenance work is quite limited, therefore, only very small repair works can be undertaken together with routine maintenance such as de-silting, grass cutting, gate painting, minor repairing and so forth.

As for Nachchaduwa and Rajangana major irrigation schemes, the handing over of D & F-canal level facilities to FOs has been officially declared. However, in realistic terms, it is not fully implemented and ID is still providing a part of O&M expenses from its annual budget. This situation is caused by various reasons such as:

(i) insufficient process for handing over by the government, for instance, insufficient awareness by and lack of training programs for FOs, preparedness of facilities, insufficient follow-up from the government and so forth, and
(ii) lack of capability and sense of ownership of FOs, which hinders smooth O&M of the facilities by the FOs.

According to the interview, a one week training program, the contents of which include O&M of facilities, water management, financial management and so on, was organized for the representatives of the FOs prior to the handing over. Follow-up by the government was, however, insufficient afterward resulting in unsatisfactory achievement of the handing over.

In the case of medium irrigation schemes, including Thuruwila, operation of the tank sluice is carried out by the FO Jalapalaka with the assistance of WIL. Maintenance work responsibility is the same as for the major irrigation schemes.

(2) Staffing and Roles

Organizational structure of RDI Anuradhapura office is illustrated in Figure 3.2.1. Two Chief Irrigation Engineers (CIEs) and four Irrigation Engineers (IEs) are positioned under Regional Director of Irrigation (RDI) at Anuradhapura. The two CIEs take charge of construction and the IMAC program while the IEs are deployed in Anuradhapura, Huruluwewa, Padaviya and Rajangana supervising 13 major schemes (24,427 ha) and 84 minor schemes (11,072 ha) in total. On the other hand, IMD appointed one RPM and one IDO to each major scheme for the management under the INMAS program. Technical staffs attached to the IE's Office consist of an Irrigation Engineer (IE), Engineering Assistant (EA), Work Supervisor (WS) and Water Issue Laborer (WIL; ID Jalapalaka), the roles of which are tabulated below:

Table 14 Role of Field Staff of the IEs' Office

No.	Designation	Role
1.	Irrigation Engineer (IE)	Overall management of irrigation systems
2.	Engineering Assistant (EA)	Technical supervision of operation and maintenance works, budget preparation, certifying payment for contracts, technical guidance to farmers etc.
3.	Work Supervisor	Technical guidance to farmers on O&M instructed by EA
4.	Water Issue Laborer (WIL, ID Jalapalaka)	Operation of spillway, sluice and turnout gates under the instruction of the EA

Source: Prepared by the Study Team

(3) Expenses for Operation and Maintenance

The ID's budgets provided for the O&M of the irrigation facilities in Nachaduwa, Thuruwila and Rajangana schemes as shown below:

Table 15 O&M Budget of Irrigation Department

No	Item to Compare	Unit	Nachchaduwa	Thuruwila	Rajangana
1	Operation Budget	Rs. (Rs./ha)	134,200 (46)	9,000 (46)	281,600 (42)
	a ID's Expenses	Rs.	67,100	9,000	84,480
	b FO Expenses	Rs.	67,100	0	197,120
2	Maintenance Budget	Rs. (Rs./ha)	874,600 (301)	58,500 (303)	1,835,900 (277)
	a Headworks	Rs.	174,920	No separate budget for Sub-items	555,700
	b Roads	Rs.	87,460		
	c Main & Branch Canals	Rs.	349,840		535,731
	d Distribution Canals	Rs.	262,380		377,286
	e Field Canals	Rs.	FO's Responsibility	FO's Responsibility	367,180

Source: Prepared by the Study Team

Operation budgets are nearly same among the three schemes at Rs. 42-46 /ha. While Rajangana's maintenance budget is at a somewhat lower level (Rs. 277/ha) than the other two schemes (Rs. 301-303/ha), however, the Rajangana scheme is provided with a higher amount of government support in the form of budget for D & F-canal level facilities.

The budget allocated from the government is reported to be only 20-30% of the actual requirements to maintain existing facilities. Consequently, the facilities have been deteriorating. If FOs could accomplish those tasks, the funds could be used for O&M of the main facilities.

(4) Collection of O&M Charges

Since the Government has relinquished collection of O&M Charges directly from farmers, FOs should be the organizations responsible for O&M of D & F-canal level irrigation systems, including collection of other relevant charges from FO members. Such charges consist of: (i) acreage taxes, (ii) membership fees and (iii) O&M fees for FO Jalapalaka & maintenance. The various present fees that the farmer has to pay are shown below:

Table 16 Water Charges and Rate of Collection

No.	Item to Compare	Unit	Nachchaduwa	Thuruwila	Rajangana
1	Acreage Taxes paid to ADC	Rs/ha/Annum	15	16	15
		Collection %	100	100	100
2	Membership Fees	Initiation fee Rs.	100	130 (Life Time)	100
		Collection %	100	100	100
		Annual dues Rs.	25	0	0
		Collection %	100	-	-
3	O & M Fees for FO Jalapalaka & Maintenance	Rs/ha/Annum	1,500 (1 bushel/ crop/acre)	750 (250/acre/ year)	1,500 (1 bushel /crop/acre)
		Collection %	Very Poor	Poor	17-25

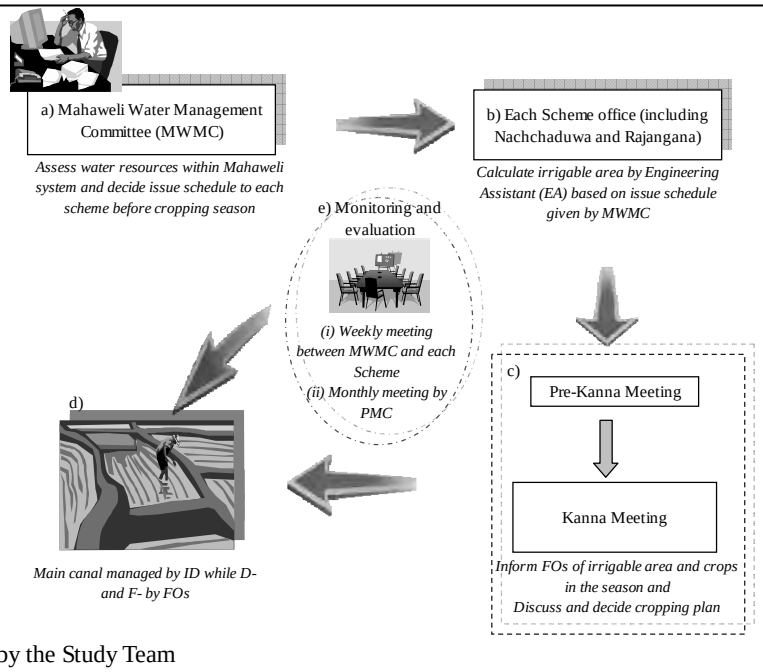
Source: Prepared by the Study Team

As clearly observed, the collection rate of acreage taxes and membership fees (Thuruwila and Rajangana is not collecting membership fees) is 100 %, however, all the schemes show an extremely low level in collecting O&M fees for the FO Jalapalaka & maintenance.

3.2.4 Irrigation Water Management

(1) Decision-making Process for Irrigation Water Management (Macro Level Issue)

The water supply schedule within the system largely depends upon the management schedule within the Mahaweli system prepared by the Mahaweli Water Management Committee (MWMC) every year before cropping season. In this sense, the Nachchaduwa, Thuruwila and Rajangana are defined as "supply-oriented systems." The water supply decision-making and management process is illustrated as follows, which is based on two legal backings consisting of the Mahweli Internal Regulation and the Irrigation Ordinance (Amendment 1994).



Prepared by the Study Team

Figure 4 Water Management Process

There are some issues to be addressed at the macro level water management decision-making process such as:

- limited farmers' participation in PMC and/or Kanna Meeting, and
- Insufficient function of PMC and/or Kanna Meeting.

The field survey clarified that those meetings or committees are not organized in interactive manner but, rather, are somewhat one-way shop talks which discourage farmers from actively participating in the meetings. The function of the meeting and the committee is another issue. In the abovementioned process, the Kanna Meeting and PMC is to propose measures based on the monitoring and evaluation of water management, however, practical measures are not sufficiently proposed and also putting such decisions into implementation is limited according to the opinion shown in the minutes of the Kanna meeting. Therefore, the power of the Kanna or PMC to mandate action seems to be questionable.

Box: Fine determined by the Kanna Meeting and its authorization

One of the important functions of the Kanna Meeting is to determine a Shramadana schedule for O&M of D- and F-canal level irrigation systems. For example, canal cleaning is carried out by the Shramadana, schedule and work volume of which are discussed and decided among FOs in the meeting. Farmers, who do not attend Shramadana as scheduled are fined, the amount of which has been determined for the study area is as follows:

	Nachchaduwa	*Rajangana*
D-canal	Rs. 150/2m	Rs. 500/2m
F-canal	Rs. 100/2m	Rs. 50/2m

According to the field survey, however, this fine was rarely collected even if Shramadana is not carried out, which implies insufficient decision implementation power of the Kanna Meetings.

(2) Water Management Practices (Micro Level Issue)

In the Kanna Meetings, the water issue schedule is prepared for the land preparation and normal cultivation period. In the land preparation period, water is continuously released to all D-canals for approximately one and a half months. Subsequently, in the normal cultivation period, rotational irrigation is scheduled within the main, D and F-canal level systems except for the Thuruwila medium scheme. In the main system, the area is divided into two: upstream and downstream for practicing rotational irrigation (3-4 day irrigation intervals), which are managed by the ID. In the D-canal command area from the head of the D-canal to the F-canals, rotational irrigation is also scheduled to be employed. Gate operation is supposed to be implemented by the FO Jalapalaka.

Turnout on Main Canal (Head of D-canal) Submerged due to Excessive Discharge and Canal Slope Erosion (Rajangana Major Scheme)

Although such rotational irrigation schedule is prepared, it is not satisfactorily practiced, particularly within the D-canal command area, which should have been adequately managed by the FOs. As a result, significant inequality in water supply between the upstream and downstream areas is observed. Deterioration of turnout gates is widely found along D-canals, which is also, in actuality, accelerating this defective water management practice within the D and F-canal level systems.

The ID Jalapalaka usually patrols to inspect the water flow of the main and D-canals once a day during the water release period. On the other hand, the FO Jalapalaka are supposed to confirm water flow of the D-canals regularly and operate the turnout gate at the head of the F-canals as scheduled. The inflow to the D-canals and F-canals is, however, not measured or recorded in any of the three schemes since almost all the measuring devices have seriously deteriorated. Consequently, excessive water tends to be diverted from the main canal down to the D-canals leading to deterioration of the D-canals.

(3) Performance Evaluation of the Long-crested Weir and Baffle Distributors

The ID implemented water management experiments in the 1990s in the Rajangana major scheme during MIRP in order to determine appropriate methodology to alleviate inequality of water distribution between the upstream and the downstream, thereby improving water use efficiency within the D-canal command area. This demonstration was carried out by adopting automatic head & flow control systems. In the area, both pilot (along D-1) and control area (along D-2) was selected in LB tract 2, the former of which was equipped with automatic head and flow control devices, and a long-crested weir with baffle distributors while the latter of which utilized a conventional steel slide turnout gate without check structures. The result was quite promising in that water distribution within the pilot area was improved more than that in the control area in terms of equity and the efficiency.

The study team carried out water measurement at both the pilot and control areas with the purpose of:

- reconfirming the effectiveness of the long-crested weir and baffle distributors in improving equity and efficiency in water use, and
- proposing further modification and future improvement processes in the above-said water management structure.

Duckbill weir on D-1 in LB Tract 2 to provide more weir length so as to reduce change of head (Rajangana Major Scheme)

Measurement from January to May, 2006 revealed the following issues.

- ***Less variation of discharge among F-canal block observed in pilot area***: in general, enough water was supplied in both the pilot and control areas. However, inequality of discharge was observed in both areas, which would be due to several reasons such as (i) unworkable gate condition and (ii) reduced water needs by farmers during the final stage of the Maha season. However, more variation was observed in the control area, which confirms its effective functioning in equal water distribution utilizing the long-crested weir and baffle distributors.
- ***Much more water diverted to D-canals***: discharge to D-canals has not been measured at most of the heads of D-canals due to the deterioration of the measuring devices. Observations at both the pilot and control areas clearly show that much more water has been diverted than it is scheduled. Some of the facilities have been significantly damaged by such excessive discharge. In addition, water wastage is observed

downstream of the control area.

- ***User capabilities and acceptance of new technologies***: Users' capabilities and acceptance should be carefully considered in selecting new technology. Although the interview with the FO Jalapalaka revealed that water management in the pilot areas was comparatively easier than with the conventional slide turnout gates in control areas, some baffle gates were actually removed by FO members due to insufficient understanding of facilities.

According to the experience in the Rajangana scheme, long-crested weirs would have some possibility of improving water management from technical and social points of view. In order to expand this practice, a gradual scaling-up approach is required, carefully considering user capability and acceptance of new technologies.

3.2.5 Water Quality Analysis

This analysis was carried out to clarify the quality of irrigation and drinking water in the Study area in order to assess the impact to irrigation and drinking water through fertilizer application.

Drinking Water Quality Analysis Sampling Sites Dug Well (Nachchaduwa Village)

Sampling sites consisted of the main inflows to two tanks. For the Nachchaduwa major scheme and Thuruwila medium scheme, the tanks themselves, main canals, return flow and the mainstream of Malwathu Oya were tested. Drinking water samples were taken from dug wells in Nachchaduwa, Thuruwila and Rajangana villages. Sampling was carried out over three consecutive months from December 2005 to February 2006.

(1) General features of water quality

Irrigation Water

Nachchaduwa Irrigation Scheme

- Irrigation water has not suffered from salinity problems or toxic concentrations, though there were some salinity concentrations in the return-flow and drainage river.
- Concentration of nitrogen and phosphorus was observed in the return flow and drainage river. Some fields downstream in plot-to-plot irrigation have a risk to be affected by nitrogen concentration, although impact to the source river is not highly significant. On the other hand, extremely high NH_3-N concentrations were observed on some occasions, which imply that farmers discharged water soon after the fertilizer application.
- High values of COD were observed in the entire system and some sites are above the recommended level for Sri Lankan surface water.

Thuruwila Irrigation Scheme

- Basically the same trend as at Nachchaduwa was observed in terms of salinity, toxicity, and eutrification, although the condition of inflow water was slightly better in terms of salinity. High values of COD were also observed in the entire system.
- There were some differences in phosphorus distribution. Return flow was not significantly concentrated in Thuruwila.

Drinking Water

- Most of the parameters analyzed for drinking wells fall within the permissible levels. The well water was less hard, non-saline and non-contaminated with concerned toxic metals or other non-hygienic chemicals such as fluoride.
- There were signs of contamination with either coliform or other bacteria since BOD5 was positive and substantial in some wells.
- The presence of fluoride ions is an endemic feature of the North Central Province of Sri Lanka; however, the concentration was relatively low since the source of the well water was seepage from surface runoff rather than ground water from aquifers.

(2) Approach for Improvement of the Water Quality in the Study Areas

The result indicates that the water quality in the study areas is within the suitable range for the designated uses, however, some nutrient enrichment was observed in all the schemes. In order to avoid further increase in concentration, the following approaches can be proposed:

i) Proper application of fertilizer

Excessive application of fertilizer does not contribute to an increase in crop production but it increases production cost and can produce a bad taste in paddy. Guidance should be given to the farmers to familiarize them with the proper dosage of fertilizer. It should be also noted that irrigation water flowing downstream in plot-to-plot irrigation contains fertilizer residue from upstream field and does not need as much fertilizer as that in the upstream fields.

ii) Suitable Water Management to Avoid Fertilizer Contamination of Effluent

Extremely high NH_3-N concentrations observed on some occasions imply that farmers discharge water unconsciously after the fertilizer application. Proper water management at the field level is prerequisite in view of effective input utilization.

3.2.6 Comparison between Irrigation Systems in the Study Area and Mahaweli System C

The Mahaweli Upgrading Project (MUP) in Mahaweli System C is one of the most futuristic and triumphant irrigation projects, employing a participatory approach in planning, implementation and monitoring of the project, putting priority on the actual communities, mainly farming, of the project. On the other hand, due to insufficient community participation and government follow-up in Nachchaduwa and Rajangana major schemes, handing-over is currently not at a satisfactory level. Fostering an environment where farmers' participation can be facilitated is one of the important keys to revitalize the

irrigation schemes. In general, Mahaweli systems are new settlement that are similar to Rajangana while Nachchaduwa and Thuruwila are traditional irrigation schemes. Although such different characteristics are observed from their historical background, it would be beneficial to reconsider System C's approach and to derive lessons from it in order to formulate a capacity development plan in the irrigation sector.

The major characteristics, by which the Mahaweli System C differed from the Nachchaduwa, Thuruwila and Rajangana schemes are:

- Rectification works of D & F-canal level irrigation facilities have been carried out with full participation of the FOs focusing on Field Canal Groups (FCGs) and farmers, and
- RPM of System C has all necessary and relevant authorities for human and institutional development, agricultural support services, marketing and so on in addition to O&M of irrigation facilities.

MUP is the combination of three areas of components: (i) increase productivity, (ii) strengthen the capacity of FOs to manage the irrigation systems, and (iii) rectify defects of the irrigation systems. Under the MUP, which covers 16,500 ha out of a total 21,500 ha of Mahaweli System C, rectification works have been carried out since 2000 with a community-driven participatory approach, from planning to construction and O&M with guidance provided by Mahaweli officers, while no substantial improvement or rectification works have been carried out recently in Rajangana or Nachchaduwa schemes because the commencement of the Pro-Poor Economic Advancement and Community Empowerment Project (PEACE project) was delayed. Although the Thuruwila scheme is now being rehabilitated in conjunction with the Anuradhapura water supply scheme under the NWS&DB, participation of farmers in the rehabilitation works is quite limited.

In Mahaweli System C, after the rehabilitation works, the D & F-canal level system has been fully operated and maintained by FOs with technical guidance provided by MASL staff. The collection of O&M charges has substantially increased with the recent rehabilitation program implemented under Japan Bank for International Cooperation (JBIC) funding. Some FOs have exceeded 80% in collection of O&M fees. The relevant FOs carried out D & F-canal level rehabilitation activities. On the other hand, the ID bears some O&M costs for D-canals in the Nachchaduwa and Thuluwila schemes and for D & F-canals in the Rajangana scheme. Lessons learnt from Mahaweli System C are discussed in section 2.2 and also summarize as follows:

- Equal prioritization of both software and hardware components of irrigation
- Outsider-oriented, overloading, and oppressing rehabilitation resulted in a poor outcome
- Frequent on-the-job training and follow-up, as well as aftercare is required
- Emphasizing of strengthening of FOs as a process is required

3.2.7 Minor Irrigation Schemes

A study of minor irrigation schemes was carried out in this sub-section so as to compare them with major and medium irrigation schemes and to derive useful lessons to incorporate

them into the capacity development plans for the target schemes.

Minor tank irrigation is the traditional irrigation system developed in the dry zone in the country. As defined in the Agrarian Development Act No.46 of 2000, irrigation works serving up to 80 ha (200 acres) are treated as *Minor Irrigation Schemes*.

The minor tank systems were constructed in ancient times in the centers of village settlements. Generally, the center of the village was the tank and houses were located on one or both sides of the tank. The irrigable extent below the tank bund is located along the main axis of the main valley. Unirrigable slopes of the uplands are used for rainfed cultivation.

Based on the historical commentaries, the construction and settlement of about 15,000 village tanks would have taken place at different periods in the different regions of the Dry Zone throughout a long period of time.

As indicated in the following table, 7,620 minor tanks are in use currently and 7,823 are abandoned; that is to say, about 50% of the minor tanks are not in use. The majority of operational village tanks are located in the North Western Province (NWP) and the North Central Province (NCP)[4].

Table 17 Distribution of Small Provincial Level Tanks Covering Part of the Dry Zone

Province	Number of small tanks		
	Operating	Abandoned	Total
Northern	608	816	1,424
North Central	2,095	1,992	4,087
North Western	4,200	2,273	6,473
Southern	653	757	1,410
Lower Uva	16	543	559
Eastern (South of Mahaweli River)	0	1,017	1,017
Eastern (North of Mahaweli River)	48	425	473
Total	7,620	7,823	15,443

Source: Prepared by the Study Team

In general, minor irrigation systems face lack of water resources, however, because of such situation, there are found various good practices in irrigation management in these areas. Although it would be difficult to instantaneously apply such those management practices in major irrigation schemes such as Nachchaduwa and Rajangana, the following points in minor irrigation schemes are derived which could be included in a guideline for improving major irrigation schemes.

- FOs' sense of ownership over irrigation systems is largely higher than that in major schemes. It would be difficult to acquaint all FOs of entire major schemes with such positive sense of ownership easily, however, good practices can be gradually introduced to FOs and FCGs for more micro level activities such as at the D & F-canal level.
- Traditional social cohesion among community members contributes to managing

[4] C.R. Panabokke, R. Sakthivadivel, A.S. Weerasinghe, Small Tanks in Sri Lanka: Evolution, Present Status and Issues, IWMI, 2002

minor irrigation systems. In the case of major irrigation schemes, that kind of relationship is observed in individual FOs and FCGs rather than the FO federation covering the entire system. Therefore, one of the ideas on capacity development of FOs should be initiated within small organization units then expanded to the federation level.

- Activities of the Kanna meetings are still much better than meetings involving the major irrigation systems, which are the result of the sense of ownership and social cohesiveness. Farmers are very familiar with water resources as well as O&M of facilities; therefore, such confidence may encourage them to actively participate in the water management decision-making process. It would be advantageous in major irrigation schemes as well if the FO members would check the water levels in the tanks before every Kanna meeting together with government field staff so that the FOs would also have an idea of available water resources for their own systems thereby stimulating them to actively take part in the meetings.

Box: Special Program for Food Security (SPFS) under FAO

FAO has been conducting SPFS in 17 Districts in Sri Lanka since 2002. The experiences of SPFS may help for planning of future projects as reported herein. The Study Team visited the village of Walpola in Arunadhapura District, where the SPFS has been implementing its works for the last two years.

The followings are the findings and lessons learned from the SPFS:

- One Institutional Development Officer is assigned under the Project, who resides in the village,
- A Project Management Unit (PMU) consisting of 4 specialists is organized in Colombo and a FIT (Field Implementation Team) consisting of farmers representatives of five subject groups and the field officers of Government institutions have organized to have monthly meetings at the site attended by specialist(s) from PMU.
- In the FIT meetings, farmers lead discussions for the activities planning and monitor them as for revolving funds with assistance from the Project and other sources. The Government field officers and the Specialist from PMU provide advice and suggestions at the meeting, and offer plans for required trainings and financial inputs.
- The farmers express their problems and concerns and those could be addressed at the meeting.
- The farmers expressed that rehabilitation of irrigation facilities by FOs under contract under the Project (the amount was approximately Rs. 300,000) gave great impact to farmers for their self confidence and trust in the Project, and released them from a dependency syndrome to a great extent. Further, they appreciated that interactions with the Government officers have been enhanced.
- Management of a revolving fund (total approximately Rs.1,000,000) for the loans for cultivation, livestock, farm equipment, fisheries etc. also provided cohesion and unity within the village community.
- As requested by the adjoining villages, the Project is going to extend the activities in the other villages.

3.2.8 Problem Analysis

As previously discussed in this section, problems and constraints extend to various parts of the area, which were identified through field surveys and investigations in the Study area and the series of problem analysis workshops that brought together government staff and representatives of the FOs.

The purpose of irrigation is, first and foremost, to provide an appropriate amount of irrigation water according to a schedule. Considering such fundamental purpose of irrigation as well as findings from field surveys and workshops, the core problem in the

sector can be defined as "improper supply of irrigation water." This core problem is caused by the following primary category of issues:

- malfunctioning facilities at the main level,
- malfunctioning facilities at the D- and F-canal levels,
- improper water management at the main level, and
- improper water management at the D- and F-canal levels.

Those problems are surely associated with various factors including physical, organizational, budgetary, capability, human behavior and so forth. The present situation and problems for the irrigation sector are explained in Table 4.2.1. In addition, in order to explain those correlations, a problem tree for irrigation sector is illustrated in Figure 3.2.1.

3.3 Agriculture

3.3.1 Land Tenure and Farm Holding

(1) Land Tenure

The Nachchaduwa scheme consists of a) descendants of the settlers from a few old village settlements ('purana' villages) in and around the scheme, b) outsiders who acquired lands through government grants in the 1930s, c) their tenant farmers, d) those who have purchased land from the original owners and e) more recent settlers on new land following expansion of the irrigated area in the late 1950s by the Irrigation Department.

The Rajangana scheme, which was inaugurated in the mid 1960s, had a more organized system of settlement, where uniformity in the holding size had been maintained based on a blocking-out plan. The settlers were selected from the old village settlements in and around the command area and also from among landless farmers in outside districts.

The Thuruwila scheme consists mainly of descendants of the original 'purana' villages that existed from ancient times. Most families are related through inter-marriages.

(2) Farm Holding

With the increasing population, most of the original land holdings have been subjected to fragmentation, and over the years, the extent of farm holding has continued to diminish. Since a fragmented farm holding is not economical to operate, systems such as 'thattumaru' have evolved where one of the many owners cultivates the land on a seasonal rotational basis. Leasing in land in order consolidate the farm holding is a very common feature, particularly in Nachchaduwa. The size of farm holdings has been analyzed in the socio-economic study and the results are given in Table 3.1.1.

3.3.2 Crop Production and Yield

The irrigated land in the Study area is double cropped, the main seasons being Yala (April to August) and Maha (October to March). The seasonal cropping calendar is agreed upon by consensus at the 'Kanna' Meetings held before commencement of each season.

However, in major and medium irrigation schemes, the cropping time and the extent of irrigable land are decided based on the availability of water in the reservoirs. Thus the cropping calendar is usually predetermined taking into account the land extensions that could be cultivated with paddy and OFCs during the season, particularly for Yala in Nachchaduwa, as there are limitations in irrigation water availability.

Table 18 Summary of Paddy Yield

(Unit: ton/ha)

Data source	Nachchaduwa		Thuruwila		Rajangana	
	Maha		Yala	Maha	Yala	Maha
IE Office ID	-	4.11	-	-	4.73	4.40
GAP/INMAS	5.98	4.76	-	-	5.78	5.00
FO Survey	4.12	4.12	-	-	4.33	4.33
Socio-economic Survey	4.85	4.76	5.20	5.40	4.22	4.20

Source: 1. IE's office, Nachchaduwa and Rajangana, ID,
2. Department of Census and Statistics
3. Central DOA, 4. Field survey of the JICA Study Team

A summary of paddy yield is given above. The Nachchaduwa and Rajangana schems remain 4.1 to 4.8 ton /ha while Thuruwila shows more than 5 ton/ha in both the Yala and Maha seasons. Demonstration trials under the Granary area Programme (GAP) in Nachchaduwa and Rajangana both significantly exceeded 5 ton/ha in the Maha season. Therefore, a potential yield increase can be observed if farming improvement support is appropriately carried out.

3.3.3 Crop Production Practices

Data and information on production practices were collected, mainly through four group interviews carried out in each of the three pilot areas studied. Additional information was gathered from the socio-economic survey and direct field observations.

(1) Paddy

a) Seed Paddy

'Pokuru' samba, a 4-4.5 month unregistered paddy variety is the main variety with 60% and 70% being cultivated in Nachchaduwa and Thuruwila respectively in the Maha season, though the DOA does not recommend the variety due to high blast susceptibility. The superior grain characteristics of this variety command a better market price. Other main Maha varieties are BG450 and BG358 (samba type), BG359 (nadu type) and the short aged Yala varieties, BG300 and BG352.

In the past, farmers used their own seed paddy for 3 – 4 seasons and replaced their own seed stock with certified or secondary seeds every 4 to 5 seasons. Though the DOA supplies 2 kg packs of certified seeds to selected farmers for multiplication as a means of quality improvement, self-seed production is not organized, and often the quality of the seeds used is below the expected standard. Non-availability of replacement seeds in time and in the required quantity is a major problem faced by farmers in all three areas.

b) Land Preparation

Land preparation begins after the commencement of water issues and is almost exclusively done by two-wheel tractors using rotovators. This method gives a tillage depth of only about 10 to 15 cm. Deep tillage is not practiced due to non availability of correct equipment and the higher cost factor. Two plowings 6 to 10 days apart is the usual practice and a field leveling operation is done in Rajangana using a leveling board drawn by a tractor or cattle. Final field leveling is followed by seed-bed preparation with shallow drains before sowing.

c) Crop Establishment

Crop establishment is done by broadcasting pre-germinated seeds while transplanting is restricted to gap filling in washed off areas and in a few very small holdings. For pre-germination, the seeds in poly-woven bags are subjected to alternate submergence in water and draining out for 3 to 4 days.

d) Plant Nutrition

Only about 15 to 20% of the farmers recycle the straw from previous seasons crops to the field, mostly in the tract demonstration plots organized by the DOA. Low adoption of the practice is observed due to i) reduced plowing efficiency, ii) the high degree of land leases where operators have little interest in soil improvement, iii) additional field work involved and iv) poor awareness of the benefits.

In general, 50% of the farmers apply basal fertilizer as a V1 mixture or, in the case of some farmers in Nachchaduwa, self-made mixtures incorporating Zink as per the recommendation. Booster doses of urea (50 to 100 kg/0.4 ha) are applied by all farmers in 14 – 21 Diamonium Sulfate (DAS). About 70 to 80% of the farmers apply Top Dressing Mixture (TDM) and 45 to 60 DAS depending on the crop duration. Except in a few of the demonstration plots, no individual farmer has availed the service of DOA for obtaining specific fertilizer recommendations based on soil analysis tests.

As mentioned in section 3.2.5 regarding water quality, above dosage indicates that excessive dosage of fertilizer as well as improper water management cause wastage of fertilizer in drainage water and contamination of water in the downstream.

e) Pest and Disease Management

The incidence and degree of damage caused by pests and diseases varies widely, and in some Maha seasons control measures have not been required. However, it is a common practice among farmers to apply chemicals, especially insecticides, in a routine manner, even when sufficient build up of the pest populations and crop damage are not observed.

Farmers were of the opinion that the practice of Integrated Pest Management (IPM) was not always satisfactory as the tract operations, such as planting at the same time,

could not be adequately synchronized due to shortages of farm machinery and labour as well as shortcomings in the irrigation system. Even in tracts where demonstrations have been conducted, the rate of adoption is insignificant due, in part, to poor follow-up action by the extension staff.

f) Weed Management

Farmers have been fully dependent on herbicides for weed control. Many farmers have applied Glyphosate or Paraquat to the fields prior to commencement of land preparation. 3-4 DPA and MCPA were widely used as post emergence herbicides.

g) Harvesting and Threshing

Due to problems with logistical arrangements with regard to contract harvesting and threshing, farmers sometimes tend to miss the best time to reap the harvest, i.e., when 85% of the panicles turn golden yellow, moisture content is around 22% and dry weather conditions persist. In Nachchaduwa and Thuruwila, where farm labor is in short supply, reaping is almost always done on a labor contract basis.

The high capacity combine thresher driven by a four-wheel tractor, which is a recent introduction to the area, has gained wide acceptance among farmers. 12 units were in operation in Nachchaduwa and 2 units in Rajangana serving the pilot areas. This method is favored by farmers as it gives good clean seeds (winnowing operation not required), needs less labor (hire charge includes 5 skilled labor units) and speed of the operation (less than 4 hours per ha).

In conclusion, problems of farming practices in paddy cultivation are 1) quality of paddy seed is low, and enough amount is not supplied, 2) dosage of fertilizer, particularly urea, is too high against the requirement, associated with improper management of irrigation water, 3) agro-chemicals are applied regardless of symptom of diseases and insects, and 4) weeding is totally depending on herbicides. Improvement of these problems will result in reduction of production cost, increase of value added and mitigation of environmental pollution. Organic fertilizers like manure will supplement such trace element as Zincs, and improve soil fertility.

(2) Vegetables

The most common vegetables grown on irrigated land in the area are bitter gourds, snake gourds, eggplants, okra, tomatoes, cucumbers, pumpkins and melons, radishes and cabbages. Cultivation of vegetables on a commercial scale is practiced largely in Nachchaduwa. Though highly profitable, the investment and labor costs of growing vegetables are very high compared to paddy and the marketing conditions remain highly unstable. In a successful vegetable project, implemented by an informal group of young farmers now comprising 35 members, 22 ha of irrigated land, leased from land owners, have been cultivated. Some relevant agricultural practices adopted by this group are listed below.

a) Improve soil fertility by incorporating organic matter (straw and cow-dung)

b) Use fertilizer recommendations from DOA based on soil analysis
c) Sink agro-wells for supplementary irrigation during off-seasons
d) Grow imported hybrid seeds to improve yield, quality and competitive edge
e) Extend production period by relay cropping and increase productivity by mixed cropping
f) Adopt innovations quickly, e.g., new trellising method to minimize cost.

(3) Other Field Crops and Fruits

Except for maize, which has a ready market as a snack food, cultivation of OFCs is insignificant. These crops are cultivated mainly under rain-fed conditions in highlands during the Maha seasons and under minor tanks in both Yala and Maha seasons.

Though cultivation of papaya and banana on the irrigated land is restricted under section 30 of the Agrarian Development Act No. 46 of 2000, the area under these crops appears to increase steadily. Banana is the main crop observed next to paddy and vegetables in Nachchaduwa, while banana and papaya are the main crops other than paddy in Rajangana. Little diversification is observed in the Thuruwila area.

The soil survey has revealed that a considerable land area is occupied by well-drained Reddish Brown Earths, which are better suited for high value crops. Thus, high potential exists for crop diversification, which can be exploited for improving farm incomes.

(4) Home Gardens

As evident from the socio-economic survey, the average holding size of a home garden in the pilot area was 0.3 to 0.4 ha. Besides the house, the home garden is largely occupied by a variety of permanent trees leaving little space for commercial production of vegetables or OFCs.

The average number of trees in a home garden is shown below.

Table 19 Perennial Trees in Home Gardens

(Unit: nos.)

Tree Crop	Nachchaduwa	Thuruwila	Rajangana
Coconut	20	13	15
Banana	11	12	11
Neem	5	5	6
Teak	4	3	8
Jack	3	2	1
Other	16	12	10
Total	59	47	51

Source: Socio-Economic Survey, JICA Study Team-2005

3.3.4 Agricultural Extension

(1) Agriculture

Agricultural extension in the Study area comes under the purview of the central Department of Agriculture (DOA) through inter provincial offices located in Anuradhapura, headed by a Deputy Director of Extension. The district organization is headed by an Assistant Director and is supported by 2 Segment Agricultural Officers and a team of 3 Subject Matter Officerss. Each

Table 20 AI Ranges in the Study Area

Rajangana Right Bank	Rajangana Left Bank	Nachchaduwa
Rajangana	Saliya-Asokapura	Shrawastipura
Nilgala	Yaya 2	Madawalagama
Puttalamhandiya	Abhayapura	Divulwewa
Adikarampura	Solewewa	Thuruwila
Gemunupura		
Angamuwa		

Source: Inter-provincial DOA, Anuradhapura

segment is divided into several Agricultural Instructors (AI) ranges. Extension in the Study area is covered by one Segment AO and 14 AIs, whose ranges are shown below.

Each range consisted of about 800 to 1,000 farm families. The annual AI work program covers a wide range of extension activities that includes 17 sub programs, each with several activities under paddy, OFCs (cereals, pulses and condiments), vegetables, fruit crops, home gardens, income generation (beekeeping, mushrooms, floriculture, home economics, etc), and others. The crop extension activities are given priority according to their relative importance in a particular range.

Research-extension linkages are maintained through pre-seasonal Provincial Technical Working Group (PTWG) meetings attended by staff from research, extension and other relevant divisions of the central DOA and senior staff of Provincial DOA (P DOA) & Inter-Provincial DOA (IP DOA). PTWG meets twice a year in February and July.

Among the priority programs for paddy extension, the tract or 'yaya' demonstrations initiated in 1996/97 Maha season are currently continued as the technology package under the Granary Area Program (GAP). Tract demonstrations program attempts to harness the productivity potential of a high yielding package of practices consisting of: a) Cultivation of the tract together according to a crop calendar, b) Improved tillage to the recommended depth of 30 cm, c) Use of high quality seed paddy, d) Addition of organic manure to improve soil organic matter status, e) Use of straight fertilizer ($N - P_2O_5 - K_2O$ – Zinc) to make mixtures, f) Proper control of weeds, g) Application of IPM practices, and h) Improved post harvest technologies.

GAP intervention strategies include irrigation support through water management, agrarian support through credit, marketing and inputs, and institutional support through cooperation among FOs, government officers and private sector institutions. It aims to produce at least 70% of the national rice requirement in the granary area (271,000 ha covering 16 districts and 5 Mahaweli project areas), while ensuring an income level of Rs. 7,500 per month per family. Toward these objectives, GAP has targeted i) increasing the average paddy yield to over 6.5 ton/ha, ii) increasing cropping intensity to 185% and iii) covering the total project area within a period of 3 years.

For 2005/06 Maha season, a total of 96 tract demonstrations have been laid down in the Study area as shown below.

Table 21 Distribution of Yaya Demonstrations in the Study Area: 2005/06 Maha

Location	No. of AI Ranges	No. of Demonstrations	Land Extent (ha)	No of Farmers
Rajangana RB	10	50	678	924
Rajangana LB	5	21	258	353
Nachchaduwa	2	17	232	272
Thuruwila	1	8	101	148
Total	18	96	1,269	1,697

Source: DOA

Besides the GAP, the IP DOA activities cover a) one acre paddy yield demonstrations, b) the 'Saruketha' program and c) seed paddy production programs, etc.

(2) Animal Husbandry

Livestock development and extension services are provided by the four Veterinary Surgeons (VS) placed at each of the four Divisional Secretariat areas covering the Study

area. Being a subject fully devolved to provincial administration, the VSs of Nachchaduwa and Rajangana (Right Bank) are serving under the Anuradhapura district office of Provincial DAP&H of North Central Province. VSs of Karuwalagaswewa and Giribewa (Rajangana Left Bank) serve the district offices of the Kurunegala and Puttalam, respectively of North Western Province. Each VS is supported by 2 Livestock Development Instructors and the services they provide are: a) dairy village development, b) cattle shed development, c) pasture development, d) facilitation for milk collection, e) poultry and goat development, f) extension and animal health.

Activities of the Provincial DAP&H within the Study area are directed largely to improving the nutritional status and to supplement the farm income of the farmers.

3.3.5 Agricultural Credit

(1) Institutional Credit

Credit schemes relating to agriculture operated by the institutional credit sources include: a) New Comprehensive Rural Credit Scheme (NCRCS) of 1978, b) Forward Sales Contract (FSC) Scheme, c) Paddy Pledge Loan Scheme and d) Agricultural Machinery Loan Scheme.

Under NCRCS, cultivation loans of Rs. 18,000 per 0.4 ha (maximum 4 ha) are granted at an annual interest rate of 8% for cultivation of irrigated paddy. Credit is disbursed in 2 to 3 installments on a set payback period of 270 days. Pre-conditions for credit grants include i) proof of land ownership or if not land owner, certification as farm operator from Grama Niladhari (GN), two guarantors or a group application by 3 farmers, and crop insurance coverage. Nine commercial banks in Anuradhapura, including the two state banks, are involved in credit disbursement of agricultural loans under the NCRCS. Five banks operate the PPL scheme for stockists and millers to purchase paddy from farmers and the FSC scheme for the farmers.

Based on the information gathered, the banks have not been able to bring about a significant improvement in the delivery and recovery of cultivation loans over the years. Many reasons had contributed to this situation. The tendency of some farmers to consider institutional loans as government subsidies and that unpaid loans are likely to be written off by the government, along with cumbersome and rigid procedures, were sited as main reasons for poor credit performance.

(2) Semi Institutional Credit Sources

The micro financing institutions supported by the government, NGOs and Community Based Organizations (CBOs) are grouped under the semi institutional category.

(a) Govigana Bank (GB)

GB was established in 1995, as a rural financial institution to provide credit facilities for agricultural production (cash and material inputs), to invest in agro-processing, storing and marketing ventures and to promote savings habit among small farmers.

The scheme is implemented by the DAD and GBs are established at each ASC to disburse credit to farmers through the FOs. It seeks to enhance farmer participation in raising funds and also to manage and implement the credit scheme at grass roots level. The FO has to purchase a minimum of 50 shares (share value Rs.100) in order to be a partner or shareholder of the bank. For a farmer to benefit from the GB, he should i) be a member of the relevant FO, ii) purchase a minimum of one share of the GB, and iii) deposit Rs. 500 or 10% of the loan value he seeks to obtain from the GB.

The capital funds of GB come from savings and deposits of FOs as well as individual farmers and from allocations made by DAD.

(b) Death Donation Societies (DDS)

DDSs are CBOs that have emerged as an important source of credit supplier for cultivation loans. Members are granted loans up to Rs.5,000 per season at an interest rate of 5% per month. Although the interest rate is high, these loans are quite popular among farmers because of quickness and ease of access.

(c) Samurdhi Bank Society (SBS)

SBS were established as an integral part of the Samurdhi movement and are involved in mobilizing savings and granting loans to Samudhi recipients. Loans are disbursed under several categories including cultivation, but mainly for crops other than paddy.

(3) Non-Institutional Credit

Non-institutional credit is supplied by wealthier individuals in the community, such as owners of large extents of land, mills, machinery and shops, as well as traders and some government servants residing in the area. The transaction takes place between money lender and the farmer, usually under conditions demanded by the lender. Farmers felt that such conditions placed them at a severe disadvantage. The annual interest rates charged may range from 60 – 150%.

3.3.6 Survey of Field Extension Staff

A survey was carried out on AIs, and Segment AO of the Study area and the SMOs attached to the Anuradhapura IP DOA office to find out 1) training they received during the 2004/05 period, 2) subject areas in which they wished to undergo further training, 3) the main problems they face in carrying out their usual duties, and 4) the main problems of farmers. The results of the analysis are summarized below

a) All 13 AIs were holders of a Diploma in agriculture, of average age 33 years (range 27 – 59 years), and had served in Anuradhapura district for over 7 years (range 2 – 34 years). Three had motorcycles for official traveling and others used public transport.
b) Of the 13 AIs that responded, 10 and 13 had been trained on IPM (1 – 3 days programs) during 2004 and 2005, respectively
c) Computer training for extension, IPM, landscaping and bee-keeping were identified as their training needs in order of priority.

d) Loss of time for official work due to poor public transport, lack of modern training aid, inadequate traveling allowance paid and poor farmer participation in training were identified as the main constraints in carrying out the assigned duties.

e) Shortage of high quality seeds, product marketing problems, poor transport facilities and inadequacies in the irrigation system were identified as the major problems of the farmers.

3.3.7. Problem Analysis

Problem analysis workshops were conducted by the Study team at different levels and the problems identified were combined to develop a sector specific problem tree. The core issue of low income from crop production was analyzed under 4 core problems, namely, 1) low productivity of paddy, 2) high production cost of paddy, 3) limitations to crop diversification and 4) weak extension services. The problem tree for the agriculture sector is illustrated in Figure 3.3.1.

The core problems were grouped into 4 categories: (i) paddy production, (ii) other field crops, vegetable and fruit production, (iii) agricultural extension and (iv) other farm income generating activities. Paddy production was further sub-divided into productivity and production costs. Issues under different categories were evaluated based on the study of the present conditions of the Study area in general and that of the pilot areas in particular, and are presented in Table 4.2.2.

3.4 Farmers' Organizations (FO)

3.4.1 General Condition of FOs in the Study Areas

The Committee of the FO generally consists of office bearers and representatives of Field Canal Groups (FCGs). The office bearers usually consist of President, Vice President, Secretary, Vice Secretary and Treasurer elected at the FOs' annual general meeting. The term of the office bearers is generally one or two years and the officer can be reappointed. In fact, the average service period of the presidents at Nachchaduwa and Rajangana schemes is approximately 20 years, according to the field survey[5]. The periods of service of secretaries at Nachchaduwa, Thuruwila, and Rajangana schemes are 18, 10, and 12 years respectively. The number of FOs and FCGs at each scheme and their registration progress is tabulated below:

[5] The survey was implemented in January and February 2006. In addition to the FOs in the Pilot Area for GIS irrigation block mapping, target FOs were selected by frequency of monthly FO Meetings from August to November 2005 under ADC with geographical distribution (upper, middle, and downstream in canals). The selected FOs are 1) Nachchaduwa scheme: Parakumba, Tissa and Isuru, 2) Thuruwila scheme: Mahanama, 3) Rajangana scheme Right Bank: Saliya Gama, Mahasen and Wijaya, and 4) Rajangana scheme Left Bank: Sri Udara, Perakum and Sadagala.

Table 22 General Information about FOs and FCGs in the Study Area

		FOs (no.)	FCGs (no.)	Total Members (no.)	Members (%)		Members registered (%)
					Male	Female	
Nachchaduwa		14	130	2,118	74	26	74
Thuruwila		1	13	196	Not identified		78
Rajangana	Gravity	32	513	6,469	85	15	80
	Lift	27	231	2,606	85	15	100

Source: prepared by the Study Team.

All the FOs except Navoda FO at Nachchaduwa were established in the 1980's under the Agrarian Services Act 56a, while Navoda FO was recently registered. According to the data provided by Nachchaduwa IMD as of November 2005 and the Integrated Monthly Progress Reports in September and November 2005, the Nachchaduwa Agrarian Development Committee (ADC) comprises 2,118 members, including estimated members of Navoda FO. The members of the FOs include 26% female[6] members.

No sub-PMCs have been established at Nachchaduwa. The average membership and number of FCG per FO are 165 members and 18 FCGs respectively. Most of the FOs' members have been changed except two (Isuru and Gemunu Eksath). The numbers of four FOs (Parakumba, Tissa, Alaksa, and Ranamauyura) have increased while the numbers of seven FOs (Senasamagi, Mahasen, Ranketha, 26/27, Ruwaweli, Eksath Gamunu, and Wijeya) have decreased. No significant change of membership are observed in such FOs having the higher capacity as Isuru, Gemunu Eksath, Tissa, and Wijeya, although the reasons cannot be precisely identified. 74% of the operators, including landowners, are registered as the member according to the data of Nachchaduwa IMD.

Mahanma FO, consisting of 13 FCGs, covers Thuruwila Medium Irrigation Scheme. It was officially registered. According to the representatives of the FO, 78% of operators are registered as members of the FO.

Rajangana scheme consists of gravity and lift irrigation systems. There are 5 sub-Project Management Committees[7] (sub-PMCs), and they are chaired by a representative of the FO, is held monthly. The agenda includes various problems[8] such as land issues.

All 32 FOs in the Rajangana gravity system were officially registered under the Agrarian Act. According to the data provided by Rajangana IMD as of November 2005 and the Integrated Monthly Progress Reports in September and November 2005, in Rajangana LB,

[6] The number of female and male members in Navoda FO cannot be shown in the Integrated Monthly Progress Report due to the FO recently being established.

[7] In the Right Bank, Sub-PMC No.1 covers Tracks 1~5, Sub-PMC No.2 covers Tracks 6~10 and 12~14, and Sub-PMC No.3 convers Tranct 11 and 15~18. In the Left Bank, Sub-PMC No.1 consists of Tracks 1~5, and Sub-PMC No.2 covers Tracts 4~7.

[8] According to the meeting minutes of the Sub-PMC No.2 of the Left Bank dated 6th October 2005, a progress report related to clearing and maintenance of canals, the result of the office bearers' election, explanation of new programs such as the agricultural program for 2005/2006, various problems and requirements presented by the representatives, loan arrangements reported by ARPA, the condition of Title Deeds explained by Colonization Officer were discussed.

and Upper Pulyankulama ADC, there are 6,469 members of the FOs associated with the gravity system that consist of 15% female members and 85% male. It has also been suggested that 80% of the operators are registered as members of the FOs. Similarly, all 27 FOs in the Rajangana lift system were officially registered under the Agrarian Act. According to the associated data, 2,606 are members of the FOs associated with the lift system and that membership consists of 15% female and 85% male.[9]

3.4.2 Present Activities of the Target FOs

The government has declared the handover of O&M at D & F-canal level to FOs. All the FOs were also officially registered under the Agrarian Service Act. Three Farmer companies were established, one of which, under LB at Rajangana, works relatively well, according to the Rajangana IMD and a representative of the Saliya Raja FO. Moreover, most of the representatives of the FOs have attended a Kanna Meeting, and a Project Management Committee meeting.

The monthly committee meetings are held by 12 out of 14 FOs (86%) at Nachchaduwa, 17 out of 32 (53%) at Rajangana gravity scheme, and 13 out of 27 (48%) at Rajangana lift scheme. Some active FOs hold the meetings twice a month.

According to the interview and the field survey, the following points are to be attended as the measurable issues in FOs in the Study area:

Table 23 FOs' Activities and Constraints

Basic Document/ Information Management
- Internal regulations were formulated as necessary documentation for official registration, but most of the FOs (except Isuru FO) have never updated them.
- Most of the FOs do not properly manage official documents, including internal regulation.
- Office bearers of FOs do not understand basic information on their own FOs.

Plans Formulated by the FOs
- Only rehabilitation work plans had been formulated at Nachchaduwa (17%).
- Rehabilitation work plans, and agricultural plans had been formulated at Thuruwila (50%).
- Agricultural plans, water distribution plans, and rehabilitation work plans had been formulated by some of the FOs at Rajangana (29%)
- No development plans had been formulated by any of the FOs.

Basic Organizational Capacity
- The appointment rates for water-masters are 50% at Nachchaduwa, 100% at Thuruwila, and 91% at Rajangana.
- The collection rates of O&M Fees are 0% at Nachchaduwa and Thuruwila, and 17-25% at Rajangana.
- The participation rates in 'Shramadana' are 21% at Nachchaduwa, 0% at Thuruwila, and 94% at Rajangana.

Present Major Activities of the FOs
- All types of activities under the FOs have been implemented at Rajangana (37%).
- Water distribution and O&M, and agricultural input have been implemented at Nachchaduwa (33%).
- Water distribution and O&M only have been implemented at Thuruwila (40%).

Documentation
- Contract rehabilitation work has been carried out by all FOs at Nachchaduwa and Thuruwila.

[9] Female and male numbers are not shown in B.O.P. 711/1 and 692[9] -Ibid- (the above report).

- Contract rehabilitation work has been implemented by 67% of the FOs at Rajangana.
- Group purchase and marketing have been implemented by 17% of the FOs at Rajangana only.

Major Problems with FO Activities

- Low participation of farmers is a common problem among all three schemes.
- Poor record keeping, including internal regulation.
- Low cognition of FO and political interference at Nachchaduwa.
- Poor financial management, insufficient water, weak legal framework, and encroachment at Rajangana.

In conclusion, the FOs were officially established according to the registration procedure, and basic activities have been implemented such as election of office bearers of the FO, attendance and discussion including distributing information of Kanna Meetings and PMC, and FO committee meeting organization. Rehabilitation works, micro credit and fertilizer distribution have been carried out as FOs' activities. However, their scale is still small under the government support. In other words, their activities are still kept as passive consciousness, and there is a lot of room to improve in areas such as record keeping, monthly committee meetings, and involvement of youth and women as well as income generation activities.

3.4.3 Present Activities of the Target FCGs

The implementation capacity of FCGs is very weak, except Shramadana in cleaning D & F-canals. In fact, most of the FCGs do not regularly organize monthly meetings. The designation period of FCG presidents is shorter than that of FO presidents.

Moreover, FCG consists of few farmers less than 5 farmers in some cases according to the FO Sample Survey, and this member size cannot operate as a group properly. In fact, some of the FCGs have not substantially taken any active role. For example, 3 out of 11 FCGs in Tissa FO at Nachchaduwa, 2 out of 26 FCGs in Perakum FO at Rajangana are no longer substantially active, according to field interviews. Thus, reorganizing FCGs by increasing the number of participants (preferably more than 15 farmers) is required. The FCGs currently have limited activities and capacities as follows:

Table 24 FCGs' Activities and Constraints

- A representative of an FCG is selected as a member of the FO committee.
- Members of FCGs are given information from PMC and FO committees.
- Formal meetings are not regularly held.
- FCG membership is less than 5 members in some cases, therefore, they cannot carry out effective group activities.
- Shramadana is not well organized, except for canal cleaning.

3.4.4 Roles of Government Agencies for FO

The main members of the sub-PMC are representatives of the FOs, the Institutional Development Officer (IDO) under IMD, EA and Work Supervisor (WS) under ID, Agricultural Instructor (AI) under DOA, Agricultural Research and Production Assistant (ARPA) under DAD, Land officer and colonization officer under DS. In addition, The

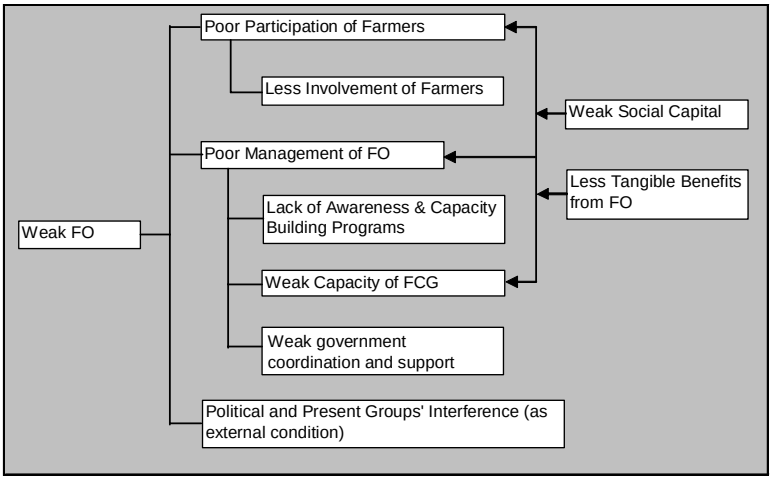
government agencies related to FOs are RPM under IMD, IE of ID, and Development Officers (DO) under DAD, and GN. The RPM chairs Pre Kanna Meetings to discuss the crop calendar and water distribution, and the PMC to discuss with IE or EA from ID various issues raised by representatives of FO, AI, DO, and related government officials. A Sub-PMC is held in the large schemes such as the Rajangana scheme. The former Cultivation Meeting was replaced by the PMC. Agricultural Development Committee (ADC) chaired by a representative of the FO with selected representatives of FO, DO, AI, RPM, an agriculture insurance representative, and a representative of the coconut group by using the meeting room and facilities such as storage, and the shop under Agrarian Service Center. ARPA is closely related to activities of FOs at the village level. Major roles of ARPA are to collect data, strengthen FOs, bridge between the AI as extension officer and farmers, arrange crop insurance, and collect acreage-tax. The Divisional Development Committee chaired by the Divisional Secretary (Assistant GA) is held monthly, but representatives of FOs do not regularly attend them.

The Kanna Meeting and PMC are of importance for farmers to manage irrigated agriculture. In these meetings and committees, the problems are weak mechanism to solve problems, low participation of farmers and agencies, and such improper procedures as agenda selection. The FOs, particularly in Rajangana LB, are located far from the IMD Office. Therefore, information sharing would be comparatively difficult.

3.4.5 Problem Trees

An integrated problem tree has been prepared as illustrated as follows based on the results obtained from the series of problem analysis workshops.

FO-related problems can be grouped into four: (i) weak social capital [10] , (ii) less tangible benefits from FOs, (iii) poor participation of farmers,



Source: The JICA Study Team

Figure 5 Integrated Problem Tree from Three Problem Analysis Workshops

[10] There are several definitions of social capital. According to the World Bank 1999: 'What is Social Capital?', social capital refers to the institutions, relationships, and norms that shape the quality and quantity of a society's social interactions (http://www.worldbank.org/poverty/scapital/whatsc.htm). Social capital in organization consists of the stock of active connections among people: the trust, mutual understanding, and shared values and behaviors that bind the members of human networks and communities and make cooperative action possible, according to Cohen D. and Prusak L.2001: In Good Company (Boston: Harvard Business School Press).

and (iv) poor management (implementation) of FOs. In addition, political and present groups' interference are the external conditions.

Present groups' interference is an outcome of weak social cohesion. Less implementation Kanna Meeting decisions, identified as a crucial problem by the different problem trees, is a serious constraint for FOs and government agencies. Poor participation of farmers, poor management of FOs, and weak capacity of FCGs are caused by weak social capital and less tangible benefits for FOs.

3.4.6 Problem Analysis

The present situation at the target schemes can be categorized into six: (i) participation, (ii) management, (iii) unity, (iv) government agencies, (v) activities, and (vi) external conditions. Problems and issues are as illustrated in Figure 4.2.4.

3.5 Marketing Aspects

3.5.1 Paddy/Rice

Most rice farmers sell their paddy immediately after harvesting, without adjusting delivery timing by checking the present market prices. Many farmers borrow cultivation funds in advance from middlemen or shop-owners in a village, who are called Mudarali. For settlement of such loans, farmers normally rush to sell their paddy for cash after harvest even though farmers know that the selling prices are at the lowest level. The quality factor of the paddy does not have much significance in the transaction, which causes poor quality control by farmers.

Under such unfavorable circumstances, some farmers are acting to increase their income by joining different payment systems involving rice millers and collectors, as seen in Nachchaduwa, aiming at earning better sales prices. Some farmers started using governmental loans as Forward Sales Contracts (FSC) for their cultivation funds. Institute of Post-Harvest Technology (IPHT) promotes Rice Processing Villages aiming at value addition by selling milled rice at higher prices instead of selling paddy in its raw form. By the end of 2005, 14 villages had joined this scheme already. Further efforts for this scheme extension are required through government agencies in addition to the efforts made by IPHT alone.

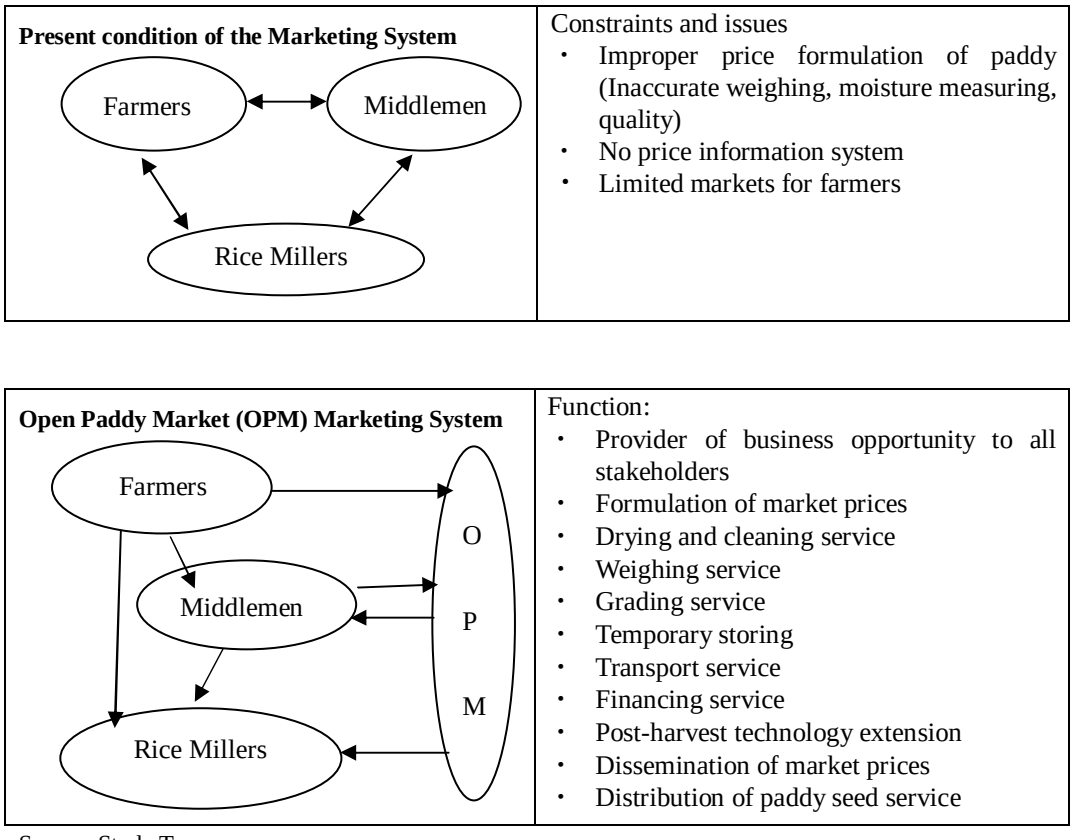
In System C, FOs practice bulking of their paddy in their warehouse and storing it for a few months until paddy prices go up, the system being financially supported by governmental banks. In the study area, availability of warehouses for paddy for farmers' use is very limited, so such bulking activity by farmers is impossible.

In the Study area, two (2) different situations are observed. In Nachchaduwa and Thuruwila Schemes, there are a lot of active commercial rice mills in operation (24 rice mills), but in Rajangana Scheme, there are only 4 small commercial rice mills that are in operation and a large numbers of village mills are working (total 133 mills). Most farmers

in Nachchaduwa and Thuruwila sell paddy directly to the commercial mills but farmers in Rajangana can only sell to middlemen at relatively lower prices. In Rajangana, local brokers are playing as mediators in paddy marketing by linking buyers and sellers. When outside traders come to the area, brokers take them to farmers or middlemen and charge Rs500~1,000 per lorry for the service.

Detailed study revealed that wholesalers' margins on milled rice are quite high. The closed market system with no information on the traded amount or price formulation has caused such a ridiculous situation. There is a lot of effort to be extended for the improvement of the situation.

No wholesale paddy market is available in Sri Lanka, unlike other field crops (OFC), vegetables and fruit, which commodities are actively dealt with every day by wholesalers & collectors and producers (farmers) in the economic centers (wholesale markets). If Open Paddy Markets (OPM) were available for producers (farmers) and users (rice millers & middlemen) on a similar line as operating in Thailand, farmers would have the opportunity to know the market requirements in terms of prices and qualities and at the same time, users can purchase the necessary quantity of required quality at once without incurring a cost of purchasing. An OPM enables all conditions in the transaction (price and quality) to be transparent to all stakeholders for mutual improvement. A schematic figure of the present condition of the marketing system and the OPM system is shown below.



Source: Study Team

Figure 6 Present Marketing System of Paddy and Open Paddy Market System

It is estimated that there are about 7,000 rice millers with different types of equipment and capacities operating in Sri Lanka. Most of the rice mills are small-scale village mills

serving farmers for their own rice consumption, so called “Custom Mills”. Some large-scale rice mills are equipped with modern machines from abroad such as Water Mist Rice Polishers and Color Sorters for milled rice. Many medium and large-scale commercial mills in the study area sell milled rice at a wholesale market located in Muradagahamula on a cash basis. Some large-scale commercial rice millers are, however, developing their own outlets in consumption areas, by-passing the wholesale market.

3.5.2 Other Field Crops (OFC), Vegetables and Fruit

(1) Other Field Crops (OFC)

Government promotes crop diversification aiming at shifting from subsistence to commercial farming as well as reducing import of agricultural products. Maize, green gram, chili (dried) and kurakkan (millet) are major agricultural commodities imported to Sri Lanka. In Anuradhapura district, chilli occupies 35% of the total national production but the amount has trended into decline.

OFC production in the Study area is small at present, but production of maize, soybean and groundnuts is on the increase in the Anuradhapura district. This is unlike Mahaweli System H located nearby, where the FO works as a window to companies (collectors) for introducing individual farmers when companies wish to enter into Forward Sales Contracts (FSC) on OFC. In the Study area farmers negotiate such agreements individually because the activity of the FO in the commercial sector is almost zero. As a result, farmers are normally put into a weak bargaining position in the agreement.

In the Study area, no warehouse for OFC or bulking activity of OFC has been observed yet. IPHT has developed several types of processing equipment with appropriate technology including pulse processing machines, chili flouring machines, grading machines for onions and potatoes, etc. However, the adoption of those innovations by farmers groups is insignificant. Promotion efforts for crop diversification by government agencies should include assistance with hardware (construction of collecting & processing centers, storage and maintenance of market roads) and software (promotion of value addition by food processing, quality control, collective marketing activity and market development).

(2) Vegetables and Fruit

The production of vegetables in Anuradhapura district and its contribution to the national production is on the increase. Vegetables that show an increase in production in Anuradhapura are tomatoes, brinjals (eggplant), cucumbers, bitter gourds, snake gourds, beet-root and red-pumpkin.

In Nachchaduwa, young farmers have successfully formed a working group for vegetable cultivation and they sell vegetables to Dambulla wholesale market directly using their own lorry for transportation. Such new activity influences neighboring farmers in Nachchaduwa to imitate it and vegetable farmers in this area are on the rise.

The channels and methods of marketing vegetables and fruit in the Study area are different. The significant points are:

- Farmers in Nachchaduwa and Thuruwila normally deliver and sell vegetables to Dambulla wholesale market by themselves but in Rajangana many farmers sell vegetables at relatively low prices to village collectors who deliver them mainly to Colombo market.
- At Pola, full-time sales persons, who go around from Pola to Pola every day, mainly carry out vegetable sales. They try to purchase as many vegetables as possible in the villages. In case required products are not available in villages they source them from Dambulla. Village farmers who sell their own products at a Pola near their residence are rare.
- There is no pre-cooling facility or cold storage for vegetables and fruit. There is no buffer function in the marketing channel from farm to consumers.
- The products are distributed using polyethylene string bags, and this method causes considerable damage and loss (some source quoted the losses up to 30~40% of the total amount). In the case of tomatoes, packaging in wooden boxes for transport and distribution is common.
- Group marketing of vegetables and fruit is very rare and most farmers control their marketing by their own judgment and risk.
- Farmers are aware of the price fluctuation through radio and by word of mouth.
- Transportation lorry services are available for all farmers in the Study area. A farmer, who wishes to sell his products at Dambulla, can use this lorry service by paying Rs.50 per bag on average.
- Normally middlemen collect fruit at the farm gate or on the farm for delivering to the wholesale market. Farmers explained that they were not familiar with determination of proper harvest timing of fruit for delivery to markets and appropriate handling methods for fruit to minimize losses during transportation to markets. Technical training for farmers in harvesting and marketing of fruit will be required.
- Large numbers of sellers and buyers gather and are actively involved in market transactions in Dambulla wholesale market every day but not so many sellers and buyers are working in Thambuttegama wholesale market. The dealing prices are also low in Thambuttegama. The access fees (parking fee) are fixed at the same rate in both wholesale markets (Rs.50 for trucks larger than 5 ton, Rs.20 for trucks smaller than 4.9 ton and Rs.10 for tricycles and two-wheel tractors). Any incentives, such as reducing the parking fee for users, are not applied in Thambuttegama.

The supermarket chain, Cargill Food City having 76 branch shops in Sri Lanka conducts consignment production with farmers for vegetables and fruit on a verbal agreement basis. In the Study area, they operate at Thambuttegama collection and distribution center. They request farmers to use plastic boxes for the transport of the products to minimize damage and loss. IPHT conducted research for the comparison of the merit of plastic boxes and string bags and concluded that plastic boxes give more profit to farmers in the long run due to less damage and loss caused during the handling and transporting stage. However, it requires a system for plastic box recirculation from farmers to wholesalers then returning them back to farmers. If such a turn-around system is not installed, nobody will be

interested in investing in such expensive boxes since the cost of plastic boxes (Rs.400 per box) compared with string bags (Rs.14-15 per bag) cannot be negligible.

In Japan, disposable cartons are common for vegetables and fruit marketing from the farm to the markets. If reasonably priced cartons are developed and commonly used for this purpose, post harvest losses and damage of vegetables and fruit can be significantly reduced. In fact, there are many cottage type carton manufactures who are working in Thailand and Viet Nam, and such technology should be introduced to Sri Lanka to improve the present situation.

3.5.3 Price Formulations

(1) General

Price formulations for agricultural products at each level have been considered taking into account all the costs added to the product. These include selling price, seller's profit margins, risks of loss, and various processing and transport costs added from farm gate to retailer.

The cost of packing products using gunny bags, polyethylene string bags and wooden boxes are borne by both farmers and consumers. Farmers use polyethylene woven bags for selling paddy and they will take them back after selling to rice millers & traders or they will receive empty bags from them as a rental. In the case of vegetable marketing, the cost of a string bag is around Rs.15 per piece and farmers receive Rs.10 for each bag after selling their products at Dambulla and Tambuttegama markets. Similarly farmers get Rs.40 for a wooden box, which are used for tomatoes though they spend Rs.45-50 for each box.

The loading and unloading costs at the economic centers are borne by farmers or middlemen, who supply products to the market. Farmers or middlemen bear the transport cost to the economic centers and traders or retailers bear the transport cost from the economic centers to retail shops. The transport cost from farm gate to markets or markets to markets vary according to weight, size and type of the package. According to the present rates, a charge of Rs.65 is made for a sack of vegetables if it is heavier than 65 kg and Rs.40 if it is less than 50 kg. However, these rates vary from area to area, condition of roads and the distance. Accordingly it can be estimated on an average at Rs.1.0 per kg of product. This cost goes up to Rs.2.0 per kg in some areas.

(2) Paddy/Rice

The milling cost of each rice mill is different according to its size and equipment. Their selling prices to market also vary widely. According to an interview survey by the Study team, small-scale commercial mills purchase paddy of the Samba variety at Rs.12/kg and they sell milled rice at Rs.28.0/kg, and for Nadu, Rs.10/kg in paddy and Rs.20.0~22.0/kg in rice. Large-scale rice mills reported that the paddy price of Samba is Rs.15.0/kg and the rice price is Rs.35.0/kg.

The price formulation of paddy from farm-gate to retailers' price paid by the consumer

shows that the profit margin accrued to wholesalers is very high. Wholesalers play a very important role in the marketing channel, not only wholesaling function but also the role as a financial provider to small and medium scale commercial rice millers. Normally rice millers in the study area rush to wholesalers in Muradagahamula to sell milled rice for cash after processing. Those rice millers can resume paddy purchase from farmers or middlemen from this fund. So the margin of wholesalers can be considered as a covering fee for their financing cost. However, the price information for buying and selling is not open to the public and the amount the wholesalers take is not clear. Transparency of reasonable price formulation is required.

Some large-scale rice millers have established their own brands, such as Nipuna Rice in Polonaruwa, Ariya Rice in Anuradhapura, Sunrice in Kalawewa and so on. These large-scale rice mills have their own outlets or direct sales routes to retailers bypassing wholesale markets.

The following tables show the price formulations of rice and its comparison with Thailand. The opaque and arcane process in the price formulations of rice in Sri Lanka is distinguished. The same comparison in Tokyo shows that it is 2.18 times that in Japan.

Table 25 Rice Price Comparisons between Sri Lanka and Thailand

	Sri Lanka	Thailand
Paddy price (1)	US$0.11/kg[1]	US$0.17/kg[4]
Wholesale price of milled rice (2)	US$0.32/kg[2]	US$0.28/kg[5]
Consumers price at retail shops (3)	US$0.42/kg[3]	US$0.34/kg[6]
Margin Ratio: Wholesale/Paddy (=2÷1)	2.94	1.68
Margin Ratio: Consumer/Paddy (=3÷1)	**3.82**	**2.03**

Source: Sri Lanka by Weekly Food Commodities Bulletin, week 09, 24 Feb. – 02 Mar. 2005, HKARTI
Thailand by Ministry of Commerce, Average prices for Jan – Feb. 2006.

Note: 1. Farmers' selling price was to Mudarali in Rajangana in March 2006 for Samba.
2. Wholesale price is calculated based on wholesale price of Rs2,100 for 65kg bag.
3. Consumers price is retailers' price in Colombo.
4. Farmers' selling price in Thailand is in Open Paddy Market for 5% paddy.
5. Wholesale price in Thailand is at Bangkok wholesale market.
6. Consumers price is retailers' price in Bangkok.
7. Exchange rate: Rs101.0/US$, B39.0/US$

(3) OFC, Vegetables and Fruit

Fresh vegetables and fruit prices fluctuate widely depending on the situation of supply and demand. Since it is hard for farmers to predict market consumption (demand side) and competition among producers (supply side), systematic record keeping for the past trend of price fluctuation and a dissemination system of such information to farmers should be established. Also as a buffering function against sharp price fluctuation, cold storage for perishable products should be constructed in the marketing channel by some official support in the near future.

The price formulation of OFC, vegetables & fruit from farm-gate to consumers in Colombo shows quite large differences by the commodity, as shown below:

Table 26 Price Formulations of Some OFC/Vegetables/Fruit in Colombo

Marketing channel	Kurakkan (Rs/kg)	Maize (Rs/kg)	Bitter gourd (Rs/kg)	Cucumber (Rs/kg)	Papaw (Rs/kg)	Mango (Rs/nut)
Farmers	30	15	30	5	15	7
Collectors' margin and trans. cost	10	10	10	3	2	5
Collectors' margin rate	**33%**	**67%**	**33%**	**60%**	**13%**	**71%**
Wholesalers buying cost	40	25	40	8	17	12
Wholesalers selling price	45	40	46	9	24	15
Wholesalers margin	5	15	6	1	7	3
Wholesalers' margin rate	**11%**	**38%**	**13%**	**11%**	**29%**	**20%**
Retailers buying price	46	41	47	10	25	25
Retail price Colombo	48	45	60	12	30	30
Price difference between Farmers' and Consumers' in Colombo (times)	**1.60**	**3.0**	**2.0**	**1.84**	**2.0**	**2.86**

Source: Interviews and investigations by the JICA Study team.

From this table, the following particular judgments can be made:

- The collectors' margin is quite high, particularly maize (67%), cucumber (60%) and mango (71%).
- Wholesalers' margin is also more than 10% for each product and for maize, papaw and mango it is more than 20%.
- In the case of perishable vegetables and fruit, the differences between the farm-gate and consumers prices spread more than 2 times, except in the case of cucumber. (Note: maize prices spread more than 3 times but the reasons are not clear).

In addition, it is perceived from this table that the following countermeasures should be taken:

- Farmers can obtain better prices by bypassing the collectors route. Instead of individual marketing by a farmer, bulking, quality control and collective marketing by farmers groups would be the direction. Coordination work on collective marketing with irrigation canal management activities by FOs will have beneficial effects.
- In order to improve farmers' income, this work will bring prompt effects. But the farmers group' capacity to access wholesale markets needs to be developed. If FOs will operate and maintain this kind of warehouse or collection center, along with coordinating irrigation canal management activities it could bring about beneficial effects.
- The margin on perishable products is on the high side in general. Because the losses and damage caused by present handling and transporting methods using string-bags and stacking on the lorry is very high, those margin ratios are reasonable. This rough handling manner should be improved.
- The government should introduce plastic boxes for this handling. However, it is almost impossible to extend to this method unless a circulation system for plastic boxes is established for farmers and collectors. One idea for improvement is to develop cheap carton manufacturing in rural areas utilizing locally available materials. In Japan, use of disposable cartons is a common method for transport of perishable products from farms up to retailers.

- Introduction of cold storage having a buffering function for those perishable products would be an issue, in the near future.

3.5.4 Marketing Infrastructure

(1) Like in many other agricultural settlement schemes, the most basic marketing facilities are available in the Study areas. They include weekly markets (Pola), marketing centers (townships) storage facilities and rice milling and food processing centers.

In Nachchaduwa, 24 commercial rice mills and 2 Pola are available and in Rajangana, only 4 commercial rice mills and 4 Pola are available.

(2) Both government and non-government organizations are involved in marketing activities. Under the liberal economic policy reforms, the government involvement in business and marketing activities are limited to facilitating, counseling and coordinating activities and the private sector is expected to play a main role in marketing of all commodities concerned. Government has started intervention in paddy purchase trying to stabilize a floor price during harvesting seasons since Yala in 2004/05. Due to budget restriction, the intervention remains at around 5% of national paddy production.

(3) Major government offices involved in the marketing sector are DOA, IMD, local governments, dedicated economic centers (Ministry of Rural Industry Development), IPHT and others.

(4) Major road networks in the Study area are paved but in Rajangana, many places have pavement distress resulting higher transport costs. Feeder roads are gravel roads but there are many distress points. In recent years, tractors and threshers have been deployed on a large scale, which has accelerated this deterioration. It was reported that some farmers have to pay Rs.70 per sack of 50kg instead of Rs.50 per sack paid by farmers who live nearer to the road. Lorries, tractors, buses and three wheelers could be regarded as the most common modes of transport in both areas. Local traders mainly use tractors while outside traders use lorries. Small producers use buses and three-wheelers to transport produce.

3.5.5 Problem Analysis

The problem tree summarized through three workshops by all participants is shown in Figure 3.5.1. Basing on the problem tree, the problems and issues categorized for paddy, OFC, vegetables & fruit and other income generation through marketing & processing is listed Table 4.2.3.

3.6 Government Organizations

Services and conditions of government organizations in the Study area were explored based on the result of interviews with government officers and a survey in each sector. Field level offices providing services important for integrated irrigation management are listed as follows: (i) RPM office (IMD), (ii) IE's office (ID), (iii) ASC (DAD), (iv) AI's office at ASC (DOA) and (v) DS office (Anuradhapura district).

General information and items explored through interview survey are tabulated as follows:

Table 27 General Information about Government Organizations in the Study Area

Agency	IMD	ID	DAD	DOA	Anuradhapura District
Local office	RPM office	IE's office	ASC	AI's office at ASC	DS
Role	· Hold PMC meetings · Coordination of line agencies · Training of FOs in O&M and financial aspects	· Design and construction of irrigation facilities · O&M and water management	· Registration of FOs · Supply of input material and machinery · Providing credit	· Agricultural extension such as GAP program · Training of FOs	· Coordinate ministries work at village level · Implementation of Samurdhi program · Land affairs
Technical staff	RPM: 1 IDO: 0-1 DA: 1	IE: 1 EA: 1-3 WS: 0-5	DO: 1 ARPA: 14	AI 4-6	Colonization officer: 1 GN: 17-19
Facilities	Vehicle: 1 Tel & Fax : 1each Computer: 1	Vehicle: 3-4 Telephone : 1 Computer: 1-2	Vehicle: 0 Telephone : 1 Computer: 0	Vehicle: 0 Telephone : 0 Typewriter: 1	Vehicle: 1 Tel & Fax : 1each Computer: 1
Importance of the role to FOs	Very important: 2 Important: 3	Very important: 4	Very important: 3 Important: 2	Very important: 1 Important: 1	Very important: 1 Important: 3
Problems related to FO activities	· Poor participation of FO members · Non cooperative attitude	· Poor response from farmers due to lack of trust · Not stable cooperation · Weak water distribution	· Lack of motivation in officers · FO officer didn't distribute fertilizer to correct person	· Not holding meetings on time · Poor loan recovery	· Inactive FO · Difficulties in solving land boundaries problem
Training needs	· Agriculture & Irrigation · Administration of FO affairs · Computer	· Institutional development · Management · GIS · Computer	· Modern technology of agriculture · Accounting · Agrarian Development Act	· Agriculture · Water management and Irrigation system · Computer	· Land survey · Land Act, Irrigation Ordinance · Agricultural & Agrarian subjects

Source: Questionnaire survey for government officials, JICA Study Team, February 2006

Some issues identified through the survey are summarized as follows:

- Many line agencies support FOs and farmers. However, their coordination is not adequate.
- Some officers pointed out that they are not sufficiently trusted by FOs.
- Compared with other agencies, ID's officers have higher awareness of the importance of supporting FO activities.
- Training needs in institutional aspects were observed in most of the agencies.
- Performance of training they received in the past should be monitored and needs follow-up.

As for the activities related to FOs, poor participation of farmers was identified as a common problem. Most of them attributed it to FO's internal relationships. However, there

were some officers who raised issues of their performance.

With regard to their awareness concerning FO activities, all the ID officers replied that their activity is "very important", while both "very important" and "important" were found in other agencies. Compared with other agencies, the role of ID is strongly related to FO activities and awareness of officers is relatively high.

In terms of training, they expressed their needs in institutional aspects, and this was commonly found in most of the agencies. Some of the officers requested training on legislation, such as the Agrarian Development Act, Irrigation Ordinance, and the Land Act. It can be said that they consider that their contribution in the institutional aspect is required.

Regarding the training they experienced, they requested further programs for the ones they received in the past. It means monitoring and evaluation and follow-up should be carried out properly.

Although, the "Farmer- Officer" relationship seems to be satisfactory, it reflected features of an "administrative relationship" rather than that of a "participatory relationship". Officers provide necessary support to FOs but it often takes the form of issuing orders. In the interview survey some officers expressed the view that farmers have yet to realize their potential and capabilities and continued to be dependant on government officers. This situation has to be changed and farmers should be facilitated to get their work done by themselves.

In order to improve coordination among line agencies, coordination at the site level requires some innovative mechanisms including support from the upper level. The agencies such as GN under the DS office, ARPA under DO (DAD) and the Sumurdhi animator that work closely with farmers at the village level should work as a team to support FOs. Alternatively, such personnel as "village facilitators" need to work with FOs to bridge the gap between support from the different agencies.

3.7 Present Situation with Training

3.7.1 General

The Irrigation Department (ID) is the key institution, which conducts training in the field of irrigation, especially for major and medium irrigation schemes. Mahaweli Authority of Sri Lanka (MASL) also conducts irrigation training for Mahaweli projects whereas the Department of Agrarian Development (DAD) deals with minor irrigation training. In addition to that, some NGOs also conduct irrigation training but they mostly limit it to on-farm water management activities.

After the amendment to the Irrigation Ordinance in 1994 to align itself to the new concept of "Participatory Irrigation Management", ID expanded its training towards the new concept. Irrigation Management Division (IMD) also conducts training related to irrigation management specifically for strengthening of Farmers' Organizations (FOs) in the schemes managed by IMD.

A large number of training programs have been conducted in the field of irrigation management, mainly under foreign funded projects as well as under local funding. The Project for the Institutional Strengthening of the Irrigation Department and Irrigation Management Division supported by ADB/SDC/UNDP was one of the largest training projects implemented in the irrigation management field. It has covered training of staff members of ID, IMD, MASL and farmers in major/medium schemes. During the three years of the project period (1990-1992) twenty-two training courses covering important subjects in the irrigation sector have been designed, validated and implemented.

The National Irrigation Rehabilitation Project (NIRP) also covered 19 staff training courses and 12 farmer training courses. The Farmer Training courses were limited to only those in the schemes selected under the project, whereas staff training had no such limitation. Staff training covered the area of Training Methodology, Project Management, Communication, Quality Control, Water Management and Operation & Maintenance. Under the farmer training, it has covered the area of Institutional Strengthening, Financial Management, Construction and Contract Management, Environmental Protection, Operation & Maintenance and Farm Production & Income. The Irrigation Training Institute (ITI) located at Galgamuwa conducted the training planning, coordination and implementation.

Apart from the training under special projects, ID and IMD conduct training courses under their annual budget with local funds.

3.7.2 Present Situation of Training under ITI Galgamuwa

ID implements training programs mainly through ITI Galgamuwa and I&WM (Irrigation & Water Management) Branch of the head office. ID also conducts training through Irrigation Management Cells (IMACs) at regional level.

Training under ITI Galgamuwa

ITI Galgamuwa has planned 22 training courses for ID staff members for the year 2006 as indicated in the following table. ITI also provide training for other agencies like Mahaweli Authority, Provincial Councils, special projects, etc.

Table 28 Training Courses for ID Staff

Course Title	Duration	Target Group	No. of Trainees
In-service training on accounting, administration and auditing	3 days	RDI, RDI	21
Math CAD application	4	Design Eng.	20
Advanced Math CAD application	4	Design Eng.	20
Rehabilitation Design	4	Design Eng.	25
Design minor tanks and anicuts	4	Junior Eng.	25
Computer application	5	Eng. Asst.	20
Design minor tanks and anicuts	5	Eng. Asst.	25
Quality control in construction	4	Design Eng.	25
Advance GIS	4	Design Eng.	25
Dam Safety	3	IE and EA	30 x 2
Drawing office management	3	Draughtperson	25
Computer application	3	Draughtperson	25

Course Title	Duration	Target Group	No. of Trainees
Computer application	5	Draughtperson	25
Quality control in construction	3	WS	25
Water management	3	WS	26
Induction training	3	Soil testers	30
Stores matters	3	Mgmt. Asst.	25
Office management	5	Mgmt. Asst.	25
Computer application	5	Mgmt. Asst.	25
In-service training	3	Minor staff	30
Maintenance of vehicles/highway regulations	3	Drivers	50
Induction training	5	Dev. Assistant	25

Source: Annual Work Plans ITI, Galgamuwa 2006.

ITI conduct 18-month Diploma Course but none have been planned for the year 2006. The training curriculum for the Diploma Course is available but for other courses only a program schedule is available with training topics and duration. Training materials, such as leaflets and booklets, are available for some training courses. Hardly any Training Manuals or Guidelines are available at the institute presently.

During the period from 1993 to 2000, ITI conducted training courses with 13 permanent resource persons and it was reduced to 11 in 2001. In the year 2003, again it was reduced to 6 resource persons and finally it has come down to 2 (Senior Deputy Director and Deputy Director) in the year 2006. Presently ITI is getting the services of outside resource persons. Attention given to evaluation of training is not sufficient and consequently no evaluation reports are available at the training institute.

Basic training equipment such as Overhead Projectors, Flipchart boards, White boards, Multi-media Projectors, Slide Projectors, Computers, etc. are available. Three training rooms are available providing facilities for 30 trainees in the Room No.01, 50 trainees in the Room No.02 and 30 trainees in the Room No.03. For the residential courses, accommodation can be provided for 76 persons at a time. Charges are made for the utilization of training facilities and accommodation for other agencies except for ID. Recreation facilities, such as play ground, gymnasium, etc. are available in the training center but it has to be improved.

Training programs under IMAC

IMAC in each region prepares an annual work program in a workshop attended by regional level officers and officers from I&WM Branch of ID head office. The IMAC annual work program covers farmer training, demonstrations to enhance water & land productivity, handing over of O&M, water measurement and calibration, conducting Project Management Committee (PMC) meetings, etc. Training programs planned for the year 2006 in the Anuradapura Region are given below.

Table 29 Training Programs under IMAC

Course Title	Duration	Target Group	No. of Trainees
Awareness program	1 day	Farmers	240
Operation & Maintenance	1 day	Farmers	160
Financial Documentation Procedures	1 day	Farmers	80
Demonstration: 32 demonstrations on soil texture improvements have been already established and based on this, field days will be held.			

Source: IMAC Annual Work Plans/ Anuradapura Region.

IMAC uses ID officers as resource persons and depending on the need, services of outside resource persons are also obtained. As in many other places, training curricula are not available and conducting training evaluation has also been ignored.

Training by IMD

IMD conducts training for farmers of IMD schemes covering the area of Financial Management, Legal Authority, Leadership Development, FO Constitution, Water Management and Operation & Maintenance of Irrigation systems. A summary of the training programs prepared for the year 2006 is indicated as follows.

Table 30 Training Programs under IMD

Course Title	Duration	Target Group	No. of Trainees
Financial Management	1 day	Farmers	1,671
Legal Authority	1 day	Farmers	877
Leadership Development	1 day	Farmers	355
Introduce procedures and constitution of FO	1 day	Farmers	42
Social Mobilization	1 day	Farmers	75
Awareness for field officers	0.5 day	Field officers	30
Farmer exchange program	2 days	Farmers	380
Awareness for FO representatives	1 day	Farmer Reps.	250
Awareness for water masters	1 day	Water Masters	220
Awareness for school children	2 hrs	Children	300
Water Management	1 day	Farmers	565
Operation & Maintenance	1 day	Farmers	355

Source: Annual Training & Annual Plan 2006 IMD

In addition to the above training programs conducted by IMD directly, it coordinates with other agencies and organizes training for farmers. Accordingly, for the year 2006, IMD has planned 27 training courses covering Seed Paddy Production, Poultry Farming, Pest Management, Post Harvest Technology, Use of Agro Wells, Self Employment, Soil Conservation, Forward Sales Agreements, Onion Storage, Homestead Development, Other Field Crop Cultivation and Integrated Farming.

For the training conducted by IMD directly, RPM and Officials from head office mainly provide the services as resource persons and, depending on the necessity, IMD gets the service of outside resource persons too.

The training curriculum is available only for Financial Management Training and for others only program agenda are available. Most of the training programs are conducted at field level and use of training materials are comparatively low. Evaluation of training has not

been considered as an important area and as a result of that proper evaluation reports are not available.

3.7.3 Issues in Current Training Program

Various training programs have been carried out for farmers and officers related with the irrigation sector. However, change has not taken place as expected. Major issues for the training that have been discussed are:

- Training has been carried out based on supply orientation, not demand orientation in the systematic training.
- Lecture-type classroom training, which is not so attractive and productive for community based training programs, is primarily conducted while on-the-job training is rare.
- No follow up training is conducted based on evaluation of past training.
- Training materials are not properly accumulated at the relevant institution for reutilization and updating.
- Support by the senior officers for the implementation of training is insufficient.
- Training is focused on FO leader level. Therefore, the effect does not reach the individual farmer level.

3.8 GIS-based Irrigation Block Mapping

3.8.1 Objective

The objective of the GIS-based irrigation block mapping is to construct an irrigation database to provide basic data for sample blocks so as to: (i) clarify the present condition of the target areas, and (ii) propose an alternative methodology of irrigation development and management. It is expected that the maps will be utilized for various purposes, particularly for irrigation asset management and water management as a first step and accordingly developed for future expansion.

3.8.2 Target Area

Six target areas as tabulated, in Nachchaduwa, Rajangana and Thruwila schemes, each of which is approximately 150 ha on average, have been selected through discussion among ID, IMD and JICA Study Team, taking several qualitative criteria into consideration, such as degree of crop diversification, level of income, O&M and other FO activities.

Table 31 Target Area

No.	Scheme	Area	FOs name
1	Nachchaduwa	HLD-36, 37, 38 & 39	Tissa
		LLD-5, 6 & 6A*	Isuru
2	Rajangana	RB Tract No.4	Saliya Gama
		RB Tract No.8	Mahasen
		LB Tract No.2*	Sri Udara
3	Thruwila	Thruwila whole area*	Mahanama

Remarks:*: the areas for which a detailed survey (facilities & socio-economic survey) has been carried out.

Out of all the blocks mentioned above, three blocks namely Nachchaduwa (Tissa FO) Rajangana (Sri Udara FO) and entire Thruwila (Mahanama FO) were selected as intensive areas for detailed survey (facilities assessment and land and FOs activities surveys), while base maps, including canal alignment, structures location and plot boundary plus F-canal command area, were only plotted for other three areas for future upgrading.

3.8.3 General Work Procedure

The works primarily consist of three steps as follows: Preparation of Base Maps (Step-1), Field Survey for supplemental data to finalize Irrigation Block Maps (Step-2), and Carrying out detailed survey and data input (Step-3).

3.8.4 Data Component

There are six GIS data layers containing canal alignment, facilities condition, socio-economic condition and soil information as shown below**.**

Table 32 Basic GIS Layers

Type of Data	Feature	Definition
1. Polyline	Canal features	Main, D, F and Drainage canal
2. Polyline	Road	
3. Point	Evaluation	Main, D and F-canal
4. Point	8 different categories	Depending on the type of structures
5. Polygon	Land and FO activities assessment	Socio-economic condition (land ownership, land use, FOs activity, etc.)
6. Polygon	Textural classification	Soil classification based on FAO

3.8.5 Findings

Survey items under mapping works included: (i) qualitative assessment of irrigation facilities (canals and structures) and (ii) assessment of land and FOs activities (land ownership, land use, FOs activities consisting of membership, payment of O&M fee and attendance at shramadana). The result of analysis is explained below:

(1) Condition of Irrigation Facilities

Locations of facilities are shown in Figures 3.8.1 to 3.8.3 while those evaluation results are illustrated separately in Figures 3.8.4 to 3.8.6.[1]

(i) Canals

The function and condition of canals have been qualitatively evaluated using the

[1] GIS maps prepared under the Study include: (i) location of facilities, (ii) evaluation of facilities, (iii) type of land ownership, (iv) land use in Maha, (v) land use in Yala, (vi) FO membership, and (vii) textural classification for three intensive survey areas. Map for (i) has been prepared also for other three target areas. In the main report, maps for (i), (ii) and (vii) are introduced as samples. Please refer Appendix E, GIS-based Irrigation Block Mapping for further information.

following check points. Finally, an overall evaluation has been given to each section.

Check point Sediment, vegetation, erosion, leakage, overflow, illegal checking, and condition of canal road
Overall evaluation A: Fully functioning, B: Partly deteriorated, but functioning in a satisfactory range, C: Not functioning well and/or affecting the downstream flow, and D: Completely not functioning

The result clearly shows that the canal condition in Nachchaduwa is far behind Rajangana and Thruwila. Better canal conditions in Thruwila can be easily explained since canals have been being rehabilitated by the NWS&DB since 2004, even though some of the works are being delayed. Although facilities in both Nachchaduwa and Rajangana were rehabilitated under MIRP in 1989, the situation in those areas differs significantly. Actually, after the rehabilitation by MIRP, the target area in Rajangana was utilized for an experiment with tertiary water management. Therefore, maintenance work was intensively carried out by ID, which contributes to keeping the facilities in a better condition.

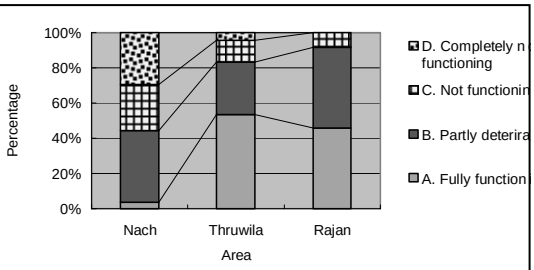


Figure 7 Canal Conditions

As one of the indicators showing the level of tertiary development, F-canal density has been calculated. Tertiary canal density ranges between 62 and 67 meters per hectare, which could be nearly a standard value for improvement of the irrigation canal network.

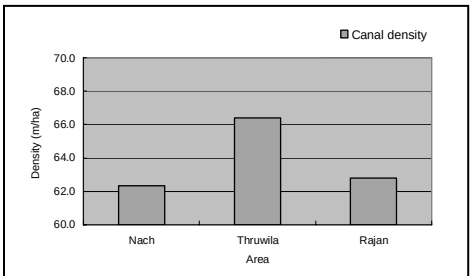


Figure 8 F-canal Density

Illegal tapping is also one of the issues in the scheme. It is difficult to judge whether the tapping is in a legal or illegal manner. However, as a preliminary analysis, the field survey clarified the number and the location of farm turnouts on F-canals, the types of which are categorized into three: concrete structure, PVC and no structures (tapping without any structures). The legal status cannot be retrospectively surveyed. However, the latter two categories would be envisioned as illegal tapping. The survey results above show that more than 30 % of all farm turnouts in Thruwila, the highest ratio among three areas, are categorized as “PVC” and/or “no structure”, which indicates that farm turnout development is necessary to properly manage irrigation water at

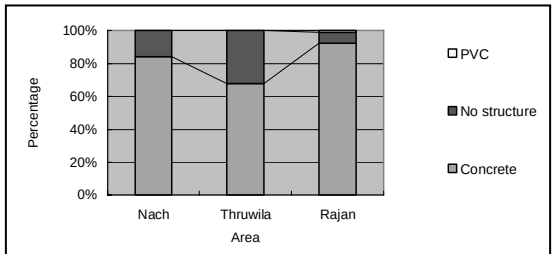


Figure 9 Type of Farm Turnout

F-canal level.

(ii) Structures

In the same way as with canals, the function of the structures has been evaluated in a qualitative manner, check points and overall evaluation of which are described below:

Check point Gate availability, operation, corrosion, cracks, leakage, downstream damage, and measuring device.
Overall evaluation A: Fully functioning, B: Partly deteriorated, but functioning in a satisfactory range, C: Not functioning well and/or affecting the downstream flow, and D: Completely not functioning

In a similar way to the evaluation result of canals, structures in Rajangana and Thruwila are much better than those in Nachchaduwa. This situation would be justified by the same reason as canals. As far as distribution facilities are concerned in Nachchaduwa, for instance, it was clarified during the field survey that most of the turnout gates have leakage problems, or are even missing, which hinders fair water distribution.

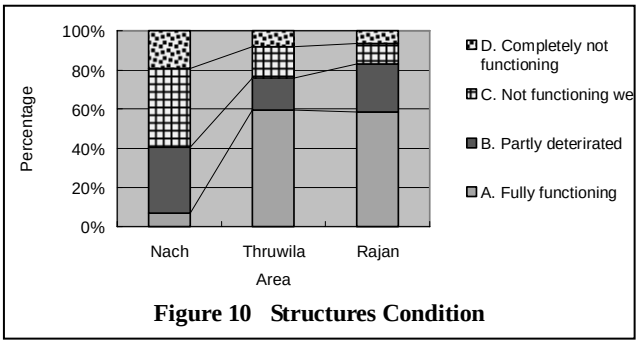


Figure 10 Structures Condition

(2) Land and FOs Activities Assessment

As mentioned above, land and FOs activities assessment includes five items: (i) type of land ownership, (ii) land use, (iii) membership, (iv) O&M fee payment and (v) attendance at shramadana. The results are briefly described as follows.

(i) Type of land ownership

The type of land ownership is categorized into four forms: original, tenant, lease, and Thattumaru.

Owner farmers in Thuruwila and Rajangana are a high percentage. On the other hand, Nachchaudwa shows a lower rate of owner farmers, and tenant and lease farmers are dominant, which shows that, under urbanization, land is currently cultivated by lease and tenant farmers while original farmers seem to be moving away from agriculture.

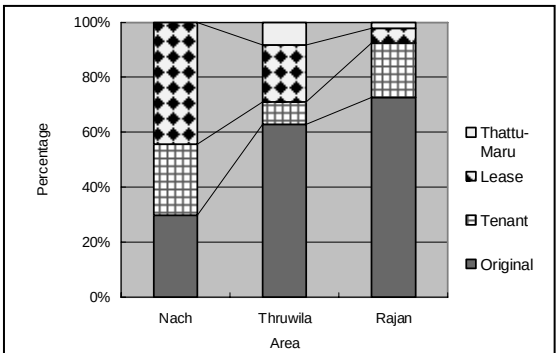


Figure 11 Type of Land Ownership

(ii) Land use

Taking field condition into consideration, land use is categorized into four for this survey, namely: paddy, other field crops (OFC), banana, and others.

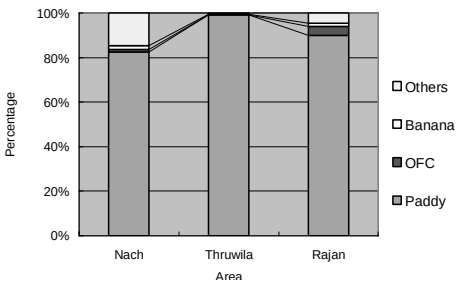


Figure 12 Land Use (Maha)

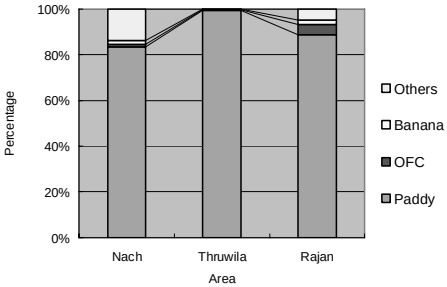


Figure 13 Land Use (Yala)

Significant features seen in the figures are the difference of crop diversification in the area. The ratio of OFC, banana and other crops cultivated in Nachchaduwa is high showing nearly 15 % of the entire area in both Maha and Yala seasons. Diversification in Rajangana is less promoted and nearly 100 % of the area is concentrated on paddy cultivation in the Thruwila medium scheme at present.

(iii) Membership

Thruwila medium scheme has more membership of FOs than in the other two schemes. The highest membership rate shown in the Thruwila scheme is because owner farmers are the main category in this area as explained above. On the other hand, although owner farmers are the main category in the Rajangana scheme, similar to Thruwila, the membership ratio shows the lowest figure. This can be explained by the situation that a significant number of farmers are some distance from the village. Therefore, such groups are not closely involved in FO activities, in accordance with the interview survey in the field.

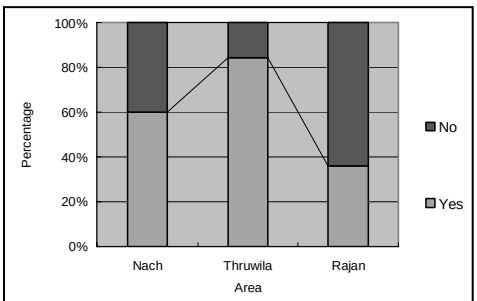


Figure 14 Membership

(iv) O&M fee payment

Almost all FOs in the target areas are not collecting O&M fees from member farmers. Interviews during the field surveys disclosed that FOs collect facility repair costs from member farmers for purchasing materials when facilities need minor rehabilitation by the FOs.

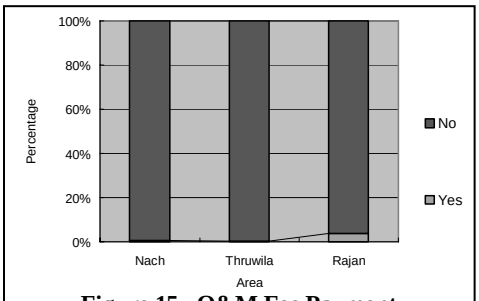


Figure 15 O&M Fee Payment

(v) Attendance at Shramadana

The ratio of present attendance at Shramadana (collaborative work) such as canal desilting and bund forming in Nachchaduwa is high followed by Rajangana and Thruwila schemes. However, this cannot necessarily demonstrate the quality of maintenance work performed by FOs since, as mentioned above, the facilities conditions in Nachchaduwa were judged worst although attendance at shramadana appears high. Poor condition of facilities in Nachchaduwa seems to be caused by poor maintenance. Therefore, an awareness program should be considered in the future plan to improve the quality of Shramadana.

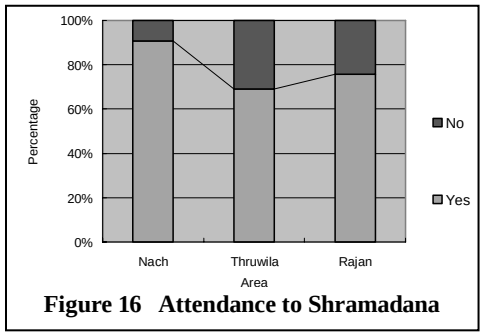


Figure 16 Attendance to Shramadana

(3) Soil Survey

The main purpose of the soil survey was to identify drainage class of the soils in the target areas to provide basic information that helps to promote agricultural extension programs as well as giving technical guidelines for an agricultural development plan in the target areas. The result is attached in Figures 3.8.7 to 3.8.9.

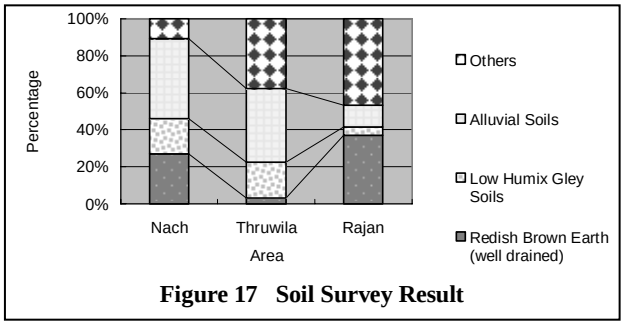


Figure 17 Soil Survey Result

The result shows that well drained Reddish Brown Earths (RBE) occupies 30 to 40% of the entire area in Nachchaduwa and Rajangana major schemes. Therefore, from soil textural view points, those schemes have possibilities for promoting crop diversification in areas with such soil characteristics. On the other hand, Thuruwila medium scheme is mainly dominated by alluvial soils, which are characterized by poor drainage and a high ground water table. As well, perched water table action is evident in the profile according to the survey. The area is, therefore, suitable for paddy cultivation. Such characteristics are incorporated into agriculture development directions.

3.9 Problem Analysis Workshop

The problem analysis workshops were held separately for (i) counterparts and steering committee members from the government staff (January 30 to 31), (ii) government project staff and FO members from Nachchaduwa major scheme and Thwuila medium scheme (February 7-8) and (iii) those from Rajangana major scheme (February 2-3).

The purpose of the workshop was to identify issues recognized by different levels of parties and different areas of location in order to incorporate them into capacity development planning. The Project Cycle Management (PCM) method was primarily applied for conducting the workshops. The outputs obtained from the workshops differed among them since the level of understanding of the methodology and depth of discussion varied. Problem trees and objective trees were prepared to identify issues, means-ends to conceptualize improvement direction and share such information and issues among participants.

Problem Analysis Workshop for counterparts and steering committee members from the government staff (Date: January 30th to 31st)

3.9.1 Participants

Participants for each workshop are summarized as follows:

Table 33 Participants of Problem Analysis Workshop (Counterparts and Steering Committee)
Date: January 30th -31st

Organization	
1. National Counterparts and Steering Committee Members	ID, IMD, DOA Provincial Council (North Central Province), JICA Expert
2. Regional Counterparts and Personnel Concerned	Regional Director of Irrigation (Anuradhapura and Kurunegara), PM/ID, Inter-provincial DOA
3. JICA Study Team	Team leader and members
4. Development Assistant	DA from ID attached to the study team
5. Other Invitee	Asset Management & Water Management, Irrigation Training Institute (ITI)

Table 34 Participants of Problem Analysis Workshop
(Nachchaduwa Major and Thruwila Medium Schemes)
Date: February 7th – 8th

Organization	
1. Isuru Farmers' Organization (FOs)	Secretary, Treasurer, Vice President, Vice Secretary, FO Representative
2. Mahanama Farmers' Organization (FOs)	President, FC Representative, FO member
3. Government Agencies	Engineering Assistant (EA), Institutional Development Officer (IDO), Project Manager, Irrigation Engineer (IE)
4. JICA Study Team	Team leader and members
5. Development Assistant	DA from ID attached to the study team

Table 35 Participants of Problem Analysis Workshop (Rajangana Major Scheme)
Date: February 2nd-3rd

Organization	
1. Sri Udara Farmers' Organization	President, Secretary, FC Representative, FO Representative, A.R.P.A
2. Government Agencies	Engineering Assistant (EA), Project Manager, Irrigation Engineer (IE), DA RPM office (IMD)
3. JICA Study Team	Team leader and members
4. Development Assistant	DA from ID attached to the study team

3.9.2 Workshop Result

Through the series of workshops, problem and objective trees were prepared by each group and the summary is shown in Tables 3.9.1 to 3.9.3.

The team firstly set "low household income" as a core problem and agreed among participants to facilitate discussion in accordance with the study objective. Although slightly different among the workshops, sub-problems obtained from discussion mainly extended to: (i) weak agricultural support system, (ii) shortage of irrigation water, (iii) weak market system, (iv) weak Farmers' Organizations, (v) insufficient function of institution, (vi) policy issues, and (vii) environmental concern. Some outstanding issues identified from the workshops are itemized as follows:

- In the workshop of Counterparts and Steering Committee Members, policy and institutional matters, such as agricultural product price stabilization, trade policy and private sector support, were particularly addressed, which are different from other two workshops.
- The workshop of Nachahaduwa and Thruwila revealed water insufficiency in the system, problems that have resulted from watershed degradation and lack of tank capacity. To consider such broader perspectives among farmers in Nachchaduwa, the awareness of water availability and its importance among Nachchaduwa FOs are higher than those in the Rajangana major scheme.
- Since they are located near city areas, environmental problems would be the concern in Nachchaduwa and Thruwila schemes more than Rajangana.
- Rajangana farmers were more concerned about insufficiency of agricultural extension support, seed paddy and machinery for threshing.
- According to the field survey carried out by the study team, the access road in Rajangana is more deteriorated than Nachchaduwa. However, Nachchaduwa farmers stressed bad road condition as one of the major issues in the workshop, which means that the awareness of the importance of physical market accessibility in Nachchaduwa is confirmed because Nachchaduwa would be more active in marketing activities.
- Rajangana farmers emphasized the need of strengthening the accessible market nearby, Thambuttegama. According to the survey, it has been already clarified that Thambuttegama market is the main market for Rajangana farmers. However, its capacity, activities and product price are not at a satisfactory level for them. Therefore, the concern addressed in the workshop can be understood and considered.

CHAPTER 4 BASIC APPROACH TO IMPROVE THE PRESENT CONDITION

4.1 Basic Approach to Improve the Present Condition of the Study Area

4.1.1 General

The present condition described in chapter 3 is summarized in Table 4.1.1. Nachchaduwa and Rajangana major schemes and Thuruwila medium scheme, which were selected from total 74 major and medium schemes in Anuradhaputa district, show differences in some features. The Nachchaduwa major irrigation scheme is characterized as 1) present farm households decendant from relatively old settlements in the 1930s, 2) located near the large town of Anuradhapura resulting into high off-farm employment opportunity and high market access, 3) fluctuation of irrigation area in the Yala season, 4) more than 50% of farm land cultivated under tenant and lease, and 5) crop diversification in progress for vegetables. The Rajangana major scheme is characterized as 1) a relatively new settlement in the 1960s, 2) located 40 to 50 km distance from Anuradhapura causing low off-farm employment opportunity and market access, 3) relatively stable irrigation area in the Yala season, 4) land fragmentation and small owner operators, 5) crop diversification in a small part, mainly banana and papaya. The Thuruwila medium irrigation scheme is characterized as 1) farm households originated from purana (old traditional) villages, and 2) farmers dependent on paddy cultivation without crop diversification. Some of these features can be seen in other major and medium schemes located in the Anuradhapura district and the Dry Zone. The direction to improve the present irrigated agriculture proposed in this Study can be applied and extended to other schemes based on their features.

4.1.2 Basic Approach to Improve the Present Condition

As presented in Table 4.1.1, the profitability of paddy cultivation estimated on a preliminary basis is quite low. Net income per crop (half year basis) ranges from Rs.12,000 per ha (Nachchaduwa and Rajangana) to Rs.29,000 (Thuruwila), mainly due to low paddy prices compared with those of inputs and labor costs. This low profitability, associated with the small scale of farming, results in low farm income from paddy, i.e., Rs.14,000 per crop in Nachchduwa (average farm size: 1.1 ha), Rs.26,000 per crop in Thruwila (0.9 ha) and Rs.8,000 per crop in Rajangana (0.7 ha). This situation is commonly regarded as one of the main causes of the dependent mentality of farmers and FOs on the government.

In order to improve this situation, farmers in the Dry Zone need to change the present paddy cultivation to more profitable irrigated agriculture, and they are also required to achieve sustainable O&M and efficient water management. In this regard, the farmers and Farmers' Organizations are the main actors for irrigation management, crop production and marketing at the farm level, and the government officials are another main actor to support the farmers. Taking this situation into account, the basic approach in proposing directions for the particular schemes are itemized as follows and illustrated in Figure 4.1.1:

Community participatory rehabilitation as an "entry point" activity

- The community participatory rehabilitation is the "entry point" activity for farmers in the capacity development process in integrated irrigation management. Because it is the process that farmers will obtain the ownership and technical skills to utilize and maintain the irrigation facilities for water management, through taking the proper steps of the community participatory approach in rehabilitation work on irrigation facilities at D & F-canal level.

- In taking the proper processes of this approach, FOs and Field Canal Groups (FCGs) will also be enhanced in their capacity and in various fields, which lead to improving their activities, not only in irrigation management, but also in other activities.

Increase profitability of paddy

- Since paddy cultivation is the main income source of farm households, the first priority is given to increasing the profitability of paddy. Provided that paddy prices will not change drastically under the present conditions, countermeasures for improvement are assumed to be in production and marketing for increase of profitability.

- Particular points in improvement of paddy cultivation are different by scheme. However, improvement should be a package from production to harvest, combining increase of unit yield, reduction of production cost, quality betterment of harvest, and an effort to sell at higher prices.

Expansion of Farm Operation Scale

- Improvement of profitability will be more effective if farm size is expanded. Farmers who have the intention to continue crop cultivation, particularly small scale farmers, should make an effort to expand operational scale through tenant and lease, as such efforts have been observed in the Study Area, particularly in Nachchaduwa. In this case, coordination by the government is required to avoid confusion and friction with tenants and leasing.

More profitable irrigated agriculture

- Such highly profitable crops as vegetables involve high risk of price fluctuation in the market. Farmers would complement these crops with a proper combination of stable income from paddy cultivation, in order to reduce the risk.

- Regarding banana and papaya planting in the Study Area, it is assumed that the planted areas will remain the same level, since these crops are regulateded according to the Agrarian Development Act.

Promotion of group activities for production and marketing

- For individual farmers, it is quite difficult to engage in production and marketing simultaneously. In order to overcome this limitation, farmers should organize themselves into a group for production and marketing. This will increase bargaining power to obtain better marketability and higher prices through bulking and stable supply of products as well as quality improvement.

Facilitation and follow-up by government officers

- The main irrigation facilities are maintained and operated by the field staff of each scheme under the Irrigation Department. At the same time, the field staff support O&M and water management at FO level. In addition to irrigation, the field staff of each government agency will provide farmers and FOs with such support as technical and institutional knowledge, managerial skills, credits and inputs. Farmers and FOs are the recipients of support from the field staff. In providing support from the staff, facilitation and follow-up will be associated in order to enable farmers and FOs to sustain the effect of support.

In addition to the above, the following assumption is considered for formulation of directions and approaches to improve the present condition:

- The present level of budget and number of staff will not increase drastically for implementation of these approaches. Temporary input for some period is assumed to increase the capacity of field staff and FOs.
- The legal framework on irrigation, land, and rural development will not change from the present condition.
- The price level of agricultural products, as well as inputs and work force costs will remain at the same level as the present. The socio-economic condition surrounding the Study Area will also remain the same without a drastic change from the present.

4.2 Sectoral Approach to Improve the Present Condition

In view of the proposed direction in each scheme, approaches to cope with the problems identified through present situation analysis are discussed by each sector as shown below:

4.2.1 Irrigation

As already discussed in section 3.2, issues and problems in the irrigation sector are gathered up into the following four categories: (i) deteriorated function of main facilities, (ii) deteriorated function of D & F-canal level facilities, (iii) inadequate water management at the main level and (iv) inadequate water management at D & F-canal level. These categories have been chosen in consideration of demarcation of responsibility between the government and FOs based on participatory irrigation management and handing-over

policy stipulated in the Irrigation Ordinance (Amendment 1994) and Agrarian Development Act (2000).

Figure 4.2.1 shows the overview of the irrigation sector from problem identification, and approaches to solve the problems. The left side of the Figure describes the causal relationship (problems and those causes) in the irrigation sector. Subsequently, approaches with those target groups, under activities (projects) under approaches, along with the implementers. In this sector, present situation analysis has clarified the primal sixteen problems and those causes of which plural factors are interrelated. Based on such analysis, thirteen approaches are listed as shown in the figure. In order to clearly understand the approaches that correspond to each problem and the causes, approaches are minutely divided. However, it should be noticed that in the implementation stages some different approaches can be combined so as to effectively carry out programs. Therefore, finally, seven activities are proposed under those thirteen approaches are proposed as briefly explained below:

(1) Function of main facilities

Instead of one-shot and repeating facility rehabilitation at the main level, a sustainable facility maintenance cycle, so called irrigation asset management plan, should be established by the government. In order to establish such a system, the proposed approaches under the scope of the study include capacity development through rehabilitation works and financial management improvement. This involves increasing the budget for the irrigation sector and should be attended to by the government.

(2) Function of D and F-canal level facilities

As has been discussed, D and F-canal level facilities are to be managed by FOs under the monitoring and evaluation of the government field staff in accordance with the current participatory irrigation management policy. However, such new vertical linkages have not adequately matured through the handing-over process in Nachchaduwa and Rajangana major irrigation schemes, and this resulted from insufficient training and follow-up support by the government. Under the five problems with causes analyzed based on the study, three approaches have been considered within the scope of the study: rehabilitation of D & F-canal level facilities through community participation, capacity development on its M&E, and farm turnout construction. In a practical manner, however, it would be effective to integrate those approaches into participatory tertiary level facilities rehabilitation with M&E by the government. In this approach, NGOs would be important partners in implementation of the rehabilitation at D & F-canal levels. NGOs, acting rather as catalysts, would have potential to serve as multipliers in facilitating community participatory works.

As discussed in Chapter 3, the government is still providing O&M budget for D & F-canal level facilities even though they have been officially handed over to FOs. Community participatory rehabilitation can contribute to reducing such government support to the D & F-level thereby diverting budget to main facilities' O&M. In order to remove farmers'

dependency syndrome, providing government support to D & F-level facilities should be, as much as possible, eliminated. Government should prepare the budget to support farmers in irrigation management only for some cases beyond the farmers' capacity.

(3) Water management at the main level

Three major problems are raised that hinder adequate water management at the main level. Then, three approaches are proposed: (i) Project Management Committee (PMC) activities improvement in M&E for water management, (ii) measuring device rehabilitation and (iii) capacity development of government field staff in water management of main systems. As discussed in chapter 3, a PMC consists of representatives of the FOs and of the government agencies concerned with irrigated agriculture in order to monitor and evaluate water management. However, in actuality, farmers' participation in PMCs is quite limited according to the survey, which makes PMC's activities almost useless in terms of water management. The survey revealed that the committee is organized, not in an interactive manner between government agencies and FOs, but somewhat "top-down" as a one-way talk-shop. Such relationship should be changed in PMC activities improvement.

(4) Water management at D & F-canal level

There are five main problems with water management at D & F-canal level which are supposed to be conducted by FOs: (i) no measurement of discharge at D & F-canal level, (ii) unsatisfactory handing-over of results, (iii) lack of communication between government field staff and FOs, (iv) the dependency attitude among FOs and (v) no practice of rotational distribution in D-canal command areas. As seen, the first two are categorized as government side issues while the latter two are on the side of FOs. Issue (iii) is ascribable to the relationship of both parties. In this context, three approaches are proposed:

- Capacity development on the facilitation of community participatory water management,
- Development of M&E guidelines to support FOs' water management, and
- Capacity development for community participatory water management.

As discussed above, participation of FO members in PMCs is limited. Such lack of incentive on the part of FOs to attend the committee is caused, not only by organizational characteristics, but also by insufficient participation in water management activities attributed to the lack of water management skills. Therefore, capacity development for community participatory water management would also contribute to facilitate FO participation in PMCs thereby directly improving the function of the PMC.

Sequencing of the above-discussed proposed training courses is also an important issue to be considered. FOs and government staff are empowered through rehabilitation work and subsequently activities can be expanded to improving water use efficiency and other income generating activities. In irrigation, water management is not necessarily related to level of facilities. However, well-rehabilitated facilities will enhance water use efficiency.

In addition, water management can be carried out by FOs with basic skills on irrigation to be obtained through community participatory rehabilitation works. Therefore, improvement of facilities functions at main, D & F-canal levels and this is followed by a water management improvement program. As shown above, this process is not one-way but is interactive and involves gradual scaling-up to increase awareness of FOs and to empower a community participatory management framework. Those approaches are described in Table 4.2.1.

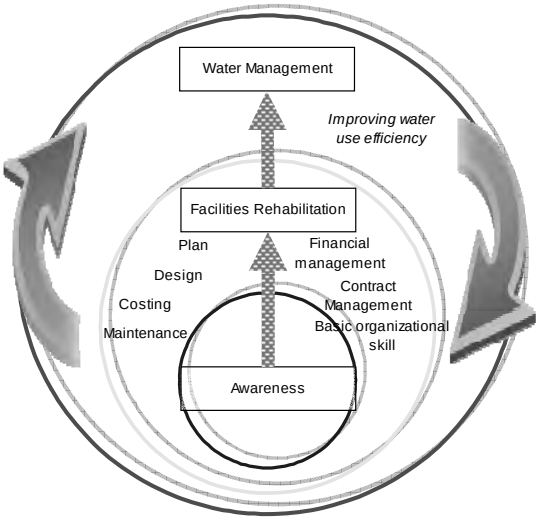


Figure 18 Sequencing of Capacity Development Process in Irrigation Sector

4.2.2 Agriculture

Present day farming has moved beyond its framework of merely providing the necessities of life to the farm family. The increasing family demand for cash has given agricultural production a market orientation thereby introducing a business component to the farming profession. A farmer has set farm resources such as land, labor, working capital, farm equipment, etc., that are not managed well. On the other hand, farmer has a set of goals to achieve, the core need being improvement of farm income. Based on the analysis of the present situation and problems of the farmers presented in Chapter 3, the problem causes and approaches for the agricultural sector were identified and presented in Table 4.2.2 along with an overview of the process shown in Figure 4.2.3.

Based on the research studies and field demonstrations as well as observations of individual farmers' fields conducted under the present agro-ecological conditions in the Study area, the present average unit yield of paddy is expected to increase to 5 – 6 ton/ha is within the reach of the farmers through improvement of the farmers' ability to combine the existing and new technologies with optimal utilization of their resources.

The main improvement approaches identified for capacity development of farmers are through technology transfer by means of tract demonstrations on crop production, seed paddy production and application of post harvest technologies for quality improvement and loss minimization. Further, cost minimization practices such as bulk purchase of inputs, group hiring of machinery and accessing low cost credit and bulk marketing, by strengthening of FOs and small groups, needs to be facilitated through capacity building. However, the profitability from paddy production cannot be expected to increase substantially, even with the anticipated yield increases. The comparison between the crop

budgets under the existing conditions and with proposed improvements, summarized below, shows that the increment in the profitability level is not significant. Further, the average operational holding per household of less than 1 ha makes the income generation from paddy cultivation alone uneconomical.

Table 36 Profitability of Paddy Cultivation

		Nachchaduwa	Thuruwila	Rajangana
Present:	Yield	4.8 ton/ha	5.3 ton/ha	4.2 ton/ha
	Gross Income (at Rs.15/kg)	Rs.72,000	Rs.79,500	Rs.63,000
	Production Cost	Rs.52,000	Rs.41,600	Rs.40,000
	Net Income	Rs.20,000	Rs.37,900	Rs.23,000
Projection:	Yield	5.5 ton/ha	6.0 ton/ha	5.2 ton/ha
	Gross Income (at Rs.15/kg)	Rs.82,500	Rs.90,000	Rs.78,000
	Production Cost	Rs.55,000	Rs.46,900	Rs.44,900
	Net Income	Rs.27,500	Rs.43,100	Rs.33,100
Increment in Net Income		Rs.7,500	Rs.5,200	Rs.10,100

Source: JICA Study Team, details refer to the Sector Report.

Secondly, crop diversification in the irrigated land offers a means for improvement of the income level of the households. Vegetables and fruit crops such as banana and papaya are grown successfully in the areas under irrigation. Though labour and capital intensive and unstable market conditions, these crops have a potential to increase income in combination with paddy cultivation. Crop profitability for some selected vegetables and bananas are shown as follows.

Table 37 Profitability of Other Crops

	Bitter Gourd	Egg Plant	Sweet Pumpkin	Maize	Cabbage	Banana
Yield	20 ton/ha	17 ton/ha	20 ton/ha	5 ton/ha	40 ton/ha	15 ton/ha
Price	Rs.20/kg	Rs.20/kg	Rs.14/kg	Rs.18/kg	Rs.10/kg	Rs.25/kg
Gross Income	Rs.400,000	Rs.340,000	Rs.280,000	Rs.90,000	Rs.400,000	Rs.375,000
Production Cost	Rs.222,000	Rs.156,000	Rs.92,000	Rs.47,000	Rs.203,000	Rs.243,000
Net Income	Rs.178,000	Rs.184,000	Rs.188,000	Rs.43,000	Rs.197,000	Rs.132,000

Source: JICA Study Team, details refer to the Sector Report.

The soil surveys conducted in the pilot area show that substantial land areas in Rajangana (37%) and Nachchaduwa (27%) are occupied by RBEs that are better suited for crops other than paddy, if the drainage conditions are improved. However, diversification requires relaxation of the regulations laid down under the Agrarian Development Act of 2000 to enable farmers to switch over from one crop to another quickly. An important aspect in crop diversification is to establish market information systems to make the farmers conscious of the market requirements (demand-supply situation) and market opportunity to minimize the risks and maximize profits.

Thirdly, the household income levels can be improved through activation of other income generating activities with active involvement of farm women and youth. These include basic agricultural products as well as value added products. Though the land area available within the Study area is a limiting factor, livestock and livestock based products assume particular importance. Programs have been implemented by the PDAP&D to promote

home-garden based dairy, poultry and goat development to supplement the household income by sale of milk, eggs and meat and to improve the family nutritional status. An added benefit from livestock rearing is the production of manure with mixing the farm products residues and sub-products like paddy straws, husks and rice bran,. Manure can be applied to the field to improve the soil's organic condition.

Other cottage level activities include production of mushrooms and fresh flowers, sweet meets, food preservation, milk products (yoghurt and curd), etc.

Facilitation of farmers to introduce desirable changes, ensuring increase of returns to fixed farm capital, requires institutional support from various quarters. In this regard, the improvement approach would target the field extension staff, comprising principally AIs, SMOs and Segment AO of the DOA and ARPAs of DAD, for improvement of their performance through improvement of technical knowledge, extension communication, monitoring of field programs and farm management approach as well as their role as facilitators of farmers in small groups. Further, the extension field staff needs to be supported by providing them with suitable transport facilities, teaching aids, etc., to ensure effective delivery of their services.

4.2.3 Marketing & Processing

(1) General

The marketing structures in the Study areas are dominated by the private sector. The role of the government sector is limited to providing the necessary advice and facilitation of marketing channels, except for the intervention in the national paddy-purchasing program. However, there are a lot of activities and support required from the government sector in the fields of:

- Capacity development of farmers and farmers' groups,
- Provision (subsidies) of structures such as storage facilities and consolidation stations,
- Improvement of financial conditions for farmers,
- Introduction of beneficial market information systems for producers,
- Development of appropriate technologies and their dissemination through various training programs.

In the Study area, paddy and vegetables & fruit are the main crops contributing to farmers' cash income. Most farmers are not satisfied with the current situation saying "Low Prices & Less Profits". The basic approach for improvement is summarized in Table 4.2.3. An overview of those processes, including some ideas for the training program are shown in Figure 4.2.3.

(2) Paddy

The self-sufficiency target of rice supply was substantially achieved but a sudden increase of rice imports has been observed, such as in 1996, 1997, 1999 and 2004, which was mainly

caused by abnormal weather conditions. Government intervenes in paddy purchase aiming at lifting the floor price at the farm gate through its national paddy purchasing program. Government should create a stockpile system against emergencies in conjunction with the paddy purchase program.

In this connection, technical assistance from donor agencies would be a help to establish an effective and efficient management system of a national stockpile and paddy purchase program.

Farmers are not satisfied with current market prices of paddy, but the total demand for rice in Sri Lanka is saturated so the real rice price will not be increased, though the apparent rice price may go up according to inflation and foreign exchange rates. Further, rice is regarded as an "inferior product". By improving the living standard of people, the consumption rate per capita is expected to decrease.

Under these circumstances, what can paddy farmers do by way of counter measures to increase their income? Some farmers have joined a different payment system involving rice millers and collectors as seen in Nachchaduwa, aiming at earning better sales prices, but this system is totally individual and risky. The Institute of Post-Harvest Technology (IPHT) promotes the Rice Processing Village concept aiming at value addition by selling milled rice at higher prices instead of selling paddy. Further efforts for the extension of this scheme are required by the Government agencies, not only by IPHT alone. A farmer who didn't join this scheme reported that there is no rice market available after milling.

Farmers who do not have much surplus of paddy should work together for bulking and quality control to strengthen their bargaining power. Multi-purpose storage facilities for bulking and quality control of paddy and other products will facilitate these activities through proper support and training from the officials. Some FOs in Mahaweli system C practice this activity.

When farmers sell their surplus of paddy, the market channel is very limited either to local commercial rice mills or collectors/middlemen by direct negotiation only. With such limited sales routes available, farmers have a sense of stagnation resulting in their inactivity in marketing efforts for their products. This situation was common in Thailand until Open Paddy Markets were introduced for the benefit of farmers, middlemen and rice millers. Study of the Open Paddy Markets in Thailand in order to establish similar ones in Sri Lanka will be informative and helpful. These markets can include the function of an Open Rice Market to anybody: farmers, small village rice millers, rice wholesalers and retailers. Through marketing of paddy/rice in this type of market, farmers will eventually improve their post-harvest practices and quality control for their own benefit. Study of price formulation with rice shows a high margin with wholesalers. Through the operation of Open Paddy/Rice Markets, efficiency and transparency for fair trade of paddy/rice will be achieved.

Approaches to improve the financial conditions for farmers who have fallen into a debt cycle is also important.

(3) OFC, Vegetables and Fruit

The self-sufficiency target of rice production was achieved resulting in a call for the diversification of agricultural products instead of heavy concentration on rice farming. However, the diversification of agricultural products cannot be progressive unless producers have access to markets with reasonable earnings.

In the Study area, OFC production is not active, unlike the neighboring Mahaweli system H where many farmers enter into forward sales contracts with feed companies/collectors through FOs as their window for introduction. In the Rajangana and Thuruwila schemes, farmers produce maize responding to verbal requests by collectors. No effort to increase their bargaining power for prices by negotiation through group activity has been observed. Bulking works by farmers using multi-purpose storage will improve the situation. A participatory construction approach to such storage facilities by farmers will strengthen their ownership, operation and maintenance.

In the case of vegetables and fruit, the biggest issues to overcome to enhance farmers' benefits are price fluctuation and high margin to wholesalers/retailers. Price fluctuation is caused by the current supply-demand relationship. Free competition among producers and suppliers of vegetables and fruit generates such an imbalance. Improvement of the market information system should be studied and established so as to enable farmers to predict future demand and supply more accurately. A zoning policy for proper production areas for specific vegetables/fruit may create better production conditions for farmers. In this connection, technical assistance from donor agencies would be able to contribute to it.

Another issue in perishable products is the high margin to wholesalers and retailers as compared with producers' farm gate prices. It is reasonable because under present handling practices of such products, damage and losses are quite high. Sellers need a certain margin to cover such marketing losses. Measures for minimization of damage and losses during handling and marketing should be introduced, such as systematic usage of plastic boxes or cartons instead of the current string-bags that are being used. A buffer function and cold storage facilities will be challenging these matters in the near future.

The Thambuttegama Economic Center should be more active for the benefits of farmers and collectors.

(4) Other income generation

IPHT has developed various types of equipment for value addition through simple processing of products. Comprehensive mobilization and facilitation is required. Bulking and quality control activity for utilization of locally available resources should be activated for the benefits of farmers.

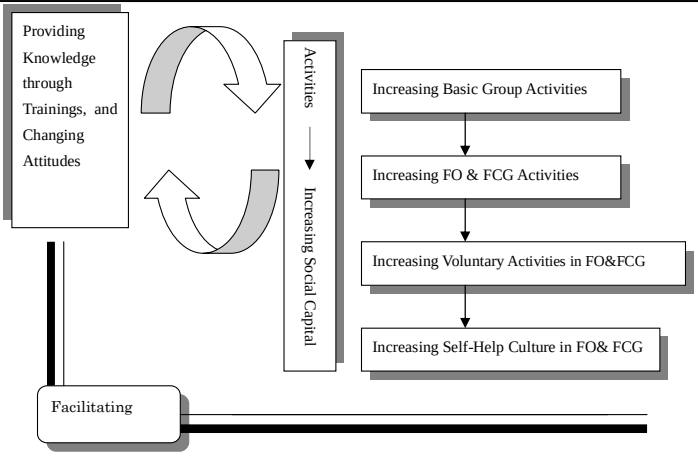
4.2.4 Farmers' Organizations

As earlier mentioned in Section 3.4, the problems were identified from the present situation and problem trees formulated at the problem analysis workshops. The problems can be categorized by three major problems (issues) caused by lack of unity, poor support from the government agencies, and limited activities/less tangible benefit to FO members as shown in Table 4.2.4 and Figure 4.2.4. Three major problems (issues) are as follows:

- Poor participation
- Poor management
- Policy and political interference as an external condition.

In other words, poor participation and poor management are substantially caused by the above causes (issues) within the external conditions. The key factors of organizational management are organizational unity, based on social capital (norm, trust, and custom built by organizational members or community members), and activities as an opportunity to change and improve consciousness and attitudes to the members' tangible benefit provided by activities to the members can be used as incentives as shown below.

The Figure shows the process of interaction between training and activities for increasing social capital. The members can learn knowledge, awareness, and skill through training. The knowledge, awareness, and skill can take root through actual activities in practice. As a result, the more social capital in a target group or community that can be built, the more complex activities with more members involved can be carried out. The type of activity in a group or a community generally can be changed and improved from basic group activities, such as social activity, to a large organization with emphasis on economic oriented activity. The whole process has to be basically implemented by facilitation in building eventually self-help culture in organizations like FOs or FCGs.



Source: the JICA Study Team

Figure 19 The Interactive Process of Training and Activities for Increasing Social Capital

According to the field survey, social capital, particularly social cohesion, is weaker in the Nachchaduwa scheme than at Rajangana. Although it is difficult to identify indications of social capital, particularly on a

Table 38 Various Agriculture-Related Indices - Comparison of Nachchaduwa and Rajangana Schemes

	Nachchaduwa	Rajangana
1) Employment in Agriculture	37%	55%
2) Tenant & Lease Farmers	70%	25%
3) Average Holding Size	1.1ha	0.7 ha
4) Rate of Other Crops	17%	10%

quantitative scale, the Rajangana scheme might be much better in terms of rate of participation in Shramadana, collection rate of O&M Fees, and appointment rates of water-masters, except in the success rate of holding monthly committee meetings.

Comparison of Nachchaduwa and Rajangana schemes in terms of (i) the rate of employment in agriculture, (ii) the rate of tenant & lease[1]operators who are not generally registered as FO members, (iii) average land holding size, and (iv) the rate of other crops in Maha is shown on the right. It can be said that land is intensively cultivated under tenant & lease farmers, and crop diversification is more popular at Nachchaduwa, although the rate of employment in agriculture is higher at Rajangana. Nachchaduwa has been also influenced by urbanization. Such findings might indicate that building of social capital in FOs is more difficult at Nachchaduwa than at Rajangana.

There are three approaches for strengthening FOs: (i) encourage participation approach, (ii) basic management improvement approach, and (iii) strengthen social capital approach. The government capacity building approach is for government agencies. As mentioned earlier, the income generation approach can be dependent mainly upon proposed activities of the irrigation, agriculture, and marketing income generation approach. Thus, the above-mentioned three approaches are to substantially support the capacity building of FOs and FCGs. The basic management improvement approach can cover the objectives of the "encourage participation" approach, and these approaches can be discussed together as an approach.

4.3 Direction to Improve the Present Conditions in the Study Area

Based on the features of the present conditions in the Study Area presented in Table 4.1.1 and the sectoral approach mentioned above, the direction to improve the present conditions in each scheme is described in this section.

4.3.1 Nachchaduwa Major Irrigation Scheme

Main Features under the Present Conditions

- More than 50% of irrigation facilities at D & F-canal level are not functioning well due to insufficient maintenance, and their rehabilitation is urgently required.
- Maintenance of irrigation facilities by FOs is not adequate and this has resulted in inefficient water management at D & F-canal level.
- The irrigated area in the Maha season has been gradually increasing from 2,600 ha in 1990 to 2,900 ha in 2005. In the Yala season, 55% of the area has been irrigated on average during the same period with a wide fluctuation from 11% to 100% against the maximum irrigated area of 2,905 ha.

[1] The study team was informed that there are many seasonal operators (only one crop) at Nachchaduwa.

- The scheme is located near Anurahdapura town, and the socio-economic features show low engagement in agriculture, 37% of total employment, which is below the district average of 52%. Due to this, the small and marginal farm households are dependent on their off-farm activities. Some landowners are not cultivating and their farm land is tenanted or leased to other farmers.

- 56% of farm land is cultivated under tenant and lease, and the average operation size of farmers is about 1 ha, relatively larger than with the other schemes. This indicates that farmers have made an effort to expand the operation scale through tenant and lease from land-owners who have left cultivation. The population below the poverty line and susceptible to poverty is nearly 35% of the total population.

- Farm income from paddy cultivation is lower than in the Thuruwila area located nearby, due to the lower unit yield, higher production costs, and low quality of products.

- The well-drained Reddish Brown Earth (RBE) extends over the area and enables crop diversification to cultivate other field crops (OFC). Crop diversification is in progress, and the main crops are vegetables and bananas. In part of the area, a group of young farmers is conducting commercial vegetable production (about 22 ha), which cannot be found in the other schemes.

- There are 24 commercial rice mills operating in the area, and in many cases farmers directly sell their paddy to commercial rice mills without selling to middlemen.

- The activity and capacity of FOs and Field Canal Groups (FCGs) are low due to limited participation of members, poor record keeping and financial management. Water-masters are appointed in 7 FOs, out of the total 14 FOs. Tenant and lease operators are not members of the FOs, due to objection from the land-owners.

Direction for Improvement of the Present Conditions

- Recovery of function in irrigation facilities is an urgent need to enable efficient water management, and the participatory rehabilitation approach at the D & F-canal level may increase the capacity of FOs for sustainable O&M and water management.

- The average farm size may expand further by tenant and lease of farm land, but the level of improvement in this situation cannot be estimated due to social complexity. Under this situation, farm income under the improvement approach can be increased by improvement of paddy cultivation. The present unit yield of paddy (4.3 ton/ha) will increase through improvement of such farming practices as use of quality seeds, balanced dosage of fertilizers, proper application of pest control, and utilization of high capacity threshing machines. Improvement of farming practices will minimize the increase of production costs.

- At the same time, crop diversification can be expanded on the well-drained RBE, particularly in the Yala season. Vegetables are assumed to be the main crops in the

diversification since the city markets are located at Anuradhapura and Dumbulla near the scheme. However, there is a restriction on the expansion of banana growing in the paddy fields and the area growing bananas in the future is expected be the same coverage as at present.

- Farm income will be increased and stabilized through such marketing improvement in bargaining power and market opportunity of paddy and vegetables as 1) facilitation of farmers to reduce debt from shops and middlemen, 2) introduction and operation of multi-purpose storage and Open Paddy Markets at FO level, 3) minimization of post-harvest and marketing loss, 4) group activities in bulking and marketing to increase bargaining power, 5) processing, hygiene and quality.

4.3.2 Thuruwila Medium Irrigation Scheme

Main Features under the Present Conditions

- Functions of irrigation facilities at D & F-canal level are relatively good due to recent rehabilitation. Irrigation coverage is 100% in both Maha and Yala seasons. Water is also utilized for domestic water supply to Anuradhapura town, with maximum allocation of 25,000 tons per annum or 0.625% of total water use.

- The socio-economic condition is similar to the Nachchaduwa scheme, showing low engagement in agriculture. 60% of farm land is cultivated by owner operators, and 76% of farmers are small scale, less than 0.8 ha. The population below the poverty line and susceptible to poverty is nearly 45% of the total population.

- The area is specifically oriented to paddy cultivation in both Maha and Yala seasons, and farmers' efforts for better unit yield and lower production costs brings higher profitability of paddy cultivation than the other two schemes. Crop diversification has not progressed, due to the poorly drained soils extending over the entire area.

- Marketing of paddy in the Thuruwila irrigation scheme is in the same situation as Nachchaduwa since the schemes are neighboring each other. Commercial rice mills are operating in the area, and in many case farmers directly sell their paddy to commercial rice mills.

- The scheme is covered by one FO consisting 24 FCGs. However, the activity and capacity of the FO and FCGs are low due to limited participation of members, poor record keeping and financial management. A water-master is appointed.

Direction for Improvement of the Present Conditions

- Irrigation facilities are functioning in a better condition because rehabilitation is in progress. In order to sustain the function and to improve water management at D & F-canal level, it is necessary to increase the capacity of the FO and FCGs.

– Due to the poorly drained soils, the potential for crop diversification is quite limited. By utilizing sufficient irrigation water available in this scheme, farmers will continue paddy cultivation in both Maha and Yala seasons.

– The present unit yield of 5.3 ton/ha in paddy cultivation is expected to increase to 6.0 to 6.5 ton/ha through improvement of farming practices, judging from the results of demonstrations and adaptable research conducted surrounding the area. The increase of unit yield will also be associated with quality improvement of harvest. The same market improvement as in the Nachchaduwa scheme is expected in principle.

4.3.3 Rajangana Major Irrigation Scheme

Main Features under the Present Conditions

– Rehabilitation at D & F-canal level is required to recover the function of irrigation facilities for 17% of canals and 24% of related structures.

– The average irrigated area was 5,660 ha in the Maha season during the period from 1990 to 2003, and the maximum irrigation area of 6,640 ha was recorded in the 1996/97 Mana season. The average irrigated area in the Yala season is 5,510 ha, 97% of the average irrigated area in the Maha season, with slight fluctuation during the same period.

– The socio-economic conditions show higher engagement in agriculture, 55% of total employment, above the district average of 52%. The population below the poverty line and susceptible to poverty is nearly 50% of the total population, and higher poverty incidence is observed in the tail end tracts.

– About 90% of the farm land is cultivated by owner operators, and the farm household size is 0.7 ha on average. The proportion of small farm households less than 0.8 ha (2 ac) is 78%. Therefore, the majority of farmers are owner operators with small land areas.

– Paddy cultivation is the main income source of the farm households. However, income from paddy cultivation is lower than in the Thuruwila scheme, due to lower unit yield and higher production costs.

– Crop diversification is in progress in about 10% of the area, and the main crops are banana and papaya. Unless annual crops are introduced, banana and papaya will not expand since these annual crops are legally regulated.

– There are only two commercial rice mills with limited milling capacity. Due to this, farmers sell their marketable surplus to middlemen, resulting in lower farm gate prices for farmers. There are 133 small-scale custom rice mills for self consumption of farmers, but no commercial activities are carried out in the small rice mills.

– The local wholesale market is located at Tambuttegama, 10 to 15 km from the scheme. However, this market is not active and the prices for agricultural products are low due to limited transactions.

– The scheme is covered by 32 FOs consisting of 513 FCGs, and the activities and capacity of FOs and FCGs are low due to limited participation of members, poor record keeping and financial management. 29 FOs or 91% of the total number of FOs have appointed water-masters.

Direction for Improvement of the Present Conditions

– Rehabilitation at D & F-canal level is required to recover the function of irrigation facilities. In order to avoid further deterioration of facilities, the capacity of FOs is required to be strengthened for maintenance and water management.

– Profitability of paddy cultivation can increase the unit yield from about 4 ton/ha to 5.5 - 6.0 ton/ha by such improvement of farming practices as use of quality paddy seed, balanced dosage of fertilizers, proper application of agrochemicals, and utilization of high capacity threshing machines, associated with minimization of production costs. However, the small operation size is a serous limiting factor for farm incomes.

– In the long-term perspective, vegetable production and other agricultural production is the effective approach, together with activation of Tambuttegama wholesale markets, for increase of farm household income.

– In the short term, improvement in marketing is conceivable by organizing farmers groups in the production and marketing of paddy and other crops, to enhance the bargaining power and for the betterment of market opportunities. Construction and operation of multi-purpose storage at FO level would be an effective measure to increase farm household income.

– The road condition along the main canal is to be repaired for improvement of market access.

CHAPTER 5 PLAN TO INCREASE THE CAPACITY OF INTEGRATED MANAGEMENT

5.1 General

5.1.1 Major Issues for the Actors

In implementing the Improvement Approach described in Chapter 4, the following items are the major issues for formulation of a capacity development plan in the irrigation sector.

For Government Agencies

- Changing government officers' role from "administration" to "facilitation" is essential and top-level administrators and policy makers should encourage it, as it is a key element in participatory development.
- Legal backing that has been already provided for irrigation management in the country is to be known and understood by the officers who are in the field of irrigation management, in addition to their technical knowledge and skill.
- A properly planned, sound, monitoring & evaluation system incorporated with the proposed improvement approach is to be introduced through an integrated training program covering different sectors.

For Farmers and Farmers' Organizations

- The proposed improvement approach is to be implemented through a community participatory approach based on facilitation.
- Increasing social capital is essential in capacity development, and hence it should be given equal priority with other key activities.
- A properly planned awareness campaign will enable the communities to change their mindsets and develop a sense of ownership of their irrigation schemes.
- Activities are to be associated with training for increasing social capital.
- The content and timing of training should be determined based on the need of target Farmers' Organizations within the framework of the proposed Improvement Approach.

One of the key roles in terms of the participatory approach is a change of mindsets of implementers towards "facilitation". Facilitation is the key event in capacity building of Farmers' Organizations as it helps them to realize their latent energy. Increasing Social Capital in Farmers Organizations is another important factor as it works as a core engineer for strengthening the organization. Hence, developing the "facilitation capacity" of officers who associate with Farmers' Organizations is imperative in any kind of capacity building program with farmers.

5.1.2 Training Process and Demand Driven Training

Training is one of the important areas in a capacity building program of people in the field of irrigated agriculture. Training is not a single activity; it is a process that helps people to perform their duties to the set-standard by filling the gap between the existing level of

performance and the expected level of performance. Training is generally defined as a process of changing knowledge, attitude and practice of people, through the process illustrated below.

The training process consists of several steps starting from the situation analysis and the isolation of the real training problem. Conducting Training Needs Assessment (TNA), Setting Training Objectives, Designing Training, Implementation of Training and Monitoring & Evaluation of Training are the other steps in the training process.

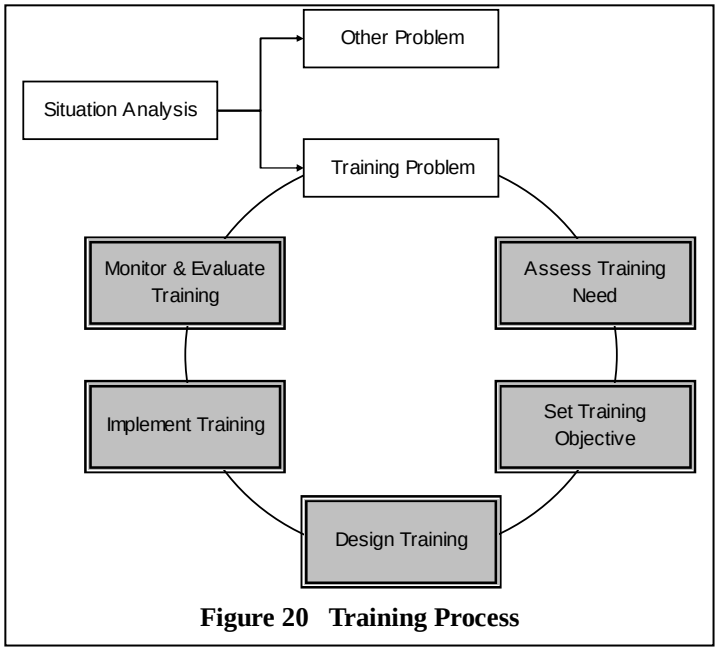


Figure 20 Training Process

Identification of a training problem and training need is imperative for a fruitful training program as it is the basis for demand-driven training. On the other hand, Needs Assessment is not so significant for supply-driven training, which appears to be the approach in some organizations.

Identification of correct trainers who are capable of doing participatory training is another crucial factor in achieving training objectives. However, it is not so easy to get the services of such trainers and hence it is advisable to train a set of officers in the relevant agencies prior to the actual implementation of the Proposed Improvement Approach.

Monitoring & Evaluation of training is an integral part in the training process. Monitoring finds out whether the resources and services are delivered on time and in the correct amount to obtain outputs as specified in the training plan. Evaluation determines effects and impacts of the training conducted. The immediate changes that have taken place as a result of training are measured under “effects” whereas long-term effects of the training are measured under “impact”.

Evaluation is the key component in the training process, as it provides information on achievement of training objectives. Hence, a well-planned Monitoring & Evaluation system must be in place with the implementation of a training plan.

5.2 Training Plan

5.2.1 Training Curriculums, Training Courses and Training Modules

Through the situation analysis in the Study Area as well as the problem analysis conducted in the workshop with the counterparts and stakeholders, the constraints and problems were

identified and categorized by sectors and actors. Then, the Improvement Approaches, consisting of activities and their implementers, were prepared for each category to improve the present constraints and problems. Based on the Improvement Approach, necessary activities and the expected result are assumed by categories and sub-categories. In order to perform activities and obtain the expected result, training items are identified separately for trainees and trainers, as shown in Table 5.2.1.

Training items identified in the above process for execution of Improvement Approach are re-arranged into 1) training curriculums, 2) training courses and 3) training modules, as shown in Table 5.2.2, and summarized below.

Table 39 Training Courses

Training Curriculums	Training Courses	Training Modules
A Awareness of Training, Facilitation and Training Management	1) Awareness of Training, 2) Facilitation Training, 3) Training Management	9 Modules
B Strengthening of FOs	1) Awareness Program for Participatory Community Development Approach, 2) Preparation of Community Action Plan, 3) Institutional Management of FO, FCG & Farmers Group, 4) Financial Management of FO	9 Modules
C Improvement of Maintenance at FO Level (3 Courses, 12 Modules)	1) Assessment of Facilities Function for Rehabilitation, 2) Community Participatory Rehabilitation, 3) Transfer of O&M Responsibility to FO	12 Modules
D Improvement of Water Management at FO Level	1) Proper Water Management at D&F-Canal Level, 2) Formation& Strengthening of Water Management Sub-Committee (WMSC) in FO, 3) Coordination for Water Management at Scheme Level	12 Modules
E Activation of Agricultural Production	1) Procurement of Credit, Inputs, Bulk Purchasing, Machinery, 2) Tract Demonstration of Crop Cultivation, 3) Seed Paddy Production, 4) Post Harvest, 5) Crop Diversification, 6) Other Farm Income Generation, 7) Monitoring & Evaluation in Extension Services	21 Modules
F Activation of Marketing & Processing (8 Courses, 21 Modules)	1) Group Activities for Marketing & Processing, 2) Paddy Marketing & Processing, 3) Open Paddy Market, 4) Market Information & Dissemination, 5) Zoning Policy for Vegetables & Fruits, 6) Minimization of Post-Harvest Loss, 7) Activation of Economic Center, 8) Other Income Generation	21 Modules
6 Curriculums	28 Courses	84 Modules

Source: prepared by the JICA Study Team.

The Training Curriculum is the highest order in training and is composed of the Training Courses. Training courses are divided into Training Modules according to the requirements of the target group or trainees. For training of FO leaders and members, the site officials are assumed to be trainers. In this case, Training of Trainers is conducted for the site officials.

A common difficulty faced by agencies is the shortage of staff and budget, and this limits the activities for support at FO level, and this difficulty is likely to continue. Actually, the RPM office in Rajangana Major Irrigation Scheme has only two staff members and a

limited budget for transportation, and it is physically impossible to cover all the 59 FOs to carry out institutional development within the scheme. One of the solutions is to create the environment to enable self-management of FOs through the participatory approach, and this will create the situation where officers can attend to the important and serious issues.

For the participatory approach, facilitation is the key event in training, and therefore, a facilitation training course is included under the common aspect of training, and training modules are for each level of senior officers, site officers and FO leaders.

5.2.2 Capacity Development Mechanism

In conducting training, there are several points to be focused on coordination among the line agencies at the site to central level, feedback through monitoring & evaluation, training management, etc. These points are discussed in the following manner:

Importance of Coordination among Line Agencies

Farmers are supported by the various government services through their FO. They are IMD for institutional development of the FO, ID for irrigation management, DOA for crop production, DAD for supply of inputs and credit, DS for organizing the Kanna Meeting, and various agencies for marketing and other activities. Unless these areas of support are coordinated, the benefit will not reach the FO and farmer level.

FO staff feel that support by the agencies is not satisfactory, as shown in Table 5.2.3, and this situation appears to be created by weak coordination in line agencies, lack of facilitation to motivate ownership of the FO and insufficient knowledge & skill. Although this is one-way assessment from the FO side, coordination in line agencies is important to implement the training.

Feedback through Monitoring and Evaluation

As mentioned in the Training Process, monitoring & evaluation are the other areas to focus on in order to sustain the effects and impact of training. Based on the monitoring & evaluation, follow-up activities will be conducted. These activities will be conducted in an integrated manner by the relevant officials so that synergy effects can be expected at FO level.

Monitoring data (data collection) are collected by FO level Working Group mentioned in the later part and the Project Management Committee at scheme level, while evaluation (judgment based on the monitoring data) is made by personnel not directly involved in the activities at the site and scheme levels so that he can evaluate the result from the third party's view points.

Setting-up of Coordination Body

For better coordination among the agencies as well as monitoring & evaluation of training, it is proposed to set-up such coordination bodies as: 1) a Training Advisory Committee

(TAC) at the central level, and 2) FO level Working Group at the site level, in addition to the Project Management Committees (PMC) at the major scheme level. The TAC consists of the representatives of the ministry, provincial councils and other relevant agencies, taking the responsibility for overall management of the plan and coordination among the agencies at the central level to support the PMCs and FO level Working Group.

The PMC is the main coordination body at the scheme level supported by the TAC, and it conducts monitoring as well. Under the PMC, the RPM acts as the main coordinator to conduct a series of activities such as situation analysis, identification of problems, formulation of approach to improve the situation, initial Training Need Assessment, and progress monitoring at scheme level.

The FO level Working Group is the coordination body at site level supported by the TAC and the TAC, and its members are the relevant site officials from IMD, ID, DOA, DAD, DS/GN, and representatives from sub-committees of the FO, and chaired by the RPM for major schemes and the PM for medium schemes. The FO level Working Group conducts training on the community action plan for the FO and community level, holds monthly monitoring meetings, and provides the necessary arrangements and advices.

Coordination Role of Galgamuwa ITI and Other Training Institutes

Galgamuwa ITI will prepare, arrange and manage the training, and undertake the necessary coordination with other training institutes, based on the initial Training Need Assessment made by the RPM or PM and the following Training Need Assessment made in monitoring & evaluation. Other training institutes are assumed to be: 1) In-Service Training Institutes MI & Gannoruwa under DOA, 2) Farm Mechanization Training Center, 3) Institute of Post Harvest Technologies, 4) Rice Research & Development Institute, 5) Field Crop Research & Development Institute, 6) Horticulture Research & Development Institute, 7) Agrarian Research & Training Institute, and other institutes, if requirement is identified.

Such information as experiences obtained and lessons learned at the site will be accumulated in Galgamuwa ITI, and will be utilized to revise and improve training records, guidelines, manuals, performance, monitoring & evaluation of training for ongoing improvement.

Entry Point Activities: Community Participatory Rehabilitation

Training should be associated with activities to obtain the expected results. As mentioned in the training process, training is conducted to fill the gap between expected performance and current performance on the particular topic as in the training module, in terms of knowledge, skill and attitude. Some problems are not solved by the training, and the necessary countermeasures are arranged by the FO level Working Group, PMC, Galgamuwa ITI and TAC.

Many activities are assumed in the Improvement Approaches formulated in Chapter 4, however, it is impossible to implement all the activities instantly and simultaneously since

the resources and the times are limited. Participatory irrigation management is currently the main policy in the irrigation sector in order to accelerate handing over O&M and water management at the field level to FO. Community Participatory Rehabilitation associated with facility maintenance and water management at the D & F-canal level is, therefore, selected as the tool for the Entry Point Activities to enhance the capacity of the FO and the site officials. Through the process of Community Participatory Rehabilitation, the following effects are expected in addition to physical improvement of facilities.

Table 40 Expected Result from Community Participatory Rehabilitation

Community, FO, FCG and Farmers	Government Officials
- Creation of ownership, motivation and social cohesion within community, FO, FCG and small groups, - Enhancement of institutional, financial, contract and construction management ability - Strengthening of activities by FCG and small groups - Obtaining knowledge and skills for maintenance of facilities and water management - Establishment of such funds as irrigation O&M funds, revolving funds for various activities - Recovery of function of irrigation facilities *These results will lead to further activities of agriculture and marketing in self-dependent basis.*	- Achievement of practical experience based on awareness of participatory approach - Acquirement of technical knowledge and skills as well as management skills - Creation of proper and reasonable acceptance by FO. FCG and Farmers on their self-dependent basis in providing support and services - Changing their role from "administration" to "facilitation"

Taking the above into consideration, the Capacity Development Mechanism is proposed for implementation of the plan, as illustrated below:

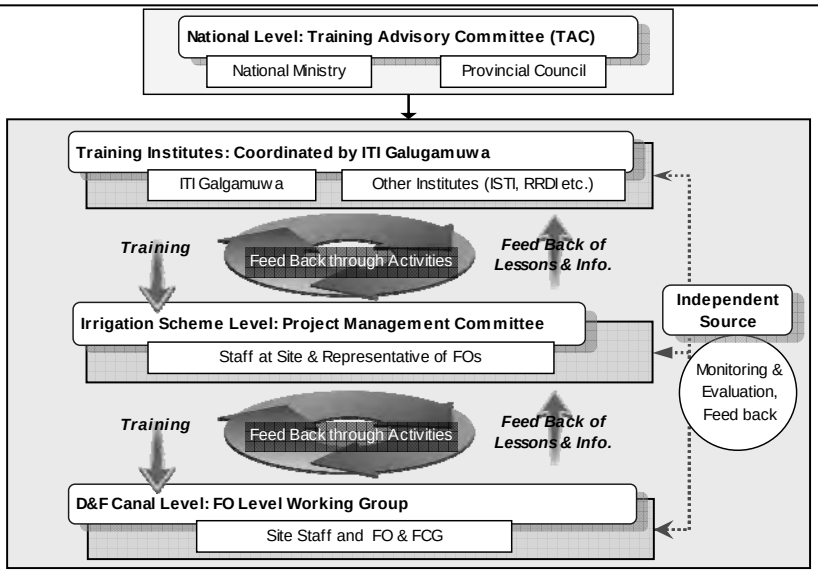


Figure 21 Capacity Development Mechanism

5.2.3 Step-wise Implementation Process from the Pilot Area

The trial and error method is an important practice in implementing the plan, as the

experience gained and lessons learned shall be utilized to accelerate training through the implementation of feed-back in the process. In this regard, the plan will be carried out in the Pilot Areas of the Study Area in advance as a Model Project, to demonstrate the performance of the training as well as to extend the experience to an area outside the pilot area through the Project Implementation Mechanism.

In order to support farmers of the Pilot Area in irrigation, agriculture and marketing, field officers from the relevant government agencies will conduct field practice in collaboration with FOs at each stage of planning, implementation, monitoring & evaluation.

By utilizing results of a series of field work exercises as training resources under the Model Project in the Pilot Area, systematic training on technical knowledge and skills will be coordinated and carried out at ITI Galgamuwa. In this process, the government officials, FO leaders, FCG members and individual farmers will increase their integrated management capacity by acquiring practical knowledge, skills and experience.

Along with the review, modification and updating of analysis of problems & issues, basic approach and training program of the Model Project in the Pilot Area, the government will gradually extend the Project Implementation Mechanism to activities in the Pro-Poor Economic Advancement and Community Empowerment (PEACE) Project to be implemented on a large scale in the surrounding area under the Irrigation Management Division and Irrigation Department in the Dry Zone.

A Plan to Increase the Capacity of Integrated Management in the Irrigation Sector has been prepared for the Pilot Areas, along with a Project Design Matrix and Plan of Operation as shown in Tables 5.2.4 and 5.2.5.

CHAPTER 6 CONCLUSION AND RECOMENDATION

6.1 Conclusion

The dry zone is the granary of the country as it contributes 80% of the national paddy production. The region, however, currently encompasses four main issues: (i) low profitability of paddy cultivation, (ii) ineffective handing-over of irrigation management, (iii) decreasing long-term trend in rainfall, and (iv) high operational complexity of facilities at the field level due to the high density of structures'.

Corresponding to this situation, the Study presented a plan to increase the capacity of integrated management for government officials and farmers on the basis of analysis on sectors related to irrigated agriculture (irrigation, agriculture and marketing) and actors (government officials and farmers) as the core stakeholders to carry out each sectoral activity. The Study identified current problems and constraints in the sector and actors; formulated an improvement approach; prepared a plan to increase the capacity of integrated management; and studied implementation mechanisms.

Basic improvement approach focused on: (i) Community Participatory Rehabilitation as an "Entry Point" activity, (ii) increased profitability of paddy, (iii) introducing more profitable irrigated agriculture, (iv) promotion of group activities for efficient production and marketing, and (v) facilitation and follow-up by government officers for the process.

Particularly, Community Participatory Rehabilitation is the most appropriate as the Entry Point to strengthen the capacity of integrated management of the officials and FO in the Participatory Irrigation Management. It has been proved that the process of Community Participatory Rehabilitation creates a sense of ownership on irrigation system among farmers and enhance their activities on self-dependent basis. Various effort have been made in the past to create understanding and acceptance of Participatory Irrigation Management, and this process has taken long period as it involves changing mindset of stakeholders. The required knowledge, attitude and skill of relevant actors of officials and FO to carry out the process will be enhanced through implementation of the plan taking proper steps.

The main components of the basic approach are: (i) Farmers' Organization strengthening, (ii) recovery of irrigation facilities' function and their sustainable maintenance through community participatory rehabilitation and proper hand-over of maintenance, (iii) irrigation water management improvement, (iv) energizing paddy productivity and crop diversification, and (v) improvement and activation of marketing and processing.

Issues for the officials are: (i) changing their role from "administration" to "facilitation", (ii) the need to become acquainted with legal aspects in addition to technical knowledge, and (iii) need for properly planned M&E. Issues for FOs' capacity development involve: (i) participatory approach based on facilitation, (ii) increased social capital, (iii) necessity for properly planned awareness program, and (iv) preparation of contents based on farmers' needs.

For employing the process of demand oriented training based on the training needs assessment and monitoring and evaluation, the Project Implementation Mechanism is proposed taking the following points into account: (i) overall coordination of line agencies by setting up the Training Advisory Committee at the central and FO level Working Group at the site level in addition to current Project Management Committee at the scheme level, (ii) proper monitoring & evaluation at each step, and feedback from field practice and training through trial and error, (iii) coordination of training by Galgamuwa ITI, (iv) activities-associated training such as participatory community rehabilitation as a tool for institutional development, (v) training to be executed in the field at first, then extend it into other areas, (vi) collaboration among officials in relevant agencies and FOs in the planning, implementation and evaluation phases in order to promote irrigation, agriculture and marketing in the pilot areas, and (vii) lessons to be learned from this process, accumulated in ITI, and used to improve training materials. Systematic training using such practical materials contributes to enhancing the capacity of the Officials and FOs for integrated irrigation management.

The plan will be firstly carried out in the Pilot Areas of the Nachchduwa, Thuruwila and Rajangana schemes to demonstrate the performance of the training as well as to extend the experience to the surrounding areas under the Project Implementation Mechanism, particularly the area in Pro-Poor Economic Advancement and Community Empowerment (PEACE) Project to be implemented under the Irrigation Management Division and Irrigation Department in the Dry Zone.

6.2 Recommendation

Recommendation consists of two categories, one for the follow-up of the Study and the other for successful implementation of the Project as detailed below:

6.2.1 Recommendation for the Follow-Up of the Study

(1) Survey on Farmers' Water Management and Socio-economic Condition

Farmers' water management and socio-economic condition should be continuously surveyed as having done through the preparation of GIS-based irrigation block maps. During the course of the study, GIS application in irrigation management is identified as an effective tool to clarify current condition, future direction analysis and consensus building among stakeholders. Therefore, additional data will be useful to incorporate into current database.

(2) Further Study to formulate Plan for Developing Marketing and Processing Activities

Out of the component identified in the basic approach for marketing and processing, three components are not included in the activities of the Pilot Area. They are i) Open paddy market, ii) Zoning policy for vegetables and fruits, and iii) Activation of economic center at Tambuttegama, since the activities of these components are beyond the Pilot Area. The

effect and benefit from these components are expected to be quite significant for marketing aspects that reach beyond the Pilot and study area. Therefore, it is recommended to conduct further studies for early implementation.

(3) Monitoring of Water Quality

In the water quality analysis component of the Study, some nutrient enrichment was observed through plot-to-plot irrigation and excessive use of fertilizer. The long-term trend in decreasing annual rainfall would also accelerate this situation if farming practices do not improve. Therefore, in parallel with farming improvement, such as application of a proper amount of fertilizer, water quality analysis should be continuously carried out to monitor and maintain water quality in the field.

6.2.2 Recommendation for Successful Implementation of the Project

(1) Introduction of Simple Water Management Devices

Rainfall decrease in dry zone is recently apparent due to the global warming, therefore, effective irrigation water use is really required. To do so, together with efficient water management in the catchment as well as the main systems, FOs' water management at D- and F-canal level should be improved through introducing devices that are simple to operate with low investment and O&M cost.

(2) Elimination of Institutional and Legal Constraints

Institutional and legal constraints are also observed which encumber crop diversification in paddy cultivation dominated area in the dry zone. Such constraints are further analyzed in details to prepare and carry out improvement measures.

(3) Extensive Stakeholders' Participation

Participation by extensive stakeholders is required in order to activate FOs. However, one of the issues for FOs to remain downturn is insufficiency of tenant/lease farmers' participation to FOs' activity due to the objection from land owners. Therefore, supporting mechanisms should be developed to particularly involve tenant/lease farmers, women and youth into FOs' activities or at least in product based sub-committees in FOs.

(4) Importance of Community Participatory Rehabilitation

O&M of D- and F-canal level facilities by FOs themselves requires mechanism of O&M fee collection within FOs through raising their awareness. Community participatory rehabilitation would be effective devices to raise awareness and ownership mind among FOs. Part of income can be saved as O&M fund if community participatory rehabilitation is appropriately facilitated and implemented particularly focusing on maintaining transparent financial management.

(5) Dissemination of Land Suitability Information

Information on land suitability specifically for OFC and vegetable cultivation is not available at the farmers' level, which is one of the reasons why crop diversification is not well promoted. Therefore, in parallel with quality seed provision, farming improvement assistance, O&M fund establishment, marketing improvement and livestock promotion, the government should take initiative in supporting farmers for micro-zoning through using information on land resources as well as its suitability so as to orient current farming based on land suitability.

(6) Development of GIS in Irrigation Management

Dissemination of GIS application in irrigation management is promising since the technology is identified as effective and alternative tools. It can be utilized for O&M of irrigation facilities and promotion of crop diversification. In addition, consensus building for regional agricultural policy, farming schedule etc. among stakeholders are facilitated by the use of this database.

(7) Development of FOs as Multifunctional Organizations

In Sri Lanka, FOs are under development as multifunctional organizations, activities of which include irrigation management, agricultural production and marketing. At present, however, level of empowerment in FOs is still challenging. The government are required to facilitate farmers' participation through maintain this policy direction. In the future, policy and institutional framework should be reformed accordingly based on the progress of FOs' development.

(8) Dissemination of Appropriate and Advanced Technology

Situation surrounding agriculture sector is continually changing so that not only the capacity development of FOs but also that of government officials is essential. In accordance with various experiences in irrigation project in Sri Lanka, the government support to FOs as well as FOs' participation tend to get into inactive after projects are completed. Therefore, with the aim of developing capacity of both FOs and the government officials, appropriate and comparatively advanced technology should be introduced and disseminated based on the coordination among relevant institutes with the hub-function of Galgamwa ITI.

(9) Coordination Among Relevant Agencies

Coordination among relevant agencies is imperative to tackle problems and constraints at the field level. Especially, agencies in charge of irrigation, agricultural extension, institutional development that are closely with FOs at the village level should work as a team to support FOs.

Tables

Table 3.1.1 Result of Socio-economic Survey

Items	Categary	Unit	N'duwa	Th'wila	R'gana	Mean
(1) Household Occupancy & Labor Contribution						
	Nucleus (Avg)	Nos	1.8	1.8	1.9	1.8
	Children	Nos				
	Young	Nos	0.7	0.7	0.9	0.8
	Dep.Adults	Nos	0.9	0.8	0.3	0.7
	Indi.Adults	Nos	1.4	0.8	1.2	1.1
	Total Family	Nos	4.8	4.1	4.3	4.4
	Others	Nos	0.4	0.4	0.4	0.4
	Total Household	Nos	5.2	4.5	4.7	4.8
	Labour Contribution for field work	Nos	1.4	1.9	1.7	1.7
(2) Land Tenure						
	Own (inherit/purch)	%	44	60	89	65
	Leased in	%	24	11	0	12
	Tennent	%	28	21	11	19
	Thattumaru	%	4	8	0	4
(3) Farm Holding						
	Irrigated (sub-total)	ha	1.10	0.91	0.65	0.89
	-Own	ha	0.48	0.62	0.52	0.54
	-Tenant	ha	0.52	0.13	0.10	0.25
	-Leased	ha	0.10	0.16	0.03	0.10
	Homestead	ha	0.41	0.28	0.29	0.33
	Other	ha	0.23	0.34	0.18	0.25
	Total	ha	1.74	1.54	1.12	1.47
(4) (a) House Condition						
	No of Rooms	Nos	2.6	2.8	3.3	2.9
	Toilet	Nos	1.0	1.0	1.0	1.0
	Water Supply %					
	Own Wells	%	88.0	66.7	63.6	72.8
	Common Wells	%	20.0	58.3	39.4	39.2
	Tube Wells	%	12.0	5.7	12.1	9.9
(b) House construction						
	Roof					
	Cadjan	%	16	3	3	7.3
	Asbestos	%	56	58	6	40.0
	Tin Sheets	%	0	3	0	1.0
	Tile	%	28	36	91	51.7
	Walls					
	Mud	%	16	3	3	7.3
	Brick	%	36	36	46	39.3
	Brick + Plastered	%	48	61	51	53.3
	Floor					
	Cement	%	88	86	85	86.3
	Mud	%	12	14	15	13.7
	Electricity	%	84	81	67	77.3
(5)Home Applicants						
	TV	%	81	82	79	80
	Radio	%	77	82	76	78
	Phone	%	42	21	12	25
	Sawing Machine	%	35	39	33	36
	Fan	%	23	39	33	32
	Fridge	%	19	16	3	13
	Kitchen Equipment	%	42	18	18	26
(6)Transport						
	Item	%	N'duwa	Th'wila	R'gana	Mean
	Car/Van	%	0	3	0	1
	Truck	%	0	3	0	1
	Motorbike	%	31	53	36	40
	Pushbike	%	154	118	127	133
	3-Wheeler	%	8	5	0	4
(7) Farm Machinary & Equipment						
	4w Tractor	%	0	11	6	6
	2W Tractor	%	19	29	18	22
	Thresher	%	0	5	0	2
	Sprayer	%	54	61	39	51
	Water Pump	%	12	11	3	8
	Trailer	%	12	11	18	13
	Rotorvator	%	19	26	9	18
	Tyne Tiller	%	0	5	6	4

Source: Socio Economics Survey -the JICA Study Team

Table 3.1.2 Distribution of Irrigated Paddy Land by Size

(Unit:%)

Size of Holding (ha)	Nachchaduwa	Thuruwila	Rajangana	Mean
0.4 or less	36.0	57.9	28.1	42.1
>0.4 - 0.8	20.0	18.4	50.0	29.5
>0.8 - 1.2	36.0	7.9	15.6	17.9
>1.2 - 1.6	4.0	7.9	6.3	6.3
>1.6 - 2.0	0.0	0.0	0.0	0.0
>2.0	4.0	7.9	0.0	4.2

Source: Socio Economic Survey - JICA Study Team - 2005

Table 3.1.3 Household Income

(Unit: Rs)

Item	Nachchaduwa	Thuruwila	Rajangana	Mean
Agriculture	123,331	92,965	73,690	96,662
Livestock	554	1,454	157	722
Labour Wages	11,507	9,289	14,424	11,740
Trading	7,261	2,662	3,451	6,879
Hire of Machinery	2,153	1,325	6,303	3,260
Samurdhi	671	1,871	2,040	1,527
Others	17,790	15,675	10,072	12,092
Total	163,267	125,241	110,137	132,882

Socio Economic Survey - JICA Study Team - 2005

Table 3.1.4 Distribution of Annual Agricultural Income by Households

(Unit:%)

Annual Income (Rs)	Nachchaduwa	Thuruwila	Rajangana	Mean
25,000 and less	15.4	23.5	21.2	20.6
>25,000 - 50,000	23.1	21.1	18.2	20.6
>50,000 - 75,000	19.2	15.8	21.2	18.6
>75,000 - 100,000	23.1	13.2	3.0	12.4
>100,000 - 125,000	3.8	2.6	12.1	6.2
>125,000 - 150,000	3.8	5.3	15.2	8.2
>150,000 - 175,000	0.0	5.3	6.1	4.1
>175,000 - 200,000	0.0	0.0	3.0	1.0
>200,000	11.5	13.2	0.0	8.2

Source: Socio Economic Survey - JICA Study Team - 2005

Table 3.1.5 Distribution of Total Annual Income by Households

(Unit:%)

Annual Income (Rs)	Nachchaduwa	Thuruwila	Rajangana	Mean
25,000 and less	0.0	5.3	12.1	6.2
>25,000 - 50,000	23.1	7.9	15.2	14.4
>50,000 - 75,000	11.5	31.6	21.2	22.7
>75,000 - 100,000	23.1	15.8	3.0	13.4
>100,000 - 125,000	11.5	7.9	12.1	10.3
>125,000 - 150,000	7.7	2.6	15.2	8.2
>150,000 - 175,000	3.8	7.9	9.1	7.2
>175,000 - 200,000	0.0	5.3	3.0	3.1
>200,000	19.2	15.8	9.1	14.1

Source: Socio Economic Survey - JICA Study Team - 2005

Table 3.1.6 Farm Household Economy

Item	Nachchaduwa	Thuruwila	Rajangana	Mean
Average Holding (ha)	1.1	0.9	0.7	0.89
Average yield/ha (kg)	4,800	5,300	4,210	4,770
Average production /farm holding/yr (kg)	10,560	9,646	5,473	8,459
Paddy reserved for consunption (kg)	1,400	1,800	1,180	1,460
Paddy surplus for sale (kg)	9,160	7,846	4,293	6,999
Average farm-gate price of paddy (Rs/kg)	15	15	15	15
Gross income from paddy/household (Rs)	137,400	117,690	64,395	104,982
Cost of production per farm holding (Rs)	114,556	75,570	51,909	80,678
Net income from paddy/household	22,844	42,120	12,486	24,304
Income from non-paddy activities (Rs)	140,423	83,121	97,651	107,065
Total household income (Rs)	163,267	125,241	110,137	131,369
Household expenditure (Rs)	100,886	86,600	90,900	92,795
Net household income (Rs)	62,381	38,641	19,237	38,573

Table 3.9.1 Summary of Problem Analysis Workshop
- Counterparts and Steering Commiittee Members -

Date: January 30th to 31st, 2006
Venue: Galgamuwa Irrigation Training Institute

Overall Goal Increase household income of farmers

Problem	Objective
1. Low income from farming (Agriculture) - Ineffective extension system - High cost of production - Low productivity of paddy - Limited diversification of OFC	**1. Increased income from farming (Agriculture)** - Effective extension system - Low cost of production - High productivity of paddy - Sufficient diversification of OFC
2. Weak FOs (Farmers Organization) - Less social capital (trust, norm etc.) - Poor management of FOs	**2. Active FOs (Farmers Organization)** - Strong social capital (trust, norm etc.) - Appropriate management of FOs
3. Poor management of Irrigation Water (Irrigation & Water Management) - Inadequate policy direction - Insufficient irrigation planning procedure - Unfunctional facilities - Low participation of farmers - Illegal tapping of irrigation water	**3. Appropriate Management of Irrigation Water (Irrigation & Water Management)** - Adequate policy direction - sufficient irrigation planning procedure - Functional facilities - Well participation of farmers - Scheduled distribution of irrigation water
4. Poor market access (Marketing) - Lack of price stabilization system - Small market size - Poor market size - Low farm gate price - Lack of marketing information	**4. Sufficient market access (Marketing)** - Price stabilization system - Enough market size - Marketing infrastructure available - High farm gate price - Marketing information available
5. Insufficient function of Institution (Institution) - Lack of capacities of ID	**5. Sufficient function of institution (Institution)** - Enough capacities in ID
6. Lack of off-farm income (Off-farm income) - Inactive fishing industry - Inactive livestock activity - Poor use of available resources	**6. Sufficient off-farm income (Off-farm income)** - Active fishing industry - Active livestock activity - Effective use of available resources

Table 3.9.2 Summary of Problem Analysis Workshop

- "Isuru" and "Mahanama" Farmers' Organizations, Nachchaduwa and Thuruwila Irrigation Schemes -

Date: February 7th & 8th, 2006
Venue: Irrigation Department Auditorium, Anuradhapura

Overall Goal — High household income

Problem	Objective
1. Insufficient Irrigation Water (Irrigation & Water Management) - Water Blocking Due to Invasive Aquatic Plants - Limited Capacity of Tank - Poor Structure of Desgning - Structure Damages in Irrigation System - Poor Maintenance	**1. Sufficient Water (Irrigation & Water Management)** - Reduce Water Blocking - Increase the Capacity of Tank (Irri.Water) - Proper Structure Designing - Improved structure in Irrigation System - Proper Maintanance
2. Weak FO(Farmmers' Organization) - Disuse of Traditional Systems-"Attam" - No Funds - Difficulties in Implement of Rules & Regulation of FO - Cultivators Changing from Season to Season - Lack of Contribution of Yonger Generation - Poor farmer Participation	**2. Strengthen FO(Farmers' Organization)** - Rebuilt Traditional System-"Attam" - Increase Funds - Minimized Difficulties in Implement of Rules & Regulation of FO - Increasing the Participation of Farmers
3. High Cost of Agriculture Production (Agriculture) - Land Fragmentation - High Cost of Agro Chemicals - High Cost of Agric.equipments - High Labour Cost	**3. Minimized Cost and Maximized Production (Agriculture)** - Increase Amount of Machineries - Usage of Machinary - Decrease Cost of Agric.Chemicals - Decrease Cost of Agric.equipments - Decrease Labour Cost
4. Weak Extension Service (Agriculture) - Lack of Knowledge in New Technology - Insufficient Advice and Support from Govt.Officers - No Awareness Progm. on Improved Varities - Agric. Demonstration for Favoured Group	**4. Strenghen Extension Service (Agriculture)** - Providing knowledge in New Technology - Getting Sufficient Advice & Support from Govt.Officers - Awareness Progm. on Newly Improved Varities - Maximizing Agri. Demostration for Every farmers
5. Weak Market(Marketing) - Lack of Storage Facilities - Poor Road Condition - Restriction on Paddy Selling	**5. Strenghthen Market(Marketing)** - Increase Storage Facilities - Proper Road Condition - Minimize the Restriction on Paddy Selling
6. Environment Problem(Environment) - Problem with Wild Animals - Infertility of Soil - Water Pollution arround Nachchaduwa City	**6. Creating Friendly Environment (Environment)** - Decreasing Problems with Wild Animals - Increase Soil fertility - Decreasing Water Pollution arround Nachchaduwa City

Table 3.9.3 Summary of Problem Analysis Workshop

- "Sri Udara" Farmers Organization (Group 2), Rajangana Irrigation Scheme -

Date: February 2nd & 3rd, 2006
Venue: Galgamuwa Irrigation Training Institute

Overall Goal | Increase household income of farmers

Problem	Objective
1. Weak Agicultural System(Agriculture) - Non Use of Applicable Traditional Methods for Pest Control - Weak Supply of Agri Input - Weak Agricultural Extension Services	**1. Improved Agricultural System** - Apply Traditional Methods (Good Traditional Practices) - Inputs Available - Strong Agricultural Extension Services
2. Shortage of Irrigation Water (Irrigation & Water Management) - Non-Maintenance of Drainage Canals - Non-Maintenance of Canal Bund Roads - Poor Canal Maintenance - Non-Availability of Locks to Turnouts - Water Use without Proper Management - Cultivation of reservation	**2. Sufficient Irrigation Water (Irrigation Water Management)** - Proper Maintenance Canal & Band Road - Improved Canal Maintenance - Functional Irrigation System - Systematic Water Management - Cultivation of Resevation Stopped
3. Weak FO(Farmers' Organization) - Low Cordination Between Government Officers & Farmers - Low Unity among Farmers - Poor Government Support to FOs - Non-Implementation of Kanna Meeting Decisions	**3. Strengthened FO(Farmers' Organization)** - Improved Cordination Between Government Officers & Farmers - Improved Farmers' Unity - Government Support for Fos - Implementation of Kanna Meeting Decisions
4. Weak Market(Marketing) - Inadequate Storage Facilities - Poor Knowdege on Post Harvest methods - Low Paddy Price at Harvest Time	**Improved Marketing(Marketing)** - Adequate Storage Capacity - Improved Knowledge in Post Harvesting
5. Environmental Problem (Health & Environment) - Health Hazards from Agro Chemical Use - Water Pollution due to Agro Chemicals - Indiscriminate Cutting Trees	**5. Environmental Problem Minimized (Health & Environment)** - Minimize Human Harzards by Systematic and Safe Use of Chemicals - Pollution Minimized by Using Approved Chemicals - Minimizing Cutting Down of Trees
6. Lack of Off-Farm Income (Employment Opportunities) - Lack of Suitable Industrial Sites - Lack of Job Opportunities - Lack of Investment - No Training	**6. Additional Household Income (Employment Opportunities)** - Available Industrial Sites - More Job Opportunities - Available Funds for Invesment - Training Available

Table 4.1.1 Summary of Present Condition of the Study Area (1/6)

Item	Nachchaduwa Major Scheme	Thuruwila Medium Scheme	Rajangana Major Scheme
Location	Located besides Anuradhapura Town	Located besides Anuradhapura Town and Nachchaduwa scheme	Located at 40 to 50 km from Anuradhapura Town Tanbuttegama & Mahaweli System H are located near by.
Background of Scheme	Restoration: 1926 Settlement: 1930s Rehabilitation: 1989	Restration: before 1900 Purana (old) village Rehabilitation: 2005/onward	Restoration: 1957 – 72 Settlement: 1960s Rehabilitation: 1989
Local Administration (Divisional Secretary's Division: DS Div., Grama Niladahari Div.)	Part of Nachchaduwa (15 GN Div., 39 villages)	Part of Nachchaduwa (1 GN Div., 3 villages)	Right Bank: Rajangana (21 GN Div., 44 villages) Left Bank: Tract 1 – 4: part of Giribawa (21 GN Div., 35 villages) Tract 5 – 7: part of Karuwalagaswewa
Population according to the RPM & ASC (2005)	17,100	1,200 in 2001 (estimated based on *1)	37,300
No. of Families and Average Family Size *2	4,500 families 3.8 persons per family	400 families 2.9 persons per family	9,300 families 4.0 persons per family
Unemployment rate *1 (District average: 5.5%)	7.1% (Nachchaduwa DS Division)	No separate data from Nachchduwa DS Division	8.0% (Rajangana DS Division)
Employment in agricultural sector *1 (district average: 52%)	37% of employment (Nachchaduwa DS Division), below District average, decrease of younger generation	37% of employment (No separate data from Nachchduwa DS Division)	55% of employment (Rajangana DS Division), above District average, decrease of younger generation
Age Structure of Employment in agriculture (at district level) *1	46% of employment in age group of 10 to 39 years old, and more than 60% of age group	- do - (no separate data)	- do - (no separate data)
Poverty (headcount index of below poverty household population, district average: 23%) *3	Headcount Index: 19.0% (Nachchaduwa DS Division),	Headcount Index: 19% (No separate data from Nachchduwa DS Division)	Headcount Index: 18.8% (Rajangana DS Division). Higher poverty incidence at the tail tracts in the schemes.
Irrigated Land *4 - Original Plan - Maximum Extent Average in 13-15 years - Maha - Yala - Yala (min. – max.)	 2,384 ha 2,905 ha (122%) 2,635 ha 1,622 ha 332 ha to 2,905 ha	 173 ha 193 ha (112%) 193 ha 193 ha 193 ha	 5,371 ha 6,639 ha (123%) 5,658 ha 5,508 ha 3,397 ha to 6,515 ha

Table 4.1.1 Summary of Present Condition of the Study Area (2/6)

Item	Nachchaduwa Major Scheme	Thuruwila Medium Scheme	Rajangana Major Scheme
Irrigated area *4	Maha season: increased steadily and almost 100% of the maximum area (2,905 ha) in 2003/04 and 2004/05. Yala season: 44% (1,411 ha) of maximum area, and fluctuation of irrigated area (330 – 2,905 ha). Irrigated area in Yala season can be increased and stabilized by effective water use and crop diversification.	Maha season: averagely 100% of the maximum area (193 ha). Yala season: 100% of maximum area. Domestic water supply in near future. Excessive discharge is observed, therefore, fertilizer and chemicals are wasted and facilities are damaged.	Maha season: averagely 85% (5,660 ha) of the maximum area (6,640 ha). Yala season: 83% (5,510 ha) of maximum area. Irrigated area in Yala season can be increased and stabilized by effective water use and crop diversification.
Water Productivity *4.1 (kg of paddy/m^3 of water)	Maha: 0.630 kg/m^3 Yala: 0.322 kg/m^3	Maha: 0.242 kg/m^3 Yala: 0.216 kg/m^3	Maha: 0.242 kg/m^3 Yala: 0.201 kg/m^3
Main & Branch Canal *4	40 km	2 km	59 km
D & F Canal *4	107 km	11 km	389 km
Canal Density of D&F Canal (pilot area) *5	62.3 m/ha	66.4 m/ha	62.8 m/ha
Condition of D&F Canals (pilot area) *5 (Pilot area in Rajangana is well-maintained due to the pilot programme done under MIRP)	Fully functioning 4% Partly functioning 41% Not functioning well 26% Completely not functioning 29% Rehabilitated in 1989, however, 55 % of the canals need to be rehabilitated due to poor maintenance.	Fully functioning 46% Partly functioning 46% Not functioning well 8% Completely not functioning 0% Rehabilitated in 1989 and 2005 (on-going), 8 % of the canals need to be rehabilitated.	Fully functioning 53% Partly functioning 30% Not functioning well 12% Completely not functioning 5% Rehabilitated in 1989, however, 24 % of the canals need to be rehabilitated due to poor maintenance.
Condition of Structures at D&F Canals (pilot area) *5	Fully functioning 7% Partly functioning 34% Not functioning well 40% Completely not functioning 19% Rehabilitated in 1989, however, 59 % of the structures need to be rehabilitated due to poor maintenance.	Fully functioning 58% Partly functioning 25% Not functioning well 10% Completely not functioning 7% Rehabilitated in 1989 and 2005 (on-going), 7 % of the structures need to be rehabilitated.	Fully functioning 60% Partly functioning 16% Not functioning well 16% Completely not functioning 8% Rehabilitated in 1989, however, 24 % of the structures need to be rehabilitated due to poor maintenance.
No. of Farm Turnout (pilot area) *5	Concrete 84% No structure 16% PVC pipe 0% Temporary farm turnout occupies 16 % of all.	Concrete 68% No structure 32% PVC pipe 0% Temporary farm turnout occupies 32 % of all.	Concrete 93% No structure 7% PVC pipe 1% Temporary farm turnout occupies 8 % of all.
Water Management *6	Rotation in 3 to 4 – day interval Excessive discharge is diverted at the upstream, therefore the downstream area face water shortage.	Continuous Excessive discharge is diverted at the upstream, therefore the downstream area face water shortage.	Rotation in 3 to 4 – days interval Excessive discharge is diverted at the upstream, therefore the downstream area face water shortage.
General of FOs	13 FOs out of 14 was established in 1980s. 75 % of	Only 1 FO in the area, 78 % of operators are registered as a	32 FOs, 80 % of all the operators are registered as a

Table 4.1.1 Summary of Present Condition of the Study Area (3/6)

Item	Nachchaduwa Major Scheme	Thuruwila Medium Scheme	Rajangana Major Scheme
	all operators are registered as members. Some FOs do not allow tenant farmer to be a member. Number of members in 4 FOs increase while decrease in 6 FOs due to giving up farming. Only one FO update bye law. Document control is in poor condition, therefore, basic information is not properly managed. 3 FOs prepared irrigation O&M plan. Agriculture plan, water management plan and overall development plan is not prepared. 5 FOs cary out water management O&M of irrigation facilities and input purchasing.	member. Document control is in poor condition, therefore, basic information is not properly managed. Irrigation O&M plan and agriculture plan has been prepared. Water management plan and overall development is not prepared. Main activity of FOs is water management only.	member, 15 % are women. Document control is in poor condition, therefore, basic information is not properly managed. 17 % of FOs prepared irrigation O&M plan, while 50 % prepared agriculture plan and water management plan. Overall development plan has not been prepared. 10 FOs carry out water management, O&M of irrigation facilities, input purchase and group purchasing and selling.
No. of FOs No. of FCG *6	HL D canal area: 1,510 ha, 8 FOs, 83 FCGs, 1,366 members LL D canal area: 910 ha, 6 FOs, 67 FCGs 945 members Total D canal area: 2,420 ha, 14 FOs, 150 FCGs, 2,118 members	Command Area: 188 ha, 1 FO, 24 FCGs, 140 members	Right Bank: 3,321 ha, 18 FOs, 268 FCGs, 3,297 members Left Bank: 2,421 ha, 14 FOs, 245 FCGs, 3,241 members Total of scheme: 5,742 ha, 32 FOs, 513 FCGs, 6,538 members
Participation Rate in Shramadana *5	90%	70%	80%
O&M Fee Collection *6	0%	0%	17 – 25%
Appointment of Water Master (Jalapalka) *6	50% (7 FOs out of 14 FOs)	100%	91% (29 FOs out of 32 FOs)
Area by Operation *6	Owner: 44% Tenant & Lease: 52% Lease-out 4% <u>Cultivated by tenant farmers</u> Effort has been made by tenant and lease farmers to increase farm size. Absentee landlord and operators from the outside of the scheme is observed.	Owner: 60% Tenant and Lease: 40% <u>Cultivated by owner farmers</u> Effort has been made by tenant and lease farmers to increase farm size.	Owner: 89% Tenant & Lease: 11% <u>Cultivated by owner farmers</u> Effort has been made by tenant and lease farmers to increase farm size in some limited areas. Half of the areas are cultivated without registration (descendant without registration).
Land Ownership (LO: Land Ordinance) *5	Title Deed 54% Permission under LO 46%	Title Deed 88% Permission under LO 12%	Title Deed 5% Permission under LO 95%
Land Fragmentation*5	Original & Registered 13% Descendant not Register 17%	Original & Registered 43% Descendant not Register 20%	Original & Registered 24% Descendant not Register 49%

Table 4.1.1 Summary of Present Condition of the Study Area (4/6)

Item	Nachchaduwa Major Scheme	Thuruwila Medium Scheme	Rajangana Major Scheme
	Tenant & Laease 70% Thattumaru 0% Majority: tenant farmer (79%)	Tenant & Laease 29% Thattumaru 8% Majority: owner farmer (63%)	Tenant & Laease 25% Thattumaru 2% Majority owner farmer (73%)
Operation Size *5	0.4 ha & below 36% 0.4 to 0.8 ha 20% 0.8 to 1.2 ha 36% more than 1.2 ha 8%	0.4 ha & below 58% 0.4 to 0.8 ha 18% 1.2 ha & below 8% more than 1.2 ha 16%	0.4 ha & below 28% 0.4 to 0.8 ha 50% 0.8 to 1.2 ha 16% more than 1.2 ha 6%
(Average Operation Size)	1.1 ha	0.8 ha	0.7 ha
Ownership of Equipment			
- 4W Tractor *7	0%	11%	6%
- 2W Tractor *7	19%	29%	18%
- Sprayer *7	54%	61%	39%
- Water pump *7	12%	11%	3%
- Rotarvator *7	19%	26%	9%
Soil Condition (pilot area) *5	Well drained soils: 27% Poor drained soils; 77%	Well drained soils: 5% Poor drained soils; 95%	Well drained soils: 37% Poor drained soils; 63%
Crops in Maha *5	Paddy: 83% Others: 17%	Paddy: 99% Others: 1%	Paddy: 90% Others: 10%
Crops in Yala *5	Paddy: 83% Others: 17%	Paddy: 99% Others: 1%	Paddy: 89% Others: 11%
Main Crops of Others *5	Vegetables & Banana Some young farmers groups are active in high-valued vegetable production. Farm gate price of paddy was low in 2005/6 Maha season, therefore, number of farmers who try to do crop diversification increased.	- Farm gate price of paddy was low in 2005/6 Maha season, therefore, number of farmers who try to do crop diversification increased.	Banana & Papaya Farm gate price of paddy was low in 2005/6 Maha season, therefore, the area of banana is increasing.
Average Yield of Paddy (1 crop) *7	4.5 ton/ha	5.3 ton/ha	4.2 ton/ha
Marketable Surplus at Average Operation Size *7	Production 4,950 kg Seed (7%) 350 kg Family members 4.8 persons Self-consmp. (0.5 year) 360 kg Marketable Surplus 4,240 kg	Production 4,820 kg Seed (7%) 340 kg Family members 4.1 persons Self-consmp. (0.5 year) 310 kg Marketable Surplus 4,170 kg	Production 2,540 kg Seed (5%) 130 kg Family members 4.3 persons Self-consmp. (0.5 year) 320 kg Marketable Surplus 2,090 kg
Paddy Profit per kg (excluding the family labour cost) *7	Profit/kg (Rs./kg) Prod. Cost 10.8 (high input and labor cost) Sales Price 12.0 Profit 1.2	Profit/kg (Rs./kg) Prod. Cost 7.8 (low input) Sales Price 12.0 Profit 4.2	Profit/kg (Rs./kg) Prod. Cost 10.2 (high input and labor cost but low production) Sales Price 12.0

Table 4.1.1 Summary of Present Condition of the Study Area (5/6)

Item	Nachchaduwa Major Scheme	Thuruwila Medium Scheme	Rajangana Major Scheme
			Profit 1.8
Paddy Profit per Farm Household at Average Size.(1 crop)	Profit/household (Rs./hh) Minimum +800 Average +13,600 Maximum +26,300	Profit/household (Rs./hh) Minimum +13,300 Average +25,900 Maximum +38,400	Profit/household (Rs./hh) Minimum +1,700 Average +7,900 Maximum +14,200
Income Source by Operation Size *7	0.4 ha & below farm income Rs.74,600 off-farm income Rs.74,100 total income Rs.149,700 0.4 to 0.8 ha farm income Rs.59,300 off-farm income Rs.5,700 total income Rs.65,000 0.8 to 1.2 ha farm income Rs.98,000 off-farm income Rs.17,200 total income Rs.115,200 more than 1.2 ha farm income Rs.185,000 off-farm income Rs.67,000 total income Rs.252,000	0.4 ha & below farm income Rs.51,5600 off-farm income Rs.27,400 total income Rs.79,000 0.4 to 0.8 ha farm income Rs.96,900 off-farm income Rs.46,000 total income Rs.142,900 0.8 to 1.2 ha farm income Rs.101,900 off-farm income Rs.32,800 total income Rs.133,700 more than 1.2 ha farm income Rs.245,300 off-farm income Rs.24,300 total income Rs.269,600	0.4 ha & below farm income Rs.34,300 off-farm income Rs.17,300 total income Rs.51,600 0.4 to 0.8 ha farm income Rs.73,600 off-farm income Rs.29,500 total income Rs.103,100 0.8 to 1.2 ha farm income Rs.116,400 off-farm income Rs.42,800 total income Rs.159,200 more than 1.2 ha farm income Rs.150,500 off-farm incomeRs.143,500 total income Rs.294,000
Proportion of Farm Income by Operation Size *7	0.4 ha & below above 50% 44% 50% and below 56% 0.4 to 0.8 ha above 50% 100% 50% and below 0% 0.8 to 1.2 ha above 50% 100% 50% and below 0% more than 1.2 ha above 50% 100% 50% and below 0% Total above 50% 73% 50% and below 23%	0.4 ha & below above 50% 55% 50% and below 45% 0.4 to 0.8 ha above 50% 71% 50% and below 29% 0.8 to 1.2 ha above 50% 100% 50% and below 0% more than 1.2 ha above 50% 100% 50% and below 0% Total above 50% 66% 50% and below 34%	0.4 ha & below above 50% 67% 50% and below 33% 0.4 to 0.8 ha above 50% 81% 50% and below 19% 0.8 to 1.2 ha above 50% 80% 50% and below 20% more than 1.2 ha above 50% 50% 50% and below 50% Total above 50% 76% 50% and below 24%
Rice Mills *8	24 commercial rice mills 25 village rice mills for custom milling (home consumption)	included in Nachchaduwa	Only 2 commercial rice mills 133 village rice mills (69 in Right Bank and 64 in Left Bank) for custom milling (home consumption)
Paddy Marketing *8	Farmers sell directly to commercial mills (24 rice mills). Differed payment system in paddy marketing under tight	included in Nachchaduwa	Farmers sell through local middlemen due to limited number of commercial rice mills. Peasants borrow money for

Table 4.1.1 Summary of Present Condition of the Study Area (6/6)

Item	Nachchaduwa Major Scheme	Thuruwila Medium Scheme	Rajangana Major Scheme
	confidence between farmers and mills/middlemen. Some farmer groups made contract to adjust shipping time by making contract with commercial mill so that they earn comparatively high profit. Peasants borrow money for cultivation from middle-men before cultivation, therefore, they can not adjust sales time.		cultivation from middle-men before cultivation, therefore, they can not adjust sales time.
Vegetable and other crops Marketing *8	Wholesale at Dumbulla and Anuradhapura, however, acute competition Young farmer group develop marketing route by themselves.	included in Nachchaduwa	Wholesale at Tambuttegama and Puttalam, however, Tambuttegama is not so active
Market & Storage *8	Pola (weekly market): 2 locations City market: 2 locations (Anuradhapura, Dumbulla) Paddy storage: 2 locations	included in Nachchaduwa	Pola (weekly market): 4 locations City market: 3 locations (Tambuttegama, Dumbulla, Puttalam) Paddy storage: 3 locations

Note *1: Population Census 2001 (at DS Division Level).

*2: Estimated based on the information from the Resource Profiles 2002 of DS Offices.

*3: Department of Census and Statistics.

*4: Nachchaduwa and Rajangana Irrigation Engineer's offices.

*4.1: Water productivity is calculated by the Study Team based on the data of "*4".

*5: GIS mapping data in the pilot area (Rajangana: Left Bank Track 2, Nachchaduwa: irrigation block under Isuru FO, Thuruwila: entire area).

*6: Survey of FO by the JICA Study Team and information from IMD.

*7: Socio-Economic Survey in the pilot area.

*8: Interview by JICA Study Team.

Table 4.2.1 Summary of Present Condition, Problems and Approach for Irrigation Sector (1/3)

Irrigation

Category	Present Situation	Problem Description	Approach	Target Group
1. Function of Main Irrigation Facilities	Common Points			
1.1 Physical condition	• Conveyance efficiency of main canals is low. Downstream block or tract is facing water shortage. • Turnout gates on main canals are highly deteriorated. • Physical rehabilitation and improvement is expected by ID under the PEACE Project.	• Deteriorated main level facilities • Poor Maintenance by the government	• Capacity development of government staff through rehabilitation works • Training program for government staff: quality control for rehabilitation and construction works including earth and concrete works, field inspection, document preparation for construction supervision • Two different levels of program are proposed for ID (more technical side) and IMD (basic techniques plus coordination and facilitation skill).	• ID / IMD
1.2 Government budget for O&M	• Government budget is supposed to be provided for maintenance of main facilities including tanks, main canals and those related facilities. • The budget provided for abovementioned O&M is, however, reported to be only 20 to 30 % of the actual requirement to maintain existing facilities.	• Budget shortage allocated for main system O&M is insufficient resulting untimely maintenance	• Increasing budget for irrigation should be attended by the government. • Supporting to establish transparent financial management procedure would partly improve situation.	• ID / IMD
	Particular Situation in Nachchaduwa Major Scheme.	Particular Situation in Nachchaduwa Major Scheme.		
1.1 Physical condition	• Rehabilitation was implemented under MIRP (1989). Canals are, however, highly sedimented and weedy which hinder smooth conveyance of irrigation water.	• As mentioned in C1.1	• As mentioned in C1.1	• ID / IMD
1.2 Drainage condition	• The area is inundated at some parts where the siphon from Thuruwila scheme is crossing the HL Main Canal.	• Inadequate design of facilities at siphon crossing HLM canal	• To be redesigned and rehabilitated with capacity development of government staff • Development of design guideline	• ID / IMD
	Particular Situation in Rajangana Major Scheme	Particular Situation in Rajangana Major Scheme		
1.1 Physical condition (canals)	• Rehabilitation was conducted under MIRP (1989). Canals are, however, highly sedimented and weeded which hamper smooth conveyance of irrigation water. • Canal section is significantly collapsed particularly the upstream from ch. 0+20 to 3+00.	• Insufficient quality of the construction • Drainage problem in the Manel Wewa command area	• Training on quality control for rehabilitation and construction works, the contents for which to the government staff is described in C1.1 • To be redesigned and rehabilitated with capacity development of government staff • Development of design guideline	• ID / IMD
1.2 Physical condition (roads)	• Roads along main canals are deteriorated (LB Main, RB Main, BC2 canals).	• Insufficient maintenance works for the road along the main canal	• To be redesigned and rehabilitated with capacity development of government staff • Development of design guideline	• ID / IMD
	Particular Situation in Thuruwila Medium Scheme	Particular Situation in Thuruwila Medium Scheme		
1.1 Physical condition	• Rehabilitation of main facilities is on-going through the project by Anuradhapura Water Supply Scheme under National Water Supply and Drainage Board. • However, collaterally, water is issued without careful attention to rehabilitation works.	• Delay of rehabilitation works • Insufficient construction supervision	• Development of construction management guideline for re-scheduling and work acceleration • Training on quality control for rehabilitation and construction works as explained in C1.1	• ID
2. Function of D- and F-canal level Irrigation Facilities	Common Points			
2.1 Physical condition	• D- and F-canal density of three schemes ranges from 62 m to 67 m per hectare which could be nearly standard value to improve the irrigation canal network at tertiary level. • Some rehabilitation works at D- and F-canal level were carried out in late 80s to early 90s. • Most of the measuring devices at the head of F-canal have been deteriorated. • Ratio of attendance to Shramadana for system O&M differs among schemes: highest in Nachchaduwa (91%) while 76% in Rajangana and lowest in Thuruwila (69%).	• Deteriorated D- and F-canal level facilities • Discharge not measured	• Rehabilitation through community participation approach • Training necessary for government staff and FOs for facilitation and implementation of community participation approach are respectively explained in C2.2 and C2.4 as follows.	• ID / IMD
2.2 Handing-over of systems from the Government to FOs (Government Side Issue)	• D-canal was rehabilitated with random rubble masonry in '90s. • Handing over of D- and F-canal level system to FOs is officially declared for Nachchaduwa and Rajangana major scheme, however, ID is still providing O&M expenses. • This situation pinches government budget for O&M of main facilities.	• Insufficient handing-over process	• Capacity development for government staff to facilitate community participation approach: • Training program for government staff: Participatory planning, communication with farmers, skills on technology transfer, handing-over of O&M responsibilities to farmers	• ID / IMD
2.3 Government Field Staff (Government Side Issue)	• All the schemes face insufficient number of field staffs (engineering assistant, work supervisor and water issue laborer) in M&E of D- and F-canal level. • Insufficient technical skills of existing government field staff are in serious condition to carry out M&E.	• Insufficient M&E by the government field staff for D- and F-canal level activities	• Training of government field staff for M&E of FOs' D- and F-canal level activities	• ID / IMD

Table 4.2.1 Summary of Present Condition, Problems and Approach for Irrigation Sector (2/3)

Category	Present Situation	Problem Description	Approach	Target Group
2.4 FOs Capability and Attitude (FOs Side Issue)	• Dependency attitude to the government still remain among FOs. Therefore, D- and F-canal level O&M is not effectively carried out. • Because of the lack of farm turnout, PVC and other temporary means are set by FOs for diverting water from F-canal into the field including illegal tapping. The survey shows that the situation Thuruwila medium scheme is worse than in that in Nachchaduwa and Rajangana major schemes. Latter two schemes reveals that 84 % and 93 % of all farm turnout respectively is constructed by concrete while only 68 % is in Thuruwila. • In some areas, encroachment of canals and reservation are observed. • In Rajangana, O&M fee is collected only from 4% of FOs members while almost zero in Nachchaduwa and Thuruwila. •	• Insufficient handing-over process (lack of awareness and capability for maintenance) • Make-shift turnout and illegal tapping	• Additional farm turnout to be planned and rehabilitated through community participation approach • Training program for FOs: participatory planning, transect walk and field investigation, design and cost estimate, contract management for construction works, quality control for earth and concrete works, field inspection, preparation of document for rehabilitation and construction, organization of shramadana for O&M, collection of O&M fee and financial management	• FOs • Community organizations such as school
	Particular Situation in Nachchaduwa Major Scheme.			
2.1 Physical condition	• Facilities rehabilitation at D- and F-canal level was carried out under MIRP (1989). • According to the mapping survey, out of 264 nos. of D- and F-canal related structures, nearly 60 % of D- and F-level structures are in poor condition.	• Deteriorated facilities	• As same as C2.1 • Training contents for government staff and FOs are explained in C2.2 and C2.4	• ID / IMD
2.2 Handing-over from the government to FOs	• Handing-over has been officially declared, however, O&M by FOs are poor.	• Insufficient handing-over process	• As same as C2.1 • Training contents for government staff and FOs are explained in C2.2 and C2.4	• ID / IMD
	Particular Situation in Rajangana Major Scheme			
2.1 Physical condition	• Rehabilitation was carried out under MIRP (1989). • In addition, pilot area tract 2 (D-1) command area was rehabilitated by "the performance evaluation of automatic head and flow control system at D-level" financially assisted by World Bank in early 1990s, therefore, they are comparatively in better condition. • As seen in above-stated pilot areas, some baffle distributor is destroyed and removed by FO members. • Mapping survey shows that out of 260 nos. of structures in D- and F-canal levels, more than 80 % of those in LB tract 2 (pilot area) are in good condition. • Other than the pilot areas, however, most of the turnout gates on D-canals are missing or impossible to be operated.	• Poor O&M of D- and F- canal level and deterioration • The situations that baffle distributor are forcedly removed shows that insufficient length of time was allocated for an introduction of improved technology.	• As same as C2.1 • Training contents for government staff and FOs are explained in C2.2 and C2.4 • Dedicating enough transition period to introduce new technology in order to ensure social acceptability through scaling-up approach (workshop, study tour, trial water management practice and so forth)	• ID / IMD
2.2 Encroachment	• Along the upstream of D-1 (LB tract 2) is highly encroached identified by mapping survey.	• Encroachment along D-canals	• Legalization • Physical approach (partial canal lining, protection works)	• ID / IMD • FOs
	Particular Situation in Thuruwila Medium Scheme			
2.1 Physical condition	• Rehabilitation at D- and F-canal level is on going through the project by Anuradhapura Water Supply Scheme under National Water Supply and Drainage Board. • Rehabilitation works are not sufficiently informed to FOs in Thuruwila. • In accordance with the mapping survey, out of 257 nos. of D- and F-canal related structures, 70 % of those are in better condition.	• Delay of physical rehabilitation works under Anuradhapura Water Supply Scheme • Insufficient participation of FOs to above-mentioned rehabilitation works	• Development of construction management guideline for re-scheduling and work acceleration • Socialization among stakeholders: awareness workshop and O&M planning	• ID
3. Water Distribution at Main Level	Common Points			
3.1 Water Management Decision-making Process	• Water issue schedule within the system depend upon distribution schedule to each scheme prepared by Mahaweli Water Management Committee (MWMC) before every cropping season. All the schemes are, therefore, defined as supply-oriented system. • Water management schedule in the system is finalized by Pre-Kanna Meeting and Kanna Meeting. The activities are monitored and evaluated by the Project Management Committee (PMC).	• Limited M&E by PMC in water management • Limited farmers participation in water management decision-making process	• PMC activities improvement for M&E in water management	• ID / IMD and other related agencies • FOs
3.2 Gate Operation	• Tank outlet and turnout gate is operated by WIL (ID Jalapalaka) based on water issue schedule prepared prior to each cropping season. • Although slight revision is observed, gate is generally operated on schedule. • Discharge is not measured at the head of D-canal	• Not equitable water distribution within the system • Excessive discharge to D-canals	• Capacity development of government field staff related with 3.3 • Training program for government staff: Awareness program, communication skill with farmers, technology transfer skills to FOs, water requirement estimation, water issue schedule preparation, gate operation for tanks and turnout to D-canals, discharge measurement and monitoring skill	• ID /IMD

Table 4.2.1 Summary of Present Condition, Problems and Approach for Irrigation Sector (3/3)

Category	Present Situation	Problem Description	Approach	Target Group
	since most of the measuring device is deteriorated. • Therefore, excessive discharge is diverted to D-canal according to the water measurement at pilot and control areas in LB tract 2, pilot and control areas.		• Rehabilitation of measuring device • Two different levels of program are proposed for ID (more-technical side) and IMD (basic techniques, and coordination and facilitation skill).	
	Particular Situation in Nachchduwa Major Scheme			
3.1 Physical condition	• Main canal is seriously deteriorated which causes high conveyance losses.	• Insufficient maintenance of main canal by the government.	• Capacity development on water management for government staff as mentioned in C3.1 • Rehabilitation of main facilities (as explained in 1.1)	• ID
	Particular Situation in Rajangana Major Scheme			
3.1 Physical condition	• Main canal is seriously deteriorated causing high conveyance losses. • Downstream areas particularly in Right Bank Tract 16, 17 and 18.	• Insufficient maintenance of main canal by the government	• As mentioned in C3.1	• ID
	Particular Situation in Thuwila Medium Scheme			
3.1 Physical Condition	• Main canals are recently rehabilitated with concrete U-flume under Anuradhapura Water Supply Project. Although work is incomplete, efficiency on water management has been much improved. • Others are as mentioned in general and common points.	• As mentioned in C3.1	• As mentioned in C3.1	• ID
4. Water Distribution at D- and F-canal Level	Common Points			
4.1 Handing-over of Systems to FOs (Government side issue)	• As for Nachchaduwa and Rajangana scheme, FOs are supposed to take charge of O&M of D- and F-canal level facilities in accordance with the Irrigation Ordinance (1994) and Agrarian Development Act (2000). • Prior to handing-over, agreement was concluded among FOs and RDI. Then basic training was provided to FOs at ITI covering the subject of O&M, financial management and so forth. • ID is, however, still providing substantial amount of funds for those O&M. • Lack of communication among FO members and government field staff exist.	• Insufficient handing-over process (training, follow-up and M&E)	• Capacity development for the government staff on the facilitation of community participatory water management • Training program for government staff: Awareness program, communication skill with farmers, technology transfer skills to FOs, water requirement estimation, water issue schedule preparation, discharge measurement and monitoring skill at D- and F-canal level	• ID / IMD
4.2 Government Field Staff (Government side issue)	• D- and F-canal water management activities by FOs are not well monitored by the government field staff (EA, WS and WIL).	• Not well trained government field staff taking charge of water management • Insufficient number of government field staff	• As explained in C4.1 • Development of monitoring and evaluation guideline to effectively conduct D- and F-level M&E • Increasing the number of field staff should be attended by the government.	• ID /IMD
4.3 FOs' capability and attitude (FOs side issue)	• FOs' awareness about importance of irrigation water is insufficient. • Although rotational irrigation schedule is prepared within D- and F-canal level under the support of EA, it is not actually practiced in Maha season. • Due to insufficient knowledge on O&M, sense of ownership among FOs is insufficient. • Dependency attitude to the government still remain among FOs for water management. • FO Jalapalaka have insufficient water management skill.	• Unprepared FOs' capability and attitude for conducting water management at D- and F-canal level by themselves.	• Capacity development for FOs' participatory water management: awareness and training • Training program for FOs: awareness program, communication with government staff, communication among farmers, communication with other FOs, preparation of water distribution schedule, skill of gate operation on D-canals, dispute settlement over water use	• FOs • Community organizations such as school
	Particular Situation in Nachchduwa Major Scheme			
4.1	• As mentioned in general and common points.	• As mentioned in 4.1 to 4.3	• Capacity development for government staff and FOs as respectively mentioned in 4.1 to 4.3	• ID / IMD • FOs
	Particular Situation in Rajangana Major Scheme			
4.1	• Nearly double of designed discharge has been diverted from main to D-canals which are identified through water measurement study at the control areas in LB tract 2. • This is caused because discharge measurement is not carried out at the head of D-canals.	• Sustainability of canals and related structures at D- and F-level is not ensured due to excessive discharge. • Wastage water through ineffective water management is not negligible.	• Establishment of proper water measurement mechanism at the head of D-canals through training of both government and FO Jalapalaka: joint monitoring • Training program for government staff and FOs as mentioned in C4.1 and C4.3	• FOs
	Particular Situation in Thuwila Medium Scheme			
4.1	• Different from Nachchaduwa and Rajangana, continuous irrigation is practiced within D- and F-canal command areas, the works of which are entrusted to FOs. • Others are as mentioned in general and common points.	• As mentioned in 4.1 to 4.3	• As mentioned in 4.1 to 4.3	• FOs

Table 4.2.2 Summary Present Situation and Problems for Agricultural Sector (1/3)

Agriculture

Category	Present Situation	Problems Description	Approach	Target Group
1. Paddy Production				
1.1 Productivity	Common Points			
	• The Study area has been declared a high potential paddy production area under the GAP (Granary Area Program) program targeting an average yield of 6.5 ton/ha. • Target yield have been achieved by some individual farmers and in Yaya (tract) demonstrations. • Under the demonstration conditions the participating farmer groups received inputs and credit. With reduced intensity of the support after conclusion of the demonstration, the adoption level and the yield level have tended to decline. • Available data from Dept. Census & statistics, DOA and field studies indicate an overall average yield in the range of 4.6 – 5.0 ton/ha for the area. • Following yields were recorded in tract demonstrations: Nachchaduwa and Thuruwila 03 Yala: 4.99 ton/ha, 03/04 Maha: 5.98 ton/ha, 05 Maha: 4.52 ton/ha Rajangana 03 Yala: 4.92 ton/ha, 03/04 Maha: 5.78 ton/ha 05 Maha: 4.58 ton/ha (RB), 5.56 ton/ha (LB)	• Low sustainability of the yield levels recorded in demonstrations due to: (1) farmers expectation of same intensity of support from the officers, (2) no follow up support by the officers.	(i) Empowerment of farmer groups to improve access to inputs, credit, and machinery through capacity development (demonstration with facilitation). (ii) Capacity development of officers to play the role of facilitator to farmer groups, and monitoring & evaluation in the demonstration.	(i) Farmer groups and FOs (ii) DOA, DAD, IMD
(1) Seed Quality	Common Points			
	• Under the National Seed Policy (1997) DOA does not produce certified seeds. • Main supply source of certified seeds for replacement is the private sector. • Farmers use self produced seed paddy for 3 – 4 seasons before replacing it with new seed paddy. DOA supplies 2 kg packets of certified seeds to promote self seed production, but supply is not enough. • The secondary seed (self produced seed) production from certified seed by farmers group is support by DOA, but, Farmers usually do not keep a special well- maintained plot reserved for seed production nor do they practice selective reaping and threshing at the time harvest. • Quality of self produced seed paddy by farmers is below standard germination (85%) and purity (94%) levels.	• Inadequate knowledge of farmers on self seed production to produce seeds of acceptable quality. • Shortage of high quality seed paddy (certified or secondary) for use as replacement seed. • Lack of seed farms managed by individual farmers or FOs producing certified or secondary seed paddy (except in Rajangana RB).	(i) Establishment and operation of seed production farms managed by farmer groups to produce secondary and certified seeds to serve each FO area, through facilitation of group formation. (ii) Training farmers on the technology of self seed production.	(i) Farmer groups and FOs., DOA, IMD (ii) Farmer groups and FOs
	Particular Situation in Nachchaduwa Major Scheme and Thuruwila Medium Scheme			
	• Un-registered paddy variety 'pokuru samba' is cultivated extensively (60%) by farmers on account of its higher marketing advantage.	• As an unregistered variety, DOA does not maintain basic seeds of this variety to produce registered seeds for multiplication as certified seeds by private sector.	Same approach as common points	•
	Particular Situation in Rajangana Major Scheme			
	• Farmers in LB expect certified seeds for replacement to come from DOA. Farmers are not confident of seed paddy produced by private sector although it carries DOA certification.	• Shortage of good quality seed paddy as replacement seeds.	Same approach as common points	•
(2) Plant Nutrition	Common Points			
	• Only 15 – 20% of the farmers practiced incorporation of paddy straw to the field prominent in tract and one acre maximum yield demonstrations. • Threshing with low capacity threshers left long strands of straw which made ploughing difficult when added to the paddy field. • Farmers rarely added green manure and/or cow dung to paddy fields except in demonstration plots supervised by the AIs. • Farmers tended to use the same paddy fertilizer dosages for all varieties.	• Degradation of soil productivity due to low organic matter status. • Farmer's knowledge on importance of adjusting dosages for different age classes and yield potential is inadequate.	Prevention from soil degradation (i) Awareness against burning of paddy straw through awareness training (demonstration with facilitation). (ii) Making straw recycling a condition for fertilizer subsidy entitlement (demonstration with facilitation). Knowledge on fertilizer level (i) Awareness training of farmers to fertilizer applications on crop duration and crop output (demonstration with facilitation).	(i) Farmers group, FOs, DAD (ii) FOs, DAD (i) Farmer groups and FOs.
	Particular Situation in Nachchaduwa Major Scheme and Thuruwila Medium Scheme			
	• Large proportion of farmers were either tenant or lease operators.	• Low interest in building up organic status of soil for long term benefits by tenant and lease operators due to lack of land ownership and frequently changing lands.	Same approach as common points	•
(3) Plant Protection	Common Points			
	• Application of IPM practices is mostly confined	• Difficulty in applying IPM practices due to	IPM & use of chemicals	

Table 4.2.2 Summary Present Situation and Problems for Agricultural Sector (2/3)

Category	Present Situation	Problems Description	Approach	Target Group
	to demonstration plots. ・ Poor adoption of the IPM practices following conclusion of field demonstrations, due to limitations of field visits by AIs have made monitoring and follow-up action needed to ensure effectiveness and continuity of the practices weak. ・ Poor adoption of the IPM practices following field demonstrations. ・ Farmers applied pesticides as a routine measure without consideration for pest populations and crop growth stage. ・ High weed population in the field and bunds of paddy fields	uncoordinated planting times and different age classes in the tract. ・ Wasteful use of chemicals leading to development of pest resistance and environmental pollution. ・ Limited use of cultural methods to contain weed growth.	(i) Facilitation for planting paddy of same age class at the same time in the tract. (demonstration with facilitation). (ii) Awareness training of farmers on proper use of pesticides. (demonstration with facilitation). Cultural methods for weed control (i) Farmer training to popularize use of cultural methods for weed control and reduce herbicide application. (demonstration with facilitation)	(i) DOA, DAD (ii) Farmer groups and FOs. (i) DOA
	Particular Situation in Thuruwila Medium Scheme and Rajangana Major Scheme			
	・ Efficacy of some agro-chemicals in the market was questionable.	・ Fraudulent labeling of chemicals stating incorrect expiry dates and concentrations.	--	・
(4) Harvest and Post Harvest	Common Points			
	・ Harvesting is done manually. ・ Farmers use many varieties with different growth duration. ・ Some farmers tended to harvest before best reaping time (85% of grains in panicle turn golden brown) to take advantage of higher market prices early in the harvest period. ・ Threshing is done using 4 wheel tractors, 2 wheel tractor (or engine) driven low capacity threshers or 4 wheel tractor driven high capacity thresher/seed cleaners, in the order of farmers preference. ・ Due to logistic reasons, threshing of several adjoining farmers fields are contracted for threshing together	・ Poor quality of paddy due to high moisture content and low seed purity (mixing different variety). ・ Losses due to early and late harvesting ・ Limited availability of high capacity units in the study area. ・ Lack of road access to field for high capacity units making farmers to use alternate methods for threshing.	Quality of paddy & minimizing harvest loss (i) Awareness programs on proper harvesting procedures to minimize grain losses and improve the quality. (demonstration with facilitation) Availability of high capacity thresher unit (i) Facilitate farmers, FOs and private sector to secure and increase the number of units in the area, with assistance of banks for credit.	(i) Farmer groups and FOs, DOA, IPHT (i) DOA, DAD, IMD
1.2 Production Cost				
(1) Labour	Common Points			
	・ Shortage of hired labour for farm work ・ Traditional labour exchange system (attam) is not practical in the present situation where cultivation is done according to crop calendar. ・ Family labour contribution to farm work for study area is 1.7 mandays. Nachchaduwa 51 mandays are used per ha of which 19 are hired at Rs. 400 per manday. Thuruwila 51 mandays are used per ha of which 25 are hired at Rs. 350 per manday.	・ High cost of hired farm labour.	(i) Assessment of applicability of mechanization of farm operations, particularly harvesting, through introduction of combine harvesters. (ii) Facilitate securing combine harvesters by farmers, FOs and the private sector through bank loans.	(i) DOA, Farm Mechanization Centre, (ii) Mahailuppallama
(2) Fertilizers	Common Points			
	・ Fertilizer dosage is below the recommended level due to high price other than urea. ・ Applying the recommended dosage sometimes increase the production cost.	・ High price of fertilizer other than urea.	(i) Facilitation to form farmers group for bulk purchase.	(i) Farmers, DOA, DAD, IMD
(3) Agro Chemicals	Common Points			
	・ Agro chemicals are imported and distributed by the private sector and there is no government subsidies offered. ・ Agro-chemicals are regularly applied without IPM practice.	・ High price of agro-chemicals. ・ High expenditure on agro-chemicals due to excessive usage from non adoption of IPM practices (same problem as plant protection).	(i) Same approach as plant protection	(i) Same as plant protection
2. OFC, Fruit & Vegetable Production	Common Points			
	・ Soil survey conducted in 3 pilot areas show that substantial land area is occupied by well to imperfectly drained Reddish Brown Earths (RBEs) ・ The Agrarian Development Act No.46 of 2000 states that paddy land can be utilized only for paddy cultivation, but written permission allows to cultivate other crops in paddy land. ・ Cultivation of vegetables and fruits (papaya and banana) under irrigation are more profitable than traditional paddy. ・ Field demonstration	・ Non utilization of high potential RBE soils for production of cash crops. ・ No written permission never issued against crop diversification in irrigated paddy lands. ・ Monitoring and follow-up for field demonstration is inadequate	Utilization of RBE (i) Soil survey, preparation of soil maps, dissemination to farmers Permission for crop diversification (i) Discuss legal and socio-economic implications in releasing irrigated paddy lands having Reddish Brown Earths for crop diversification Monitoring and follow-up (i) Same approach as paddy productivity (demonstration and facilitation).	(i) Farmers, DOA, DAD, IMD (i) Commissioner General of DAD, GA, DOI (i) Same as paddy productivity
	Particular Situation in Nachchaduwa Major Scheme			
	・ More than 60 ha of irrigated lands are cultivated mostly with vegetables, 22 ha of which are by an	・ Non regularization of the irrigated paddy land presently cultivated with seasonal and	Same approach as common points	・

Table 4.2.2 Summary Present Situation and Problems for Agricultural Sector (3/3)

Category	Present Situation	Problems Description	Approach	Target Group
	informal youth group. ・ The main vegetables cultivated are bitter gourd, snake gourd, eggplant, tomato, cucumber and sweet melon.	annual crops.		
3. Agricultural Extension	Common Points			
	・ The annual implementation plan 2005/06 for implementation in each AI range targets a wide of activities. ・ Implementation, supervision, monitoring and follow up action on the progress of the field demonstrations are inadequate ・ Only 3 out of the 14 AIs in the Study area are using motorcycles to visit the field and operate on a restricted traveling allowance. All other AIs use public transport which has restricted their field visits considerably. ・ Training programs conducted for the farmers by the AIs, and SMOs are not effective. The AI center of Rajangana LB at ASC is provided with cyber extension facilities for use of farmers. ・ There is sometimes a delay in the transfer of new technologies developed at the research centers to the field extension staff	・ Poor mobility of the AIs. ・ Lack of basic teaching aids and ineffective extension communication to improve the quality of training and presentations to farmers. ・ Lack of pre-seasonal training sessions for AIs on specific subjects that are relevant to the season to bridge the technology transfer gap. ・ Low sustainability of extension effects in farmers side due to lack of follow up and monitoring (same problem as in productivity).	Mobility of AIs (i) Establish a revolving fund to providing the AIs with loans to purchase motorcycles for official field traveling. Teaching aid (i) Preparing and providing the AI offices in ASCs with a package of teaching aid. Training of AIs on season specific subject areas (i) Commence a regular pre-seasonal training program for AIs and other agricultural staff at a relevant In-service Training Institute of the DOA. (ii) Arranging a training program in a foreign country in the region for a senior staff member of the DOA to gain experience on agricultural extension aspects in a large settlement project.	(i) AIs of DOA (i) AIs of DOA (i) AIs of DOA (ii) DOA
4. Other Farm Income Generating Activities	Common Points			
	・ AI (IP DOA), VS and LDI (PDAP&H), DO and ARPA (DAD), CDO/CDB, RPM (IMD), and sometimes, NGOs all providing services to the farmers tended to act independently, implementing their own line responsibilities. ・ Important sectors for income generation, namely issues on development of livestock and fisheries are identified in the Sector Development Plan 2006 – 2010, North Central Provincial Council.	・ Lack of coordination of the development activities of different agencies to avoid overlaps and deficiencies in the services provided specially	(i) Making participation of officers of DOA, PDAP&H, DAD, NGO and any other organization involved in development activities in the Project Committee Management meetings.	(i) FO, DOA, PDA&H, DAD, NGO

Table 4.2.3 Summary Present Situation and Problems for Marketing Sector (1/3)

Marketing

Category	Present Situation	Problems Description	Approach	Target Group
1. Marketing and Processing of Paddy	Common Points			
1.1 Farmers sell paddy at low prices	・ Farm gate price of paddy in April was lowest. (Rs11.88/kg, while Ra13.23/kg in March and Rs13.63/kg in May in 2004 in Anuradhapura), See Table 3-5-6/7 & Figure 3-5-1. ・ Many small-scale farmers have been fallen in a vicious circle of reiterate credit and its settlement by immediate sales at low prices though they know the price level is lowest. (About 80% of farmers in Rajangana sell paddy immediately after harvest, according to DO.)	・ Most of farmers sell paddy immediately after harvesting for cash at low price due to mainly settlement of cultivation credit.	(i) Improve the situation by farmers' own efforts and supports from outside.	(i) Farmers with debits (ii) Women group
1.2 Short of paddy storage	・ Farmers store paddy in polyethylene sacks in their house. 2 Large-scale storages are available in Nachchaduwa and 3 in Rajangana, both owned by ASC. Mudalali(s) have small-scale multiple storage and commercial rice mills have large-scale storages within their possession. But there is no paddy storage for table rice available for farmers in the Study area except seed paddy storage.	・ Paddy storage facilities are limited, which causes low sales price of paddy and makes it difficult to adjust adequate timing of paddy sales. ・	Construct storages and capacity development for operation and management of those storages. (i) Multipurpose storage for Agrarian Service Center for storing paddy/fertilizer/etc. (ii) Multipurpose storage for Farmers group (FO) for storing paddy, paddy seed, other grain and salable resources like coconuts fibers. (Participatory construction approach will enforce farmers' ownership)	(i) Gov. agencies (DOA, IMD, District Gov., etc) (ii) (2) Farmers groups (FOs)
1.3 No market available for paddy/rice	・ There are 2 Pola in Nachchaduwa and 4 Pola in Rajangana (See Table 3-5-12) but no body sells paddy/milled rice in Pola. Wholesale markets are available in Dambulla and Thambuttegama but no paddy/rice sales is carried out in the markets unlike to OFC, vegetable and fruits.	・ No open paddy/rice market is available for better market access and transparent rice market.	Study on setting up Open Paddy/Rice Market (OPM) in its necessity and effectiveness for increasing farmers' income. (i) To arrange study tour in Thailand where OPM is effectively functioning for the benefits of farmers, rice millers and collectors/middlemen. (ii) To apply donor agencies including JICA to conduct feasibility study. (iii) To introduce auction system in paddy sales by farmer groups to rice millers/brokers	(i) Gov. agencies (DOA, IMD, Bank, etc) and Rep. of FOs. (ii) Ditto (iii) Gov. agencies (DOA, IMD, District Gov., Farmers, Wholesalers)
1.4 Inactive group activity	・ Local brokers play mediator role in paddy marketing by linking buyers and sellers with their commissions. ・ Price formulation surveyed (see Table 3-5-11) shows wholesalers gain very high profit margin but no statistics are available.	・ Collective marketing by farmers group is very rare resulting in poor bargaining power of farmers due to inactive farmers group activity.	Facilitation of farmers group for collective activities (i) Capacity development of Gov. officers for the facilitation of group activity to farmers. (ii) Extension of awareness training of the benefits by group activities to farmers. (iii) Training of management skill for group activity.	(i) Officers (DOA, IMD, etc) (ii) FO and Farmers (iii) FO and farmers group
1.5 Poor quality control of paddy	・ The quality factor of paddy is not much significant in the transaction, which causes poor quality control by farmers.	・ Most of middlemen and some rice millers play speculation of paddy/rice sales rather than quality controllers	Improve post harvest-processing technologies of farmer. (i) Extension of post-harvest technologies (ii) Awareness training to farmers, rice millers and middlemen for the benefits of high quality paddy.	(i) Gov. agencies (IPHT, DOA, IMD, etc) (ii) FO, Farmers group, rice millers group and middlemen group
1.6 Insufficient paddy purchase by Gov.	・ Government intervenes to regulate paddy price at relatively higher price than present market prices. But the amount is limited i.e. one family can sell 100 bushels (2.2 ton) only and her budget is also ceiling to approx. 5% of total surplus in Yara 2004. For Maha 2005, Government announced in Feb. to intervenes paddy market by purchasing 40,000 ton of paddy, which is equivalent to 1.5% of national production only at average price of Rs17.5/kg. The budget for this intervention was announced as Rs700Millions. ・ ASC at RB of Rajangana revealed that due to shortage of storage capacity available, they could intervene paddy purchase only 150ton in Yara 2004, though the budget was allocated for 500ton.	・ Farmer welcomes Government intervention for paddy purchase scheme because of its good prices but not satisfied with the amount they can sell due to the ceiling policy and not enough Gov. budget for this scheme. ・ Shortage of storage capacity causes Gov. intervention troublesome or inefficient in conducting paddy purchase.	(i) To approach Gov. to increase the budget (ii) To approach local ASC to increase purchasing and storage capability.	・ Gov. agencies

Table 4.2.3 Summary Present Situation and Problems for Marketing Sector (2/3)

Category	Present Situation	Problems Description	Approach	Target Group
1.7 Deterioration of feeder roads	・ Large tractors or large size threshers are getting popular in the study area. Those farm machines deteriorate rural and feeder roads by its weight though roads are graveled.	・ Maintenance of rural and feeder roads should be done periodically otherwise the market accessibility will become difficult.	Planning of road maintenance and its execution. (i) Increase Gov. budgets. (ii) Communal repair works	(i) Gov. agencies (ii) FO and residents
	Particular Situation in Nachchaduwa Major Scheme and Thuruwila Medium Scheme			
	・ In Nachchaduwa scheme, 24 commercial rice mills are actively in operation mainly along with main road (number of village mill is 25 only). So farmer can sell paddy directly to rice mills without paying collectors' margin except those farmers who have informal loan/credit from local traders (mudalali) or rice mills having no choice but selling to creditors.	・ Farmers in Nachchaduwa and Thuruwila have better chance in selling their paddy by direct negotiation with buyers (rice millers) or joining differed payment agreement system	・ Facilitation of differed payment agreement system and secure the transparency of the agreement	・ Gov. agencies, FO, Rice Millers and middlemen
	Particular Situation in Rajangana Major Scheme			
	・ Number of commercial rice mill within the Scheme is very limited. DO reports there are only two (2) commercial rice mills in the area. The reasons behind would be ① Power supply to this area was late, in early 1990s. ② Location is far from main national road ③ New settlers with less assets are majority The capacity of these commercial rice mills is low. ・ In Rajangana, many small village mills are in services; 69 mills in RB and 64 mills in LB totaling to 133 mills for mainly farmers' own consumption.	・ Farmers in this area have no choices but to sell paddy to middlemen/collectors who deduct their commission from farmers' price or transport to rice millers with certain transport fee for the distance. The selling price is lower than in Nachchaduwa in general, where farmers can sell paddy to commercial rice mills directly due to the availability of commercial rice mills. For increase paddy sales price, farmers in Rajangana should aim to group activities such as bulking with quality control or collective marketing of their paddy.	(i) Direct sale to large-scale rice millers at better price through bulking and quality control of paddy. (ii) Awareness training to farmers for the benefits of bulking and collective sales. (iii) Construct paddy storage and quality control training and machine input. (Participatory construction approach will enforce farmers enrollment for the scheme) (iv) Facilitation of farmers' group activity by Gov. agencies.	(i) 1.1 FO and Farmers groups (ii) FO and Farmers group (iii) FO/Farmers group and Gov. agencies for subsidy. (iv) Gov. agencies (DOA, IMD, etc)
	・ Number of commercial rice mill is so little.	(i) To facilitate commercial sector to invest new commercial rice mill by some incentives.	(ii) To facilitate commercial sector to invest new commercial rice mill by some incentives.	(i) Rice mills, Bank, Rice brokers & Gov.
2. Marketing and Processing of OFC, Vegetables & Fruits	Common Points			
2.1 Price fluctuation	・ Farmers sometime suffer damages by price fluctuation of vegetable and fruits.	・ Fresh vegetable and fruits prices are always changing largely depending on the situation of supply and demand, however farmers are very hard to predict such situation. Systematic record keeping for the past price fluctuation and its disseminating system should be established.	(i) Systematic recording of such fluctuation and its dissemination to farmers for their benefits. (ii) Zoning policy for specified products	(i) Gov. agencies and FO (ii) Policy makers in Central Gov.
2.2 Inactive group activity	・ Cultivation of other crops than paddy is on the increase because of better profitability. But farmers carry out marketing of those crops individually due to inactive group works which causes poor bargaining power, except one case of young farmers' group activity	・ Facilitation of farmers group for collective marketing should be pushed forward. ・ Bulking activity with quality control of OFC by farmers enables farmers to be in better market access and/or negotiation with buyers.	(i) Facilitation of farmers group for collective activity. (ii) To construct consolidating station.	・ Gov. agencies and FO
2.3 Low prices of perishable products	・ Table 3-5-12 shows wholesales and retailers margin is high for perishable products. It is reasonable that they need margin to cover damages and losses during marketing under present conditions.	・ New technologies in post-harvest handling, packing, storing should be established and extended, such as use of plastic box or carton box, cold storage and cold chain and etc.	(i) Extension of gentle post-harvest handling practice for minimizing damages to perishable products (ii) Introduction of plastic box and cold storage into practice	・ Gov. agencies, farmers, wholesalers, retailers and transporters
2.4 Lack of know-how on fruits harvesting products	・ Normally middlemen collect fruits at farm gate or on farm in stead farmers sell them at markets unlike the case of vegetable, because farmers lack know-how in determining appropriate harvest timing and minimizing damages of fruits in transporting and marketing.	・ IPHT developed parameter of proper harvest timing for various agricultural products but extension or dissemination of such technology is not successful yet. Further extension works in joint efforts of relevant Gov agencies such as DOA、IMD and District Gov. is required. If fruits farmers can harvest and sell at wholesale market, they can earn better income.	(i) Dissemination of appropriate technologies and training	(i) IPHT, DOA, IMD, Farmers and FO
2.5 Forward sales contract by individual farmers	・ Forward sales contract is made individually not through FO, which put farmers in a weak position during contract negotiation ・ The function of FO is not strong like Mahaweli system H, where FO works as a window to collectors (companies) for member farmers in entering into to forward sales agreement of OFC with collectors.	・ Individual negotiation by a farmer and a collector always put farmers in a weak position during contract negotiation. Group activity of farmers or negotiation through FO is required through appropriate supports from Gov. agencies. ・ Common pick-up points (consolidating stations) are not available for OFC such as maize, beans and kurakkan (millet) so farmers deal with collectors individually resulting to lower farm gate prices. ・	Facilitation of farmers group for collective activities (i) Capacity development of Gov. officers for the facilitation of group activity to farmers. (ii) Extension of awareness training of the benefits by group activities to farmers. (iii) Training of management skill for farmers group.	(i) Officers (DOA, IMD, etc) (ii) FO and Farmers (iii) FO and farmers group
2.6 High post-harvest loss	・ Post-harvest losses of vegetable and fruits are reported as high as 30~40% which causes reduced income of farmers. ・ Polyethylene string-bag is common for packing and transport vegetable and fruits. The use of plastic box for minimizing damages/losses is very rare, it only	・ Cost of packing material of products is borne by farmers and consumers. The cost of string-bag is Rs14-15/bag and farmers receive Rs10/bag for each bag after selling the products in markets. The cost of plastic box is Rs400/box. Unless there is a system to return the plastic box to farmers, the use of plastic box	(i) Extension of post-harvest technologies to farmers and traders. (ii) To extend plastic boxes in the marketing with returning system to suppliers.	(i) IPHT, DOA, IMD, Farmers and FO (ii) Ditto

Table 4.2.3 Summary Present Situation and Problems for Marketing Sector (3/3)

Category	Present Situation	Problems Description	Approach	Target Group
	can be observed at specific marketing route between farmers and buyers. But for tomato transport, wooden box is widely used.	will not be popularized. ・ If carton box for fruit/vegetable transport is developed locally at very reasonable price level, it will help minimizing damages and losses during marketing and will benefit farmers and traders eventually consumers. It is recommended Gov. sector such as IPHT to study setting up cottage level Carton Box factory utilizing locally available material such as used newspaper, banana tree, bagasse, etc.	(iii) To construct carton box factory for low cost box production utilizing local available materials.	(iii) IPHT for study
	Particular Situation in Nachchaduwa Major Scheme and Thuruwila Medium Scheme			
	・ Farmers started imitating young farmers' group activities in vegetable cultivation. As most of those vegetable farmers sell products at Dambulla directly, oversupply and sharp price drop of vegetable might be happened.	・ There is no pre-cooling facility or cold storage for vegetable/fruits available in the Study area, no buffer function to those perishable products. It is necessary to study introducing such facility in near future for Government sector.	(i) Study pre-cooling facility and cold storage system (ii) Study the buffering function	(i) IPHT and Gov. agencies (ii) Ditto
	Particular Situation in Rajangana Major Scheme			
	・ As Thambuttegama wholesale market is not lively in business and farmers' selling prices are generally lower than those in Dambulla. Many farmers sell vegetable to village collectors, who send about 60% of available vegetable in Rajangana Scheme to Colombo, which results lower farm gate prices. ・ The access fee (parking fee to sellers) in the market is fixed at same rate in Thambuttegama and Dambulla i.e. Rs50 per larger than 5 ton lorry, Rs20 per smaller than 4.9 ton lorry and Rs10 per 2 wheel tractor and 3 wheeler.	・ No special incentives such as reducing the parking fee or other assistances to buyers and sellers have been taken to activate Thambuttegama wholesalers market.	・ Incentives should be applied for active transaction to all stakeholders, who use this facility	・ Min. of Rural Industries and District Gov.
3. Other income generation through Marketing & Processing	Common Points			
3.1 Value addition activity is not active	・ Value addition activities such as Pulse processing, Chili powder making, Rice flour making by farmers on commercial basis are not in active, which results poor opportunity for income generation.	・ Food processing activities by farmer/farmers group is not active due to ① Insufficient farmers' capacity/competence ② Inadequate technical and marketing skill training by Gov. sectors ③ Messy application for bank loans and its high interest rate, etc. Comprehensive approach to strengthen food-processing activities including mobilization of farmers and holistic support system by Gov. sector should be studied and implemented.	(i) Comprehensive approach by technical, financial and social supports are required.	(i) IPHT, DOA, IMD, Farmers and FO
3.2 Available resources are not utilized	・ Available resources in villages such as Coconuts fiber, Cow-dung and Rice straw are not utilized for additional income generation	・ Coconuts fiber can be sold at Rs0.35/piece if bulked. Farmers collect cow-dung as a material of organic fertilizer in Mahaweli system C area. Rice straw can be good nursery of mushroom, animal feed and organic fertilizer. These available resources should be utilized for additional farmers' income through appropriate training and group activities.	(i) To construct storing facility and marketing activities by group.	(i) IPHT, DOA, IMD, Farmers and FO

Table 4.2.4 Approach to Improve the Present Constraints and Problem for Farmers' Organization

Farmers Organization (FO)

Category	Problems and Issues (key words)	Approach	Target Group
1. Poor Participation	• Operators not being the member of FO • Few members in some FCG	**Encouraging Participatory Approach** • Awareness of basic regulation • Shared information of legal formulation	FO and FCG
2. Poor Management	• Weak organized information/ document • Longer service period of the official bearers • Less involvement of youth and women • Poor implementation of decisions at Kanna Meeting and PMC	**Basic Management Improvement Approach** • Awareness of basic management including the roles of the official bearers • Awareness of youth and women encouraged	FO and FCG
3.Lack of Unity based on social; capital	• Different understanding and expectation of FOs' members • Lack of planned activities • Insufficient transparency of activities	**Strengthening Social Capital Approach** • Integrated training with planned practice • More transparency of procedure and activities process in practice • More building basic grouping activities at Nachchaduwa	FO and FCG
4. Limited Support from the Government Agencies	• Insufficient government agencies • Insufficient training of the agencies • Insufficient transparency procedure • Insufficient M & E system	**Government Capacity Development Approach** • Capacity development training for the agencies • Awareness of legal formation • Formulation of integrated M & E system	Related government agencies
5. Limited Activities/ Less Tangible Benefit to FO	• Lack of grouping activities such as 'Sharamadana' • Very limited development activities	**Income Generation Approach** • Depending mainly upon irrigation, agriculture, and marketing income generation approach	FO and FCG, related government agencies, and other groups

Table 5.2.1 Training Items by Categories and Sub-Categories (1/9)

Category	Sub-Categories	Activities	Result	Training Items	Trainee	Trainer
A Overall Aspect: Training, Facilitation, Training Management	1. Understanding of Trainings	- Workshops and seminars for senior officials to share the principles& importance of trainings and its motivation	- Importance of training is understood, and trainings are supported.	- Awareness Seminars and Workshops on Training - Study Tour	- Senior officers (Head Office, Provincial Council and District)	- Out-source Personnel Expert
					- Site Officials (IE Office, RPM Office, ASC: AI Office & DO Office, DS Office)	- Counterpart & Expert
					- FO & Community Members	- Site Officials, Counterpart, Expert
	2. Facilitation	- Workshops & Seminars for changing attitude from “administrative” to “facilitation”	- Importance of facilitation is understood. - Facilitation procedures and methods are obtained. - Role of the Officials changes from administrator to facilitator.	- Facilitation Seminars - Facilitation Training (Process, Role, Changing Attitude) - Study Tour	- Senior officers	- Out-source Personnel Expert
					- Site Officials	- Counterpart & Expert
					- FO & Community Members	- Site Officials, Counterpart & Expert
	3. Training Management	- Workshops & Seminars for obtaining the basic knowledge and skill on trainings - Workshops & Seminars for obtaining communication skills	- Trainings are well managed at each level.	- Training of Trainers (Training Cycle & Process) - Communication Management - Management of Training Function - Study Tour	- IE, RPM,PM, IDO, DA, EA, DO, AI, ARPA	- Out-source Personnel Expert
B Farmers’ Organization	1. Awareness of Participatory Community Development Approach	- Seminars & workshops for participatory development to each levels	- Principles & importance of participatory community development are understood.	- Awareness Seminar - TOT for Awareness Workshop at Scheme and DS Level - Awareness Workshop at FO & Community - Study Tour to Advance Area	- Senior officers - Site Officials - FO & Community Members	- Out-source Personnel Expert - Out-source Personnel Counterpart & Expert - Site Officials, Counterpart & Expert
	2. Community Development Plan	- Seminars & workshops to field officers and key informant in community for understanding the principles & importance of participatory development	- Community Development Plan is formulated and implemented	- Awareness Program - Basic Knowledge & Techniques for the Participatory Approach	- RPM/PM, IDO, DA, DS Staff, ASC Staff,	- Out-source Personnel Counterpart, Expert through Galgamuwa ITI

Table 5.2.1 Training Items by Categories and Sub-Categories (2/9)

Category	Sub-Categories	Activities	Result	Training Items	Trainee	Trainer
		- Meetings & workshops for community and FO members to identify problems, objectives, approach, and formulate community development plan & action plan - Consensus of an action plan from the community and FO members - Establishment of sub-committees for each component of an action plan - Submission of an action plan to relevant organizations		- Approach & Method of Formulation of Community Development Plan, and Preparation of Action Plan - Management of Sub-Committees - Gender Mainstreaming - Basic technical knowledge - Project cycle management (planning, monitoring & evaluation)	- FO Leaders, FCG Leaders, Community Leaders, Key Informant	- Site staff
	3. Institutional Management of FO, FCG, Farmers Group	- Learning of basic management skills - Review of FO by-law, Confirmation & increase of FO members - Preparation of FO work plan - Maintaining the records of FO - General meeting and monthly meetings - Implementing economic activities	- Institutional Management of FO is improved and strengthened	- Institutional Management (Roles & responsibilities of FO & FCG, structure of FO & FCG, representatives and their role, legal aspect of FO & FCG, record keeping, leadership and its quality, identification of resources and activities, preparation of work plan	- RPM/PM, IDO, DA, DOA / DAD staff,	- Out-source Personnel Counterpart, Expert through Galgamuwa ITI
					- FO Leaders, Sub-committee Members, FCG Leaders, Farmer Group Leader	- RPM/PM, IDO, DA, Community Organizers
	4. Financial Management of FO	- Obtaining basic financial knowledge and skill, - Understanding of transparent financial management - Establishment and management of revolving fund by farmers group	- Financial Management of FO is improved and strengthened	- Management of Fund including O&M fund & revolving fund (Importance of account, cash book & its use, ledger account, bank account, trial balance, income & expenditure, balance sheets, stock book	- RPM/PM, IDO, DA, Community Organizers	- Galgamuwa ITI, Out Source Trainers
					- FO leaders, sub-committee members, FCG leaders, Farmer Group leader	- RPM/PM, IDO, DA, Community Organizers
					- FO, FCG, Member Farmer	- RPM/PM, IDO, EA, WS, DA

Table 5.2.1 Training Items by Categories and Sub-Categories (3/9)

Category	Sub-Categories	Activities	Result	Training Items	Trainee	Trainer
C Maintenace of D- and F-Canal Level Facilities	1. Assessment of Facilities' Function for Rehabilitation	- The importance of data collection, management and assessment on facilities' function is explained. - D- and F-canal level facilities are surveyed by FOs. - GIS-based facilities' information is collected and developed by FOs and field staff (RPM/PM, IDO, EA, WS and DA). - Facilities' function is evaluated by FOs' and field staff (EA, WS and DA) based on the collected data.	- Information on facilities' function is collected and effectively utilized.	- Awareness program - Field survey of D- and F-canal level function - Data collection and recording method - Assessment of facilities' function - Database management and update using GIS	- RPM/PM, IDO, EA, WS, DA, DOA/DAD staff, - FO, FCG, Member Farmer	- IE, Galgamuwa ITI - RPM/PM, IDO, EA, WS, DA
	2. Community Participatory Rehabilitation	- Part of facilities rehabilitation is carried out by FOs through community contract. - Facilities maintenance is planned and implemented using GIS-based irrigation block map. - Facilities' maintenance is properly monitored.	- Function of D- and F-canal level facilities is recovered. - Function of D- and F-canal level facilities is maintained. - O&M fund is established by FOs. - Ownership mind toward D- and F-canal level facilities is generated, and attendance rate is increased for O&M works.	- Community participatory rehabilitation (Awareness program, planning, designing, contract management, financial management and construction management) - Maintenance planning - Establishment of O&M fund - Facilities' information management using GIS	- RPM/PM, IDO, EA, WS, DA - FO, FCG, Member Farmer , Community Member	- IE, Galgamuwa ITI External sources - RPM/PM, IDO, EA, WS, DA
	3. Transfer of O&M Responsibility to FOs	- D- and F-canal level facilities' O&M is transferred to FOs. - Maintenance plan is prepared and implemented. - O&M fee is determined and agreed among FO members. - Follow-up and monitoring & evaluation for maintenance is carried out.	- Function of irrigation facilities of D- & F-canal level is maintained by FO. - O&M fee payment rate increase.d and utilized as O&M fund. - O&M subsidies for D- and F-canal level facilities are reduced.	- Awareness on transfer O&M - Maintenance planning and its implementation - Monitoring and follow-up	- RPM/PM, IDO, EA, WS, DA, DOA/DAD staff, - FO, FCG, Member Farmer	- IE、Galgamuwa ITI、External sources - RPM/PM, IDO, DA
D Water Management	1. Proper Water Management at D-	- Water management schedule at D- and F-canal level is prepared by FOs.	- Importance of water management and role of water	- Awareness on water management	- IE, RPM/PM, IDO, DA, DOA/DAD staff,	- Galgamuwa ITI、External sources

Table 5.2.1 Training Items by Categories and Sub-Categories (4/9)

Category	Sub-Categories	Activities	Result	Training Items	Trainee	Trainer
	and F-canal level	- Irrigation water is distributed by FOs and government field staff in accordance with the schedule. - Water management practice is monitored by FOs and government field staff (discharge recording and information sharing). - Water is managed based on the monitoring result. - Facilities are improved by FOs, if necessary, based on field condition and previous water management - Necessity on drainage improvement is studied by FOs.	master (Jalapalaka) are understood by farmers. - Irrigation schedule is prepared and adjusted based on the monitoring & evaluation result - Gate operation & water measurement are carried out for monitoring of water issue. . - Water management among D- and F-canal level is improved and water is equitably allocated. - Drainage plan is prepared corresponding to the needs for the promotion of OFC and vegetable cultivation.	- Preparation of irrigation schedule - Gate operation, monitoring (discharge measurement, recording and reporting), rotational irrigation & role water master (Jalapalaka) - Drainage improvement	- FO, FCG, Member Farmer , Community member	- IE, RPM/PM, IDO, DA
	2. Formation & strengthening of Water Management Sub-Committee (WMSC) in FO	- The importance of irrigation water is understood by FO leaders, FCG leaders and member farmers. - Water master (FO Jalapalaka) is appointed so as to establish water management sub-committee for water management. - Rule of water management and job description is prepared and agreed among FOs.	- Rotational irrigation is carried out in accordance with the schedule. - Salaris is appropriately paid by FOs. - Water use coordination is carried out among FO members.	- Awareness program - Operation of water management sub-committee - Collection of O&M fee and management & operation of O&M fund - Rotational irrigation & role of water master (Jalapalaka)	- IE, RPM/PM, IDO, DA, DOA/DAD staff, - FO, FCG, Member Farmer, Community member	- Galgamuwa ITI、External sources - IE, RPM/PM, IDO, DA
	3. Coordination of water management at scheme level	- Water issue schedule in each season is prepared based on previous monitoring & evaluation result, tank storage and	- Importance of water management at scheme level is understood.	- Awareness program - Preparation of system-level	- DS Staff, IE, RPM/PM, IDO, DA, DOA/DAD staff,	- Galgamuwa ITI、External sources

Table 5.2.1 Training Items by Categories and Sub-Categories (5/9)

Category	Sub-Categories	Activities	Result	Training Items	Trainee	Trainer
		the decision by water panel. - Water issue schedule in each season is presented and discussed in pre-Kanna and Kanna meetings. - Water management is conducted and monitored based on abovementioned plan and coordinated by PMC. - Irrigation area and water distribution schedule is monitored using GIS.	- Water management method is established. - Water consumption in Maha season is reduced so as to increase available water in Yala season thereby increasing overall irrigation area.	water management plan - Pre-Kanna and Kanna meeting function - Water management monitoring using GIS - Water management monitoring - Tank management - Water use coordination during drought period	- FO, FCG, Member Farmer	- IE, RPM/PM, IDO, DA
E Agriculture Production	1. Procurement of Credit, Inputs, Bulk Purchasing, and Machinery	- Formation and management of farmers' group - Procurement of credit, bulk purchasing of inputs, machinery arrangement	- Credit, inputs, machinery are procured smoothly.	- Awareness on accessibility of credit, input, machinery - Group management - Record keeping for farmers group	- RPM, IDO, AI, DO, ARPA	- In-Service Training Institute MI (RRDI, FCRDI) - FMTC
					- FO, FCG, Farmers Group, Member Farmer	- RPM, IDO, AI, DO, ARPA
	2. Tract Demonstration of Crop Cultivation t	- Preparation of crop production plan - Selection of suitable variety and use of quality seeds - Maintaining of soil fertility, proper application of fertilizer, and production & use of organic fertilizer - Application of IPM for proper plant protection, and minimization of agro-chemicals	- Sustainable effects of tract demonstration are remained at farmers' level. - Productivity of paddy production is improved.	- Production plan - Land preparation - Soil fertility conservation - Plant nutrition - Plant protection - Post harvest - Pre-Seasonal Training - Study tour to advance area - Farm mechanization	- AI, ARPA - FO, FCG, Farmers Group, Member Farmer	- ISTI MI (RRDI, FCRDI) - FMTC Anuradhapura - AI, SMO, Segment AO
	3. Seed Paddy Production	- Registration of seed farmers group - Seed farm management - Field inspection by DOS staff - Seed testing and certification procedure	- Quality seed paddy is produced in the FO farmers' plots - Quality of self seed (secondary seed) is improved, and production is increased. - Production & supply of certified seed is increased.	- Self seed production	- FO, FCG, Farmers Group, Member Farmer	- In-Service Training Institute MI - SMS, AI, SMO

Table 5.2.1 Training Items by Categories and Sub-Categories (6/9)

Category	Sub-Categories	Activities	Result	Training Items	Trainee	Trainer
	4. Post-Harvest	- Selection of variety and use of quality seed - Use of equipments - Minimization of post-harvest loss, and Improvement of paddy quality	- Harvest loss is minimized and quality is improved.	- Improvement of paddy quality	- FO, FCG, Farmers Group, Member Farmer	- ISTI MI & FMTC, - SMS, AI, IPHT
	5. Crop Diversification	- Selection of suitable area - Crop selection based on adaptability, production cost, marketability - Involvement of younger generation	- Crop Diversification is expanded	- Crop diversification - Vegetable cultivation - IPM in vegetables - Pre-Seasonal Training - Study tour to advance area	- SMO, AI, ARPA - FO, FCG, Farmers Group, Member Farmer	- ISTI MI & FMTC - SMS, AI, SMO
	6. Other Farm Income	- Involvement of women and younger generation	- Off-farm income is increased	- Animal husbandry - Mushroom cultivation - Home gardening - Food preservation	- FO, FCG, Farmers Group, Member Farmer	- SMS, AI, SMO, Veterinary Surgery (VS), Livestock Development Instructor
	7. Monitoring & Evaluation in Extension Services	- Data collection in the field, - Facilitation to farmers, - Communication with extension workers - Follow-up based on the evaluation results	- Activities are improved - Effect of training and demonstration is remained at farmers' level.	- Role of extension agents as a facilitator - Extension communication - Principles of Farm Management - Monitoring of field program	- SMO, AI, Segment AO	- ISTI MI, FMTC, IPHT
F Marketing	1. Group Activity Promotion	- Farmers are trained for understanding the importance of group activity. - Techniques on community participatory action plan are disseminated. - Study tour to group activity developed area is organized.	- Importance of group activity is understood among FOs. - Action plan is prepared through community participation. - Accounting book keeping is properly carries out for managing group activity.	- Group activity - Financial management - Study tour	- FO, FCG, Member farmers, wholesalers	- IPHT NGO, Private sector

Table 5.2.1 Training Items by Categories and Sub-Categories (7/9)

Category	Sub-Categories	Activities	Result	Training Items	Trainee	Trainer
	2. Marketing & Processing of Paddy	- Farmers are trained for financial management for paddy marketing. -- Paddy storage is planned and designed through community participatory approach. - Scientific method of grain storage is introduced. - Grain quality management method is introduced including methods of sampling. - Study tour is organized for money saving and O&M of warehouse.	- Importance of accounting is understood by FOs. - Financial management is properly carried out by FOs. - Storage facilities for paddy are constructed. - Grain quality is improved through properly storing paddy in the warehouse.	- Facilitation of money saving - Operation and maintenance of warehouse	- FO, FCG	- FO, FCG Bank supported by the government DOA, IMD and District Government NGO, IPHT
	3. Open Paddy Market (OPM)	- Function and operation of OPM is introduced. - Paddy/rice quality and its control method are introduced. - Auction system for paddy and rice is introduced. - Study tour is organized for visiting OPM developed area.	- OPM is operated and managed. - Financial management is properly conducted by FOs for O&M of OPM. - Auction system for paddy & rice is introduced - Price formation is opened to the farmers and buyers. .	- Open paddy market (OPM) operation and maintenance - Study tour	- Rice millers, paddy collectors	- District Government, Operation Committee, NGO, NPO IPHT
	4. Market Information & Dissemination for OFC, Vegetables & Fruits	- Market information such as price fluctuation and its background for OFC, vegetables and fruits is collected and analyzed. - Supply and demand situation is surveyed and analyzed. - Techniques on keeping collected information is introduced	- Market information for OFC, Vegetables & Fruits is accumulated. - Such information is extensively shared among Farmers for shipping coordination. - Information is properly recorded and kept.	- Market information and dissemination	- FO, FCG, Collectors, wholesalers,	- Government Agency - FO, FCG

Table 5.2.1 Training Items by Categories and Sub-Categories (8/9)

Category	Sub-Categories	Activities	Result	Training Items	Trainee	Trainer
	5. Zoning Policy for Vegetable & Fruits	- The importance of policy on zoning and its regulation system is disseminated to related-government staff. - Knowledge on zoning policy and its regulation is disseminated to related-government staff. - Study tour is organized for zoning policy.	- Knowledge on zoning policy and its regulation is accumulated among the government staff - Policy on zoning and its regulation system is prepared for promotion of OFC, vegetable and fruits promotion. - Buffer system and facilities are established and effectively functioned.	- Zoning policy for vegetable and fruits	- DOA	- Overseas training External sources
	6. Minimization of Post-harvest Loss for OFC, Vegetables & Fruits	- Post harvest technology of grains, vegetable/fruits is introduced and disseminated. - Effectiveness of delivery box to minimize conveyance losses is introduced and disseminated.	- Post harvest technology of grains, vegetable/fruits is understood and utilized by relevant parties. - Post harvest loss is reduced by using new technologies. - Effectiveness of new delivery box such as plastic box and carton box is understood by farmers. - Such boxes are utilized for shipping thereby minimizing delivery losses.	- Minimization of post-harvest loss - Delivery box promotion	- FO, FCG, Collectors, wholesalers, transporters and retailers	- Government Agency External Sources - Institute of Post Harvest Technologies
	7. Management of Economic Center (Tambuttegama Wholesale Market)	- Activation skill of whole sale market is introduced and disseminated. - Incentive application for the activation is planned and introduced.	- Management skills on economic center is understood by relevant parties. - Incentive mechanism is established and functioned to attract seller and consumers.	- Management of economic center	- Thumbutegama E.C., farmers FCG, FO, buyers	- Ministry of Rural Industry, District Government

Table 5.2.1 Training Items by Categories and Sub-Categories (9/9)

Category	Sub-Categories	Activities	Result	Training Items	Trainee	Trainer
	8. Other Income Generation	- Group activities for value addition generation are promoted. - Food processing technologies are introduced. - Importance of food hygiene and quality control of products are disseminated by Farmers.	- Group activities for value addition generation are sufficiently carried out. - Food processing activities are promoted. - Importance of food hygiene and quality control of products are understood by Farmers. - Food hygiene and quality of products are improved.	- Value addition and food processing	- FO, FCG	- IPHT, NGO FO, FCG Private sector

Table 5.2.2 List of Training Curriculums, Course and Modules (1/7)

Training Curriculum	Training Course	Training Module	Target Group / Trainee	Agency in Charge	Trainer
A Awareness on Training, Facilitation and Training Management	A1 Awareness on Training	A1-1 Awareness Seminar on Training at Central, Province and District Level	Senior Officials at Head Office, Provincial Councils & Districts	Training Advisory Committee	Out-source personnel
		A1-2 Awareness Workshop on Training at Scheme & DS Division	Site Officials (IE Office, RPM Office, ASC Office, DS Office)	Galgamuwa ITI, ID/IMD	Counterpart / Out-source personnel
		A1-3 Awareness Workshop on Training at FO & Community	FO & Community Members, GN Office	RPM Office / IE Office	Site Officials, Counterpart / Out-source personnel
	A2 Facilitation Training	A2-1 Facilitation Seminar at Central, Province and District Level	Senior Officials at Head Office, Provincial Councils & Districts	Training Advisory Committee	Out-resource personnel
		A2-2 Facilitation Training at Scheme & DS/GN Level	Site Officials (IE Office, RPM Office, ASC Office, DS Office)	Galgamuwa ITI, ID/IMD	Out-resource personnel
		A2-3 Facilitation Training at FO & Community	FO & FCG Leaders, Key Informant of Community	RPM Office / IE Office	Site Officials
	A3 Training Management	A3-1 Training of Trainers	IE, EA, RPM, PM, IDO, AI, ARPA, EA	Galgamuwa ITI	Out-resource personnel / Counterpart
		A3-2 Communication Management	(Same as above)	(Same as above)	(Same as above)
		A3-3 Management of Training Function	(Same as above)	(Same as above)	(Same as above)
B Strengthening of Farmers Organization	B1 Awareness Programme for Participatory Community Development Approach	B1-1 Awareness Seminar at Central, Province and District Level	Senior Officials at Head Office, Provincial Councils & Districts	Training Advisory Committee	Out-source personnel
		B1-2 TOT for Awareness Workshop at Scheme and DS Division Level	Site Officials (IE Office, RPM Office, ASC Office, DS Office)	Galgamuwa ITI	Out-resource personnel / Counterpart
		B1-3 Awareness Workshop at FO and Community & Study Tour to Advance Area	FO & Community Members, GN Office	RPM Office / IE Office	Site Officials
	B2 Preparation of Community Development Plan	B2-1 TOT for Preparation of Community Development Plan	Site Officials (IE Office, RPM Office, ASC Office, DS Office)	Galgamuwa ITI	Out-source personnel / Counterpart
		B2-2 Approach and Preparation of Community Development Plan & Study Tour to Advance Area	FO and Community Members	RPM Office / IE Office	Site Officials

Table 5.2.2 List of Training Curriculums, Course and Modules (2/7)

Training Curriculum	Training Course	Training Module	Target Group / Trainee	Agency in Charge	Trainer
	B3 Institutional Management of FO, FCG & Farmers Group	B3-1 TOT for Institutional Management	Site Officials (IE Office, RPM Office, ASC Office, DS Office)	Galgamuwa ITI	Out-source personnel / Counterpart
		B3-2 Institutional Management of Organization & Group & Study Tour to Advance Area	FO and Community Members	RPM Office / IE Office	Site Officials
	B4 Financial Management of FO	B4-1 TOT for Management of Fund in FO	Site Officials (IE Office, RPM Office, ASC Office, DS Office)	Galgamuwa ITI	Out-source personnel / Counterpart
		B4-2 Management of Fund (including Irrigation O&M Fund and Revolving Fund) & Study Tour to Advance Area	FO and Community Members	RPM Office / IE Office	Site Officials
C Improvement of Facilities Maintenance at D- & F-Canal Level	C1 Assessment of Facilities Function for Rehabilitation	C1-1 TOT for Assessment of Facility Function of Facilities	Site Officials (IE Office, RPM Office, ASC Office, DS Office)	Galgamuwa ITI	Out-source personnel / Counterpart
		C1-2 Awareness on Assessment of Facilities & Study Tour to Advance Area	FO and Community Members	RPM Office / IE Office	Site Officials
		C1-3 Field Survey, Data Collection & Record, Assessment of Facility Function	(Same as above)	(Same as above)	(Same as above)
		C1-4 Database Management& Data Updating using GIS	Site Officials (IE Office, RPM Office, ASC Office, DS Office)	Galgamuwa ITI ID Head Office	Out-source personnel / Counterpart
	C2 Community Participatory Rehabilitation	C2-1 TOT for Community Participatory Rehabilitation	Site Officials (IE Office, RPM Office, ASC Office, DS Office)	Galgamuwa ITI	Out-source personnel / Counterpart
		C2-2 Rehabilitation Planning, Contract Management, Construction Management & Quality Control of Rehabilitation Work & Study Tour to Advance Area	FO and Community Members	RPM Office / IE Office	Site Officials
		C2-3 Financial Management of Rehabilitation Work	(Same as above)	(Same as above)	(Same as above)
		C2-4 Facilities Information Management using GIS	Site Officials (IE Office, RPM Office, ASC Office, DS Office)	Galgamuwa ITI ID Head Office	Out-source personnel / Counterpart

Table 5.2.2 List of Training Curriculums, Course and Modules (3/7)

Training Curriculum	Training Course	Training Module	Target Group / Trainee	Agency in Charge	Trainer
	C3 Transfer of O&M Responsibility to FO	C4-1 TOT for Transfer of O&M Responsibility	Site Officials (IE Office, RPM Office, ASC Office, DS Office)	Galgamuwa ITI	Out-source personnel / Counterpart
		C4-2 Awarenes on Transfer O&M Responsibility	FO and Community Members	RPM Office / IE Office	Site Officials
		C2-3 Maintenance Planning of Irrigation Facilities, and Its Implementation (Setting & Collection of O&M Fee, Management of O&M Fund, Transparent Accounting)	(Same as above)	(Same as above)	(Same as above)
		C4-4 Follow-up and Monitoring & Evaluation	Site Officials (IE Office, RPM Office, ASC Office, DS Office)	Galgamuwa ITI	Out-source personnel / Counterpart
D Improvement of Water Management	D1 Proper Water Management at D- & F-Canal Level	D1-1 TOT for Proper Water Management	Site Officials (IE Office, RPM Office, ASC Office, DS Office)	Galgamuwa ITI	Out-source personnel / Counterpart
		D1-2 Awareness on Water Management & Study Tour to Advance Area	FO and Community Members	RPM Office / IE Office	Site Officials
		D1-3 Irrigation Scheduling	FO Members	(Same as above)	(Same as above)
		D1-4 Gate Operation, Water Measurement, Rotational Irrigation and Role of Water Master (Jalapalaka)	(Same as above)	(Same as above)	(Same as above)
		D1-5 Drainage Improvement	FO and Community Members	(Same as above)	(Same as above)
	D-2 Formation & Strengthening of Water Management Sub-Committee (WMSC) in FO	D2-1 TOT for Formation & Strengthening of WMSC	Site Officials (IE Office, RPM Office, ASC Office, DS Office)	Galgamuwa ITI	Out-source personnel / Counterpart
		D2-2 Formation, Strengthening and Role of WMSC	FO Members	RPM Office / IE Office	Site Officials
	D3 Coordination for Water Management at Scheme Level	D3-1 Awareness on Coordination for Water Management at Scheme Level	Site Officials (IE Office, RPM Office, ASC Office, DS Office)	Galgamuwa ITI	Out-source personnel / Counterpart
		D3-2 Water Management at Scheme Level (including monitoring, Tank Operation, Monitoring,	(Same as above)	(Same as above)	(Same as above)

Table 5.2.2 List of Training Curriculums, Course and Modules (4/7)

Training Curriculum	Training Course	Training Module	Target Group / Trainee	Agency in Charge	Trainer
		Coordination during Drought Period)			
		D3-3 Function & Management of Pre-Kanna & Kanna Meeting	(Same as above)	(Same as above)	(Same as above)
		D3-4 Awareness on Water Management at Irrigation Scheme Level	FO and Community Members	RPM Office / IE Office	Site Officials
		D3-5 Monitoring using GIS	Site Officials (IE Office, RPM Office, ASC Office, DS Office)	Galgamuwa ITI ID Head Office	Out-source personnel / Counterpart
E Activation of Agriculture Production	E1 Procurement of Credit, Inputs, Bulk Purchasing, Machinery	E1-1 TOT for Awareness on Accessibility to Credit, Input, Machinery	Site Officials (IE Office, RPM Office, ASC Office)	Training Institutes arranged by through Galgamuwa ITI	Out-source personnel/ Counterpart
		E1-2 Awareness on Accessibility to Credit, Input, Machinery, and Study Tour to Advanced Area	FO & FCG Members	(Same as above)	Out-source personnel/ Site Officials (AI),
	E2 Tract Demonstration of Crop Cultivation	E2-1 TOT for Crop Plan, Overall Farm Management & Pre-Seasonal Training	Site Officials (IE Office, RPM Office, ASC Office)	Training Institutes arranged by through Galgamuwa ITI	Out-source personnel, Counterpart
		E2-2 Awareness for Cropping Plan & Farm Management, and Study Tour to Advanced Area	FO & FCG Members	(Same as above)	Out-source personnel, Site Officials (, SMO, Segment AO)
		E2-3 Land Preparation, Soil Fertility, Plant Nutrition	(Same as above)	(Same as above)	(Same as above)
		E2-4 Plant Protection	(Same as above)	(Same as above)	(Same as above)
		E2-5 Post Harvest	(Same as above)	(Same as above)	(Same as above)
		E2-6 Farm Mechanization	(Same as above)	(Same as above)	(Same as above)
		E2-7 Follow-up of Tract Demonstration	(Same as above)	(Same as above)	(Same as above)
	E3 Seed Paddy Production	E3-1 TOT for Self Seed Production	Site Officials (IE Office, RPM Office, ASC Office)	Training Institutes arranged by through Galgamuwa ITI	Out-source personnel, Counterpart
		E3-2 Self Seed (Secondary Seed) & Certified Seed Production, and Study Tour to Advanced Area	FO & FCG Members	(Same as above)	Out-source personnel, Site Officials (AI & SMO)

Table 5.2.2 List of Training Curriculums, Course and Modules (5/7)

Training Curriculum	Training Course	Training Module	Target Group / Trainee	Agency in Charge	Trainer
	E4 Post Harvest	E4-1 TOT for Improvement of Paddy Quality, and Study Tour to Advanced Area	Site Officials (IE Office, RPM Office, ASC Office)	Training Institutes such as IPHT arranged by through Galgamuwa ITI	Out-source personnel, Counterpart
		E4-2 Improvement of Paddy Quality	FO & FCG Members	(Same as above)	Out-source personnel, Site Officials (AI & IPHT)
	E5 Crop Diversification	E5-1 TOT for Crop Diversification, Vegetable Cultivation, IPM in Vegetables, Pre-Seasonal Training	Site Officials (IE Office, RPM Office, ASC Office)	Training Institutes arranged by through Galgamuwa ITI	Out-source personnel, Counterpart, Expert
		E5-2 Awareness on Crop Diversification , and Study Tour to Advanced Area and Markets	FO & FCG Members	(Same as above)	Out-source personnel, Site Officials (AI & SMO)
		E5-3 Vegetable Cultivation and IPM	(Same as above)	(Same as above)	(Same as above)
	E6 Other Farm Income Generation	E6-1 TOT for Other Farm Income Generation Activities	Site Officials (IE Office, RPM Office, ASC Office, APH)	Training Institutes such as IPHT arranged by through Galgamuwa ITI	Out-source personnel, Counterpart, Expert
		E6-2 Other Farm Income Generation Activities such as (Animal Husbandry, Mushroom Cultivation, Home Gardening, Food Preservation)	FO & FCG Members	(Same as above)	Out-source personnel, Site Officials (AI, VS & LDI)
	E7 Monitoring & Evaluation in Extension Service	E7-1 Role of Extension Agents as a Facilitator and Extension Communication	Site Officials (IE Office, RPM Office, ASC Office, SMO, AI, Segment AO)	Training Institutes (ISTI MI & Gannoruwa) arranged by through Galgamuwa ITI	Resource Personnel from Training Institute (ISTI MI & Gannoruwa), Counterpart
		E7-2 Farm Management	(Same as above)	(Same as above)	(Same as above)
		E7-3 Monitoring & Evaluation of Field Programme	(Same as above)	(Same as above)	(Same as above)
F Activation of Marketing & Processing	F1 Group Activities for Marketing & Processing	F1-1 TOT for Strengthening & Management of Group Activities	Site Officials (IE Office, RPM Office, ASC Office, DS Office), NGO	Training Institutes (IPHT & ARTI) arranged by through Galgamuwa ITI	Out-source personnel, Site Officials (AI)
		F1-2 Awareness on Group Activities & Sales, and Study Tour to Advanced Area and Market	FO & FCG Members, Women Members in Community	(Same as above)	Site Officials (AI), Counterpart, NGO

Table 5.2.2 List of Training Curriculums, Course and Modules (6/7)

Training Curriculum	Training Course	Training Module	Target Group / Trainee	Agency in Charge	Trainer
		F1-3 Management of Group Activiries	(Same as above)	(Same as above)	(Same as above)
	F2 Marketing & Processing of Paddy	F2-1 TOT for Facilitation of Money Saving and Operation & Maintenance of Multi-Purpose Warehouse	Site Officials (IE Office, RPM Office, ASC Office), NGO	Training Institutes such as IPHT arranged by through Galgamuwa ITI	Out-source personnel, Counterpart
		F2-2 Awareness & Facilitation on Saving and Revolving Fund Formation, and Study Tour to Advanced Area	FO & FCG Members	(Same as above)	Out-source personnel, Site Officials (AI & ARPA), NGO
		F2-3 Construction & Utilization of Multi-Purpose Warehouse, and Study Tour to Advanced Area and Market	(Same as above)	(Same as above)	(Same as above)
	F3 Open Paddy Market	F3-1 TOT for Open Paddy Market	Site Officials (IE Office, RPM Office, ASC Office, DS Office), NGO	Training Institutes such as IPHT arranged by through Galgamuwa ITI	Out-source personnel, Counterpart
		F3-2 Awareness on Open Paddy Market, and Study Tour to Advanced Area	FO & FCG Members, Rice Millers, Paddy Collectors	(Same as above)	Out-source personnel, Site Officials (AI & ARPA), NGO
		F3-3 Establishment & Operation of Open Paddy Market	(Same as above)	(Same as above)	(Same as above)
	F4 Market Information & Dissemination for OFC, Vegetables & Fruits	F4-1 TOT for Dissemination of Market Information	Site Officials (IE Office, RPM Office, ASC Office, DS Office), NGO	Training Institutes such as IPHT & ARTI arranged by through Galgamuwa ITI	Out-source personnel, Counterpart
		F4-2 Dissemination of Market Information, and Study Tour to Market	FO & FCG Members, Collectors, Wholesalers	(Same as above)	Site Officials (AI & ARPA), NGO
	F5 Zoning Policy for Vegetables & Fruits	F5-1 Policy on Zoning and Its Regulation System	Senior Officials at Head Office & Local Government, Site Officials (IE Office, RPM Office, ASC Office, DS Office)	Training Institutes such as IPHT & ARTI arranged by through Galgamuwa ITI	Out-source personnel, Counterpart
		F5-2 Buffer System and Facilities	(Same as above)	(Same as above)	(Same as above)

Table 5.2.2 List of Training Curriculums, Course and Modules (7/7)

Training Curriculum	Training Course	Training Module	Target Group / Trainee	Agency in Charge	Trainer
		F5-3 Study Tours to Particular Production Zones	(Same as above)	(Same as above)	(Same as above)
	F6 Minimization of Post-Harvest Loss for OFC, Vegetables & Fruits	F6-1 TOT for Minimization of Post-Harvest Loss	Site Officials (IE Office, RPM Office, ASC Office, DS Office), NGO	Training Institutes such as IPHT & ARTI arranged by through Galgamuwa ITI	Out-source personnel, Counterpart
		F6-2 Awareness on Post-Harvest Loss, and Study Tour to Advanced Area and Market	FO & FCG Members, Collectors, Wholesalers	(Same as above)	Site Officials (AI & ARPA), NGO
		F6-3 Delivery Box Promotion	(Same as above)	(Same as above)	(Same as above)
	F7 Activation of Economic Center (Tambuttegama Wholesale Market)	F7-1 Management of Economic Center	Site Officials (IE Office, RPM Office, ASC Office, DS Office), NGO	Training Institutes such as IPHT & ARTI arranged by through Galgamuwa ITI	Out-source personnel, Counterpart
		F7-2 Awareness on Wholesale Market and Economic Center, and Study Tour to Advanced Area	FO & FCG Members, Collectors, Wholesalers	(Same as above)	Site Officials (AI & ARPA), NGO
	F8 Other Income Generation	F8-1 TOT for Value Addition and Food Processing	Site Officials (IE Office, RPM Office, ASC Office, DS Office), NGO	Training Institutes (IPHT & ARTI) arranged by through Galgamuwa ITI	Out-source personnel, Counterpart
		F8-2 Awareness on Value Addition and Food Processing, and Study Tour to Advanced Area and Market	FO & FCG Members, Women Members in Community	(Same as above)	Site Officials (AI & ARPA), NGO

Table 5.2.3 Preliminary Assessment of Capacity of Government Agencies and FO

	Major Roles to FO Identified by FO	Performance	Reasons Observed
IMD	- Coordination in line agencies	- Not good	- Difficulties to arrange line agencies' support due to less clear power of IMD - Lack of integrated Monitoring & Evaluation system
	- Support to solve FO's problems (institution)	- Sometimes solved, but difficult	- But reasonable within existing staffs, particularly administration - Lack of coordination in line agencies
ID	- Maintenance & rehabilitation work	- Not good	- But reasonable within budget provided - Lack of practical knowledge & skill among young technical staffs
	- Water management	- Not good	- Lack of practical knowledge & skill in FO and yound technical staffs - Poor condition of the facilities, Lack of motivation
ASC (DAD)	- Fertilizer distribution	- Working, but not enough	- Difficulties to confirm membersship due to improper document management - No sufficient stocks on time. Lack of FO' s group purchase
	- Credit provided	- Working, but not enough	- Difficulties to arrange loan resource - Lack of FO' s own activities
DOA (AI)	- Technical assistance (demonstration)	- Not sufficient	- But on average in the country. Lack of transportation and teaching material - Lack of follow up, Delayed transfer technology from research centers to field staffs
	- Training programme provided	- Not good	- But on average in the country. Lack of transportation and teaching material - Lack of follow up, Delayed transfer technology from research centres to field staffs
DS	- Land issue	- Sufficient, but takes time	- Delayed decision making, Problems between the central and provisional administration
	Major Roles of FO		**Reasons Observed**
FO	- O&M for D- & F-canal	- Not good	- Lack of ownership of D- & F-canal, Lack of knowledge & skill - Lack of FO' s unity (social capital)
	- Rehabilitation works	- Not good	- Lack of ownership of D- & F-canal, Lack of knowledge & skill - Lack of FO' s unity (social capital)
	- Basic management	- Not good	- Inactive FOs' activities, Lack of the unity, no confirmation of membership - Lack of understanding about basic management due to less trainings & understanding
	- Income generation activities	- Very limited	- Pre-mature as organization to deal with complicated activities - Lack of vision and experience for income generation activities in FO

Poor coordination in line agencies (Ambiguous locus of responsibility)

Lack of FO's ownership (Lack of facilitation)

Insufficient practical knowledge and skill through practical experience

Source: JICA Study Team

Table 5.2.4 Project Design Matrix: Plan to Increase the Capacity of Integrated Management in Irrigation Secto

Narrative Summary	Objectively Verifiable Indicators	Mean of Verification	Important Assumptions
Overall Goal At the D & F-Canal level of the schemes under the PEACE Project, O&M of irrigation facilities and water management are properly conducted through increasing the capacity of integragted management of the officials and Farmers' Organizations (FOs), and agricultural production and marketing of agricultural products are activated, then farmers' income increases.	- Frequency and participants of trainings - Condition of irrigation facilities at D & F-canal level - Gate operation at D & F-canals - Income of farm household	- Training record - Maintenance record - Water management record - Socio-economic survey	- No such serious disaster like severe drought occurs. - Policy of the government not hinder implementation of the project.
Project Purpose At the D & F-Canal level of the schemes in the Pilot Area of Nachchaduwa, Thuruwila and Rajangana Irrigation Schemes, O&M of irrigation facilities and water management are properly conducted through increasing the capacity of integragted management of the officials and Farmers Organizations, , and agricultural production and marketing of agricultural products are activated, then farmers' income increases.	- Frequency and participants of trainings - Condition of irrigation facilities at D & F-canal level - Gate operation at D & F-canals - Income of farm household	- Training record - Maintenance record - Water management record - Socio-economic survey	- No drastic change to social condition in the Pilot Areas.
Outputs 1. Training is well managed. 2. Farmers' Organizations are strengthened. 3. Maintenance of irrigation facilities at D & F-canals is improved. 4. Water management at D & F-canals is improved. 5. Crop are cultivated according the land use plan. 6. Multi-purpose storages are constructed and utilized.	- Demand driven training conducted based on Training Need Assessment and result of Monitoring & Evaluation. - Memebership of Farmers' Organization, and Progress of Community Action Plan. - Rehabilitation result and progress of maintenance of irrigation facilities. - Proper gate operation according to the water issue schedule. - Progress of crop diversification. - Marketing opptunity and bargening power of farmers.	- Training record at site, scheme and ITI Galgamuwa - Record of monthly meeting for FO level Working Group - Completion certificate of rehabilitation, maintenance record - Gate operation record and water issue schedule. - Land use survey and monitoring. - Operation record of storage, sales record of farmers group.	- Govern organization and agencies do not change drastically. - Government policy on water management does not change.
Activities 1. Training Management 1.1 Training Organization is established. 1.2 Importance of training is understood. 1.3 Facilitation training is conducted. 1.4 Training management is strenthened. 2. Farmers' Organizations 2.1 Community Participatory Approach is understood. 2.2 Community Development Plan & Community Action Plan are prepared. 2.3 Institutional and Financial Management is enhanced. 3. O&M of Irrigation Facilities at D & F-Canals 3.1 Function of irrigation facilities is assessed. 3.2 Community Participatory Rehabilitation is carried out. 3.3 O&M responsibility is transferred. 4. Water Management at D & F-Canals 4.1 Proper water management is carried out. 4.2 Water management sub-committee is established and strengthened. 4.3 Water management at scheme level is coordinated. 5. Croppiong based on Land Use Plan at Farmers' Level 6. Multi-Purpose Storage	Inputs Japan (1) Long Term Expert (2) Short Term Expert (3) Training equipment and materials (4) Study Tours to Advanced Area (5) Rehabilitation of D & F-canals level in Pilot Areas (6) Construction of Multi-Purpose Storage (7) Baseline Survey, Monitoring & Evaluation	Sri Lanka 1 Appointment of Counterpart 2 Setting up of 1) Training Advisory Committee (TAC) at central level & 2) FO Level Working Group at site, and involvement of Project Management Committee (PMC) at scheme level 3 Arrangement of office space and equipment in ITI Galgamuwa and RDI Office 4 Arrangement of transportation for counterpart / site officials, materials and inputs for training & demonstration 5 Per diem for counterpart	- Cunterpart trained under the project remains in the counterpart agencies. - Community development is given to high priority. Pre-conditions - Necessary counterpart and budget are allocated.

Table 5.2.5 Plan of Operations: Plan to Increase the Capacity of Integrated Management in the Irrigation Sector (1/2)

Activities	Expected Results	Time Schedule (Year) 1st 2nd 3rd 4th 5th	Agencies	Input	Remarks
1. Training Management					
1.1 Training Organization					
1.1.1 Establishment of Organization	- Training Advisory Committee (TAC) is established at central level. - Project Management Committee (PMC) is enhanced at scheme level. - FO Level Working Group (FLWG) is established at each Pilot Area.		- ID, IMD - TAC - PMC	- Out-source Personnel - Counterpart - Site Officials	- Periodical meeting
1.1.2 Reinforcement of Irigation Training Institute (ITI) Galgamuwa	- Staff of ITI Galgamuwa is increased and trained.		- ITI Galgamuwa	- Out-source Personnel - Counterpart	- Monitoring & evaluation, and follow-up are associated.
1.1.3 Preparation of Implementation Plan	- Implementation Plan is prepared, expalined to TAC / PMC / FLWG. - Implementation Plan is agreed by TAC / PMC / FLWG. - Implementation Plan is revised agreed by TAC / PMC / FLWG.		- ID, IMD	- Out-source Personnel - Counterpart - Site Officials	
1.1.4 Bench Mark Survey	- Bench Mark Survey is conducted in the Pilot Areas, and evaluated.		- ID, IMD	- Counterpart/Site Officials	- Assisted by Out-source Presonnel
1.2 Awareness of Training	- Importance of training is understood by senior officers & site officers, and training is supported.		- ID, IMD	- Out-source Personnel - Counterpart	- Follow-up is required.
1.3 Facilitation Training	- Attitude of the Officials is changed from "administration" to "facilitation".		- ITI Galgamuwa	- Out-source Personnel - Counterpart	
1.4 Training Management	- Trainings are managed as "Demand Oriented Training"based on "Training Need Assessment". - Experience and lesson learnt in the Pilot Area are accumulated in ITI Galgamuwa. - Trainings and materials are improved at ITI Galgamuwa based on the experience and lesson learned. - Improved Trainiings are extended to other areas and schemes.		- ITI Galgamuwa, RPM Office, IE Office	- Out-source Personnel - Counterpart	
2. Farmers' Organiztion					
2.1 Awareness of Participatory Approach	- Principle and importance of participatory community development are understood.		- ITI Galgamuwa, RPM Office, IE Office, FO Level Working Group	- Out-source Personnel - Counterpart/Site Officials	- Monitoring & evaluation and follow-up
2.2 Community Development Plan	- Problems, objective and approach in the community are identified. - Community development plan and community action plan (CAP) are formulated. - Consensus of development plan and action plan is obtained. - Action plan is submitted to relevant organizations.		- RPM Office, IE Office, FO Level Working Group	- Counterpart/Site Officials - Study tours	- Assisted by Out-source Presonnel
2.3 Institutional and Financial Management	- Instiurional and finacial management of FO/Field Canal Group (FCG) is strengthened in transparancy manner.		- ITI Galgamuwa, RPM Office, IE Office, Site Working Group	- Counterpart/Site Officials	- Assisted by Out-source Presonnel
3. O&M of Irrigation Facilities at D & F-Canals					
3.1 Assessment of Irrigation Facilities	- GIS database is updated based on information of facilities. - Facilities are assessed based on GIS database. - Rehabilitation requirement is ratified and prioritized.		- ITI Galgamuwa RPM Office, IE Office FO Level Working Group	- Counterpart/Site Officials	- Assisted by Out-source Presonnel
3.2 Community Participatory Rehabilitation	- Rehabilitation work is carried out by Field Canal Groip, function of facilities is recovered, ownership mind of farmers is matured, O&M fund is established.		- RPM Office, IE Office, FO Level Working Group	- Counterpart/Site Officials - Study Tours Training Materials	- Assisted by Out-source Presonnel
3.3 Transfer of O&M	- O&M responsibility is transferred to FO & FCG. - Maintenance plan is prepared and executed. - O&M fee is set and collected, and O&M fund is managed in transparate manner. - Follow-up and monitoring & evaluation are conducted.		- RPM Office, IE Office, FO Level Working Group	- Counterpart/Site Officials	- Assisted by Out-source Presonnel

Table 5.2.5 Plan of Operations: Plan to Increase the Capacity of Integrated Management in the Irrigation Sector (2/2)

Activities	Expected Results	Time Schedule (Year) 1st 2nd 3rd 4th 5th	Agencies	Input	Remarks
4. Water Management at D & F-Canals					
4.1 Proper Water Management	- Irrigation schedule based on the water issue schedule of the scheme is prepared, executed and monitored. - Drainage plan is prepared according to the needs for other field crops and vegetables.		- ITI Gulgamuwa, RPM Office, IE Office FO Legel Woring Group	- Counterpart/Site Officials - Training Material - Study tours	- Assisted by Out-source Presonnel - Periodical follow-up
4.2 Water Management Sub-Committee	- Water Management Sub-Committee is formed, water master (Jalapalaka) is appointed, and water management is carried out.		- RPM Office, IE Office FO Level Working Group	- Counterpart/Site Officials - Training Material - Study tours	- Assisted by Out-source Presonnel - Periodical follow-up
4.3 Coordination at Scheme Level	- Pre-Kanna & Kanna Meeting are effectively organized. - Waste water is reduced and irrigation area in Yala season is increased. - Water management in the Pilot Areas are monitored using GIS.		- RPM Office, IE Office FO Legel Woring Group	- Counterpart/Site Officials - Training Material	- Assisted by Out-source Presonnel - Periodical follow-up
5. Cropping based on Land Use Plan at Farmers' Level					
5.1 Awareness on Land Use Plan 5.2 Preparation of Land Use Plan at Farmers' Level 5.3 Utilization of Land Use Plan	- Importance of land use planning is understood. - Land use plan is prepared according to soil distribution, drainage class and micro topography in the GIS database. - Crop are cultivated according to the land use plan		- Galgamuwa ITI. RPM Office, IE Office, FO Level Working Group	- Counterpart/Site Officials - Demonstration package - GIS analysis result - Training materials - Study tours	- Periodical follow-up - Trainiong institutes to be coordinated as ISTI MI & Gannuruwa, FMTC, RRDI, FCRDI, HORDI. - Vegetables cultivation in Nachchaduwa. - OFC (grains) cultivation in Rajangana.
6. Multi-Purpose Storage					
6.1 Awareness of Multi-Purpose Storage 6.2 Preparation of Multi-Purpose Storage Plan 6.3 Community Participatory Construction 6.4 Utilization of Multi-Purpose Storage 6.5 O&M of Multi-Purpose Storage 6.6 Monitoring & Evaluation of Operation	- Needs and importance of multi-purpose storage are identified. - Plan is prepared and ratified. - Multi-purpose storage is constructed thourhg community participation. - Farm inputs and products are purchased and sold in bulk using storage. - Storage is well maintained using benefit from bulk sales and purchase. - Follow up activities are carried out based on the resultu of Monitoring & Evaluation on operation of multi-purpose storage.		- FO Level Working Group, RPM Office, IE Office	- Counterpart/Site Officials - Construction cost - Training materials - Study tours	- Periodical follow-up - Trainiong institutes to be coordinated as IPHT