I. Introduction

Authority

01. This is the Final Report on the Study for Potential Realisation of Irrigated Agriculture in the Dry and Intermediate Zones of Sri Lanka (hereinafter referred to as "the Study") prepared in accordance with the Scope of Work (S/W) agreed upon between the Government of the Democratic Socialist Republic of Sri Lanka, represented by the Ministry of Irrigation and Power (MIP), and the Japan International Cooperation Agency (JICA) dated 26 October 1998. The Report presents the results of the Master Plan (M/P) and Feasibility Study (F/S) performed in Sri Lanka and Japan during the Study.

Progress of Field Works

02. The Study consists of the field works and the home works of Phase I for the Master Plan and the field works and the home works of Phase II for the Feasibility Study. The Study was performed from March 1999 until October 2000.

Objectives and Areas to be covered in the Study

03. The objectives of the Study are to prepare a Master Plan for the Potential Realisation of Irrigated Agriculture in the Dry and Intermediate Zones with the goal of achieving more profitable agriculture and higher standards of living for rural farm households through facility rehabilitation, efficient use of water with participatory management, improvement of support services for farmers including credit and marketing, and to conduct a Feasibility Study on selected priority projects. The area to be covered by the Study is estimated at about 6,500 km^2, extending over the four districts of Anuradhapura, Kurunegala, Puttalam, and Matale.

II. The Master Plan Study for Irrigation Schemes of the Study Area

2.1 Present Situation of the Study Area

Nature and Social Conditions

04. While the topography of the Study area is undulating to flat with a pre-dominant slope towards the west and northwest, there are variations in micro-topography. The terrain gradually descends towards the west into valleys and flood plains, with flat elevations rising gradually up to 60 m above msl. There are isolated peaks of erosional remnants in the south, with elevations up to 300 m above msl. The Study area is principally situated under three agro-ecological zones which are demarcated by the Department of Agriculture (DOA) as Low-country Intermediate zone 1 (IL1), Low-country Intermediate zone 3 (IL3) and Low-country Dry zone 1 (DL1) from the south to the north. The Study area has a tropical monsoon climate with a highly variable bi-modal rainfall pattern with the mean annual rainfall between 1,000 and 1,500 mm. The northeast monsoon period (Maha season) is between October and

March and the southwest monsoon (Yala season) is from April to September. The monthly temperatures range from 25-29°C.

05. The Study area comprises 30 Divisional Secretary (DS) Divisions, of which 12 are in the Anuradhapura district, 16 in the Kurunegala district, and one each in the Matale and Puttalam districts. The area had a population of around 1,275,000 in 1994. About 45% of the population is engaged in agricultural pursuits and approximately 25% is categorised as production and related workers. There are about 292,500 housing units in the area and the average household size is 4.3. In the Study area, farmland covers 63% of the area, and forestland 15%. The water area occupies about 7% of the area, which consists of mainly reservoirs/irrigation tanks. The remaining 15% is accounted for by grasslands, homesteads and other land uses.

Agriculture

06. Total cultivated area for paddy in the Study area, during 1996/97 Maha and 1997 Yala, is estimated to be 71,200 ha which consists of 26,700 ha for major and medium irrigation schemes, 28,200 ha for minor scheme, and 16,300 ha as rainfed. Cropping intensity of paddy cultivation in these seasons is estimated to be 96%. Anuradhapura district has shown higher unit yield, which is estimated at 4.2 tons/ha, in contrast to 3.2 tons/ha in the Kurunegala district.

07. Of the 30 kinds of other field crops (OFC) and vegetables being cultivated in the Study area, main crops grown are greengram, gingerly (sesame), and chilies in the Yala season, and maize, greengram, cowpea, black gram, cassava, and chilies in the Maha season. The yields and production of OFC grown in the area vary, mainly depending on the amount and the distribution of the rainfall. The yields of gingerly, chilies and greengram are estimated at 0.4 ton/ha, 3.5 tons/ha (green), and 0.4 ton/ha, respectively.

Irrigation and Drainage

08. There are some 4,700 schemes (67,000 ha) in the Study area including tanks, anicuts, and lift irrigation units. This includes 36 major irrigation schemes, which account for 40% of the irrigated area. The minor irrigation schemes support 120,400 farm holdings that operate some 40,200 ha.

09. In smaller irrigation tanks, the irrigation water released through the sluice is normally directed along a contour canal and fields are irrigated by a continuous flow of water. Larger reservoirs have more complex canal systems consisting of main, branch, distributaries, and field canals. Most of these are earthen canals, although a few lined canals have been introduced recently.

10. Farmers' organisations (FOs) manage the distributaries canal and below in the major irrigation schemes. The facilities below the tank are also managed by FOs and the tank is managed by either the Irrigation Department or by FOs. All minor

irrigation schemes are managed by farmers, under the technical guidance of the Provincial Engineering Department and the DAS. The operation and management by FOs in the major and medium schemes is subsidised by the Government. However, it is not enough to cover the entire O&M cost.

Marketing and Processing Facilities

11. Paddy is sold by the farmers to either assemblers or collectors and sent to millers or sometimes to country based millers. Millers buy paddy from assemblers or collectors normally at a firm price that is negotiated in line with market movements. On the other hand, each village has several small rice mills for paddy that is consumed within the area. Each village has also one or two grinding mills for chilies and corn.

12. As for marketing of OFC and vegetables, farmers in the area have three basic options: (i) rural Polas where local producers bring seasonal OFC and vegetables for sale to itinerant traders with lorries, (ii) collection points along roads or near major producing areas, and (iii) few local assembly markets. The Study area borders Dambulla, a major transhipment centre and many traders in Dambulla deal with OFC over the entire country.

Rural Infrastructure

13. In the Study area, approximately 60% of the households have access to drinking water from protected wells. In Kurunegala, Matale and Puttalam districts, a large number of wells were rehabilitated with IDA, UNICEF, GTZ and DANIDA (Denmark) funding. Road access is relatively developed in the populated areas of the Study area. The supply of electricity to areas around the provincial capitals and along the national roads is increasing rapidly. However, only 26% of the households in the whole Study area have access to electricity. Health infrastructure is relatively satisfactory, and educational facilities have met the basic rural requirement, quantitatively.

Farmers Organisation

14. Since the early 1990s, FOs have been established in each irrigation scheme of the Study area. The main objectives of the FOs in the area are to operate and maintain the irrigation facilities and to provide agricultural support services to the member farmers. In the Study area, FOs are now carrying out water management of D-canals and the system below it of the major schemes and all minor and medium schemes, although they are very poor in maintaining the facilities and providing support services.

Agricultural and Social Support Services

15. The introduction of the devolution policy in 1987 prompted the involvement of the Provincial Councils in development, and agricultural and rural development activities have currently been implemented both by the line agencies of the central

government and the institutions under the PCs in Sri Lanka. Among such institutions, the major institutions related to the present Project are as follows:

Agencies involved in the Project

Major Functions	Institutions
Irrigation Development & Management	Department of Irrigation Development
Irrigation Management	Irrigation Management Division
Crop Sub-sector Development & Extension	DOA, IPEU, PDO NCP & NWP
Livestock Sub-sector Development & Extension	PDAP&H, NCP & NWP
Inland Fisheries Sub-sector Development & Extension	NAQDA
Coconut Sub-sector Development & Extension	Coconut Cultivation Board
Farmer Supporting & Management of Minor Scheme	DAS, Anuradhapura & Kurunegala
Agricultural Research & Development	Research institutions of DOA, KARTI & others
Seed Production & Distribution	DOA, PDOA & private sector
Rural Credit Services	State & private banks, co-operatives etc.
Income Generation Support	NYSC, NAITA, SEDD, DS

Lesson Learned (Case Study)

16. There are many ongoing development projects related to the Study area at present. These projects incorporate "bottom up" initiatives by the participation of the beneficiaries. However, actual works at the field levels are carried out by a "top down" system. Farmers' attitudes on development is becoming passive and leading to increased dependence on the external organisations. The past development projects were inflexible in the matter of scheduling and budgeting. Projects are conducted according to the government intentions without considering farmers' opinions. Unsatisfied farmers are expecting other projects and their dependency is increasing.

2.2 Selection of Irrigation Schemes for Master Plan Study

17. The Master Plan Study is conducted in 100 schemes selected in the Study area. Selected schemes are eight major schemes, twelve medium schemes and eighty minor schemes. These are selected based on following four conditions and reviewed by the Ministry of Irrigation and Power: i) considering comprehensive water management, ii) excluding ongoing project scheme, iii) excluding small schemes less than 4 ha, and iv) considering cascade system in the minor scheme.

2.3 Inventory of Irrigation Schemes Selected for Master Plan Study

18. In order to grasp the present condition and problem of the irrigation schemes in the Study area, the Inventory Survey, Rapid Rural Appraisal (RRA) and the Questionnaire Survey were conducted. The inventory survey was conducted mainly for determining the present condition and problems of irrigation facilities, O&M and farmers' organisation. RRA was conducted to determine the for development needs of the community through the workshop by FO leaders and the questionnaire survey of 1,500 samples was for farming conditions and problems of individual farmers.

Present Conditions of Socio-economy

19. Total farm households and population in all the schemes are estimated at 25,300 and 113,000, respectively. Labour force among family members is defined as the members from age 15 years to 60 years. The average number of labour force in a farm household is 2.9. The population in all the schemes has a relatively high educational level in comparison with the whole Study area. About 33% have passed the GCE/ ordinary level, and 16% have passed the GCE/advanced level examinations. There are significant differences regarding total land holdings among the major, medium and the minor schemes on under various forms of tenure, that is, 1.79ha, 1.77ha, and 1.34ha, respectively.

Present Conditions of the Agriculture

20. The average holding of the irrigated paddy land per farm household is 1.16 ha in the major scheme, 1.05 ha in the medium scheme and 0.66 ha in the minor scheme. As far as the holding size distribution of irrigated paddy land is concerned, the percentage of small scale farmers having less than 0.4 ha is less than 10% in the major schemes, over 30% in the minor schemes and 21% in the case of the medium scheme.

21. The cultivation area per farm household and the average yield are shown in the table below. One of the significant features seen in the table is the very low level of land cultivated with irrigated water in minor tanks during Yala. Only an average 0.07 ha of land was cultivated in Yala 1998 as compared to 0.57 ha in the major schemes and 0.36 ha in the medium schemes. Many farmers in the minor scheme have been unable to cultivate crops due to limited irrigation water. Paddy yield in the major scheme is higher than in the medium and minor schemes.

Cultivation Area of Crops per Farm Household (1998 Yala-1998/99 Maha)

Scheme	Cultivated Area (ha/household)				Crop Yields (ton/ha)					
	Paddy - Irrigated		Rainfed	OFC	Paddy - Irrigated		Sesame	Maize	Chili	Onion
	Maha	Yala	Maha		Maha	Yala				
Major	1.07	0.57	-	0.02	4.10	3.84	0.44	-	0.64	-
Medium	0.68	0.36	-	0.07	3.59	3.28	0.43	1.67	0.58	6.45
Minor	0.41	0.07	0.01	0.06	3.41	3.51	0.62	1.26	0.91	8.12
All	0.49	0.14	0.01	0.06	3.49	3.52	0.54	1.31	0.85	7.96

Source: Questionnaire survey carried out by the Study Team in 1999.

Farmers' Organisation

22. Farmers' organisation (FO) is organised in most of the schemes and the total number of FOs is 206. The average rate of participation is 57% according to the result of the inventory survey. The participation rate tends to be higher in the major scheme than that in the minor. FO's activity is more on the irrigation rotation, the organisation of Sramadana and the settlement of irrigation disputes and less in the preparation and implementation of annual maintenance programme and collecting irrigation service fee.

Irrigation

23. The total command area in the irrigation schemes is about 18,200 ha as shown in the table on right.

Commanding Area (ha)

Category	Total	Average	Max	Min.
Major	14,167	1,771	5,668	365
Medium	1,509	137	227	34
Minor	2,509	31	182	8
Total	18,185	184	5,668	8

Source: Inventory Survey carried out by the Study Team in 1999.

24. Over 80% of the tanks in the major scheme were fully filled with water every year during the last five years (1994 to 1998), while only 40% in the medium and minor schemes. Average cropping intensity of paddy during the last five years was 156% in the major scheme, 133% in the medium and 90% in the minor. However, it was less than 20% in Yala season. The minor schemes are facing a serious water shortage, which is the major cause of the low yield and are also exhibiting the limitation of water resources.

Necessity for Rehabilitation and Improvement of Irrigation Facilities

25. According to the result of the inventory survey conducted by the Study Team, 88 schemes need rehabilitation of tanks, and 69 need rehabilitation of irrigation facilities. Major rehabilitation and improvements are described in the table below. Some 75% of FO leaders replied that deterioration of the system is caused by poor maintenance.

Major Points for Rehabilitation and Improvement

Scheme	Tank	Irrigation
Major	Rehabilitation of sluice gate	Rehabilitation of structures Improvement of measuring devices
Medium	Rehabilitation of sluice gate and spillway	Rehabilitation / improvement of structures
Minor	Bund re-filling, rehabilitation of sluice gate and spillway	Rehabilitation of channels Construction of structures

26. The operation of the sluice gate of the tanks is carried out by the staff of the Irrigation Department in the major and medium schemes and by FO in the minor schemes. The gate operation is done by their experience as the measurement devices are not installed. The rotational irrigation is practised at field levels by 75% of FOs. The method is determined in the FO meeting based on the operation rule of tank. Many farmers in the medium and minor schemes are not satisfied by water distribution because it is not practised according to the decision of the Kanna meeting.

27. The results of the survey on O&M and activities are summarised in the following table. The O&M system exists in the scheme and farmer/FOs are carrying out it, though they are inactive. The possible cause of the deterioration of the facilities is the low level of O&M activities. Therefore, the existing system is not functioning properly.

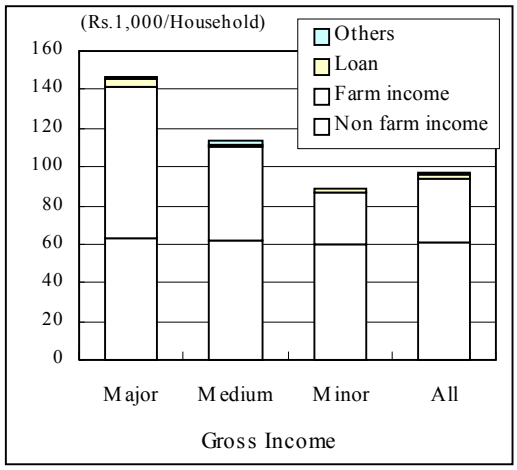
Decision organ of O&M activity	Kanna meeting is established in all the schemes.
Existence of FO for O&M	Established in most of the schemes.
Entry rate to FO	Entry rate is 57% in the entire scheme.
O&M activity by farmers.	Most farmers participated for weeding of canal, desilting of canal, earth work of canal bund, etc.
FO's concerning to O&M	It is insufficient but 60% of FO managing D-canal and F-canal and 50% on main canal.
Organise O&M Sramadana	90% of FO is practising.
Collecting irrigation service charge	10% of FO is collecting and there is subsidy from ID & IMD though insufficient.
Maintenance and repair cost in emergency	80% of FO has funds for recovering from disaster.
Farmer training on O&M	60% of FO received training but unsatisfactory.

Rural Infrastructure

28. Roads are relatively well developed, but there are some maintenance problems. Over 80% of total households obtain potable (drinking) water from surface wells. With the exception of severe drought months in the Yala season, there is enough water supplied to meet the farmers' basic requirements. However, the groundwater contains a high amount of calcium. The electrification ratio is about 50% on average, though several irrigation schemes have low ratios estimated at 10-20%.

Farm Economy

29. The gross average income of the farmers is estimated to be Rs.96,800 for all schemes, and the gross outgoing is Rs.77,400. Of total living expenses, food expenses account for about 60%. Net income averages about Rs.19,400, and of that, about Rs. 1,900 is deposited in the bank. Most of the remaining amount is used to cover expenses other than foods. The farmers in the schemes have significant non-farm incomes obtained from various occupations, which account for over 50% of gross income. Agricultural production in the dry and intermediate zones largely fluctuates from year to year due to irregular rainfall pattern, and the farm income is extremely unstable. The farmers have to look for additional non-farm income to stabilise their income.



Role of Women in Farming and Living

30. Transportation of domestic water and collection of fuel wood are entrusted to women, while land preparation and spraying of chemicals are carried out by men. Other farm works are done by both men and women. Women contribute significantly to living since they are responsible for the domestic tasks, such as cleaning and maintaining the house, caring for children, preparing meals and fetching fuel and water for domestic use. It may be said that women play an important role in farming and everyday activities. The income is managed by both women and men.

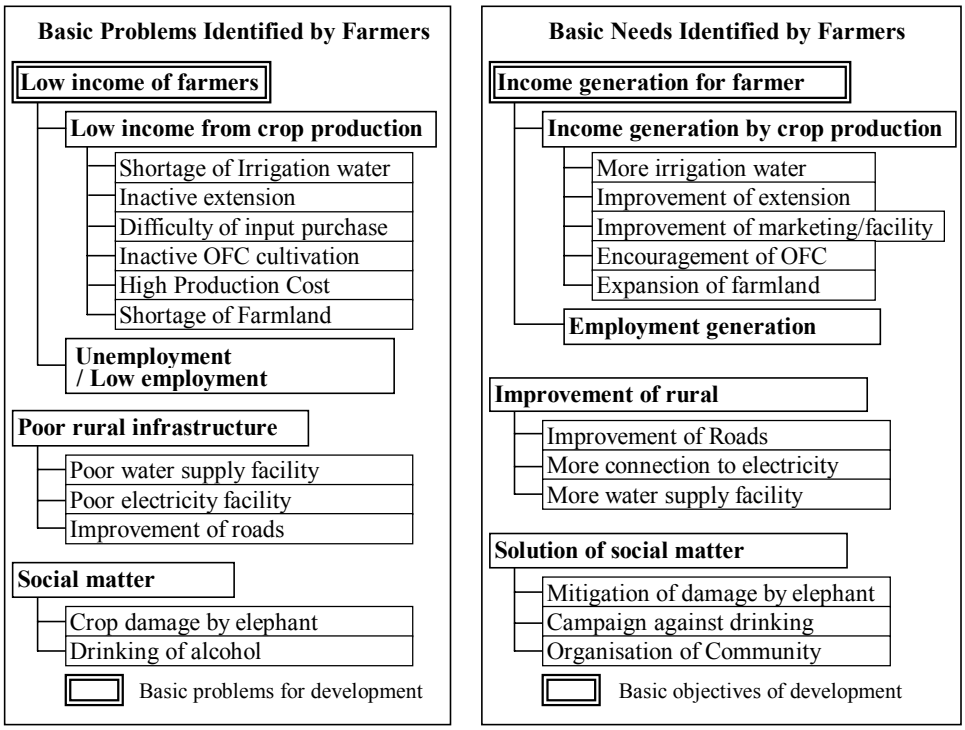
The Poor in the Irrigation Schemes

31. In all irrigation schemes, the poor who are recognised by the leaders of FO account for 24% of total households in a typical village. The minor irrigation schemes show a higher number of the poor than that of the major schemes.

2.4 Problems in Community (Village) and Farmers'/FOs' Need for the Development

32. As a part of the participatory survey, workshops with farmers were held on the RRA survey. The objectives of the workshops were to understand problems in the community and the needs on the development raised by farmers. The workshops were conducted at 100 locations in the irrigation schemes of the Study area and the participants were ordinary farmers and community leaders. The total number of participants was 1,770.

33. Analyses of basic problems of the community in the irrigation schemes based on the results of discussion of the workshops were attempted. The results are described below. Farmers have noted insufficient irrigation water and unemployment/low employment opportunity as their largest problems. These are the main causes for the low income of farmers. Therefore, "Low Farm Income" is determined as their basic problem.



34. Farmers discussed the needs for development based on the problems in the community. The results of the analysis on the basic purpose of the development of the community are described above. The needs of the development are concentrated on "Increment of Irrigation Water" and "Improvement of Employment." The increment of irrigation water is aimed at increasing income from crop cultivation by

improving the present low productivity. The improvement of employment is aimed at increasing non-farm income. In conclusion, farmers' basic objective of the development is to "Increase Farm Household Income."

2.5 Constraints and Development Potential

35. In the RRA workshops, problems of the community and the needs of the development were identified. The problems and constraints on the development and the development potential are reviewed based on the results of the field surveys (Inventory survey, RRA survey, Questionnaire survey) conducted by the Team in the Study area and 100 irrigation schemes. The results are summarised below.

Problems and Development Constraints

1) Farmers' increasing dependency on outside support institutions
2) Inactive O&M facilities and poor FO for low entry rate
3) Complicated government supporting services
4) Decline in farm income due to subdivision and fragmentation of lands
5) Price fluctuation and increasing production costs of OFC
6) Changed traditional and less communal works necessary for O&M and farming due to diversified values
7) Quality problem of the rehabilitation of irrigation facilities done by contractors and farmers
8) Unused resources in community
9) Lack of linkage on agricultural extension agencies, lack of established farmer side to participatory extension system and poor extension system of livestock and fishery sector
10) Defaulters, poor mortgage, complicated procedure, and access to bank on agricultural credit

Development Potential on Agricultural Development

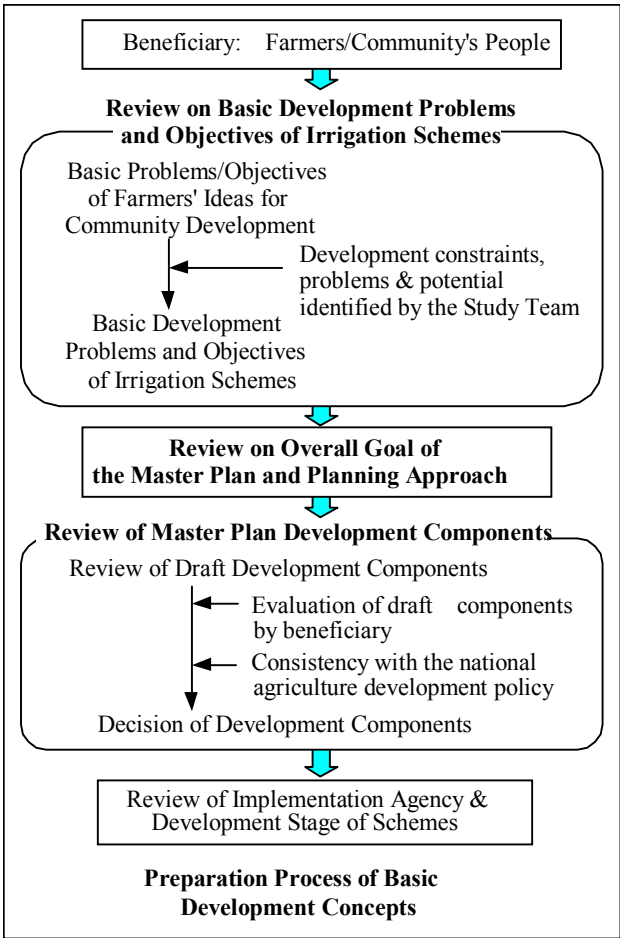
1) Possible to use limited water resources effectively by rehabilitation and improvement of irrigation facilities and water management.
2) Farmers in the irrigation schemes of the Study area have a relatively high education level. They are expected to play an important role in activation of FOs and sustainable development of the area.
3) Establishment of an autonomous body, which is multifunctional and plays a major role in community development. FO has potential to play the role as an autonomous organisation.
4) The Study area is located in a place, which is favourable for marketing of agricultural products. It is close to the capital's largest consumption area and is adjacent to Dambulla, the centre point of agriculture products. Road networks in the area are relatively developed.
5) Horticulture crops can be cultivated in fallow land and home garden, inland fishery in tank and fruits culture in communal land in the catchments area

and unused land in the village.

6) OFC is cultivated under rainfed highland in the irrigation schemes at present. Stable and high yield of crop is possible when OFC is cultivated in irrigated paddy land. High yield of crop lowers the relative production cost and thereby improves the profitability.

2.6 Basic Development Concept of the Master Plan

36. The beneficiary of the Master Plan is Farmer/Community. The development concept of the Master Plan is prepared based on the participation of the beneficiaries right from the planning stage. The process is as described in the figure on the right.



Preparation Process of Basic Development Concepts

Basic Development Constraints and Basic Objectives of the Irrigation Schemes

37. The development constraints and the basic objectives of the entire irrigation scheme are reviewed based on the constraints and objectives on development raised by farmers, and proposed by the Study Team. The results are "Low income of farm household" as the basic constraint and " Increase income of farm household" as the basic objective.

Basic Constraints: Low Income of Farm Household

1) Low Income of Crop Cultivation
   - a) Deterioration of irrigation facilities
   - b) Water management problem
   - c) Weak Farmers' Organisations
   - d) High dependency of farmers to outsides
   - e) Agricultural extension problem
   - f) Marketing and rural credit problems
   - g) Inactive OFC cultivation
   - h) Low paddy productivity
   - i) Land problem
2) Unemployment / Low Employment Opportunity
   - a) Insufficient vocational training
   - b) Poor of job information
   - c) Inactive small-scale business
3) Unused Resources of Community
   - a) Unused farmland and homestead
   - b) Unused tank for inland fishery

Basic Development Objectives: Increase Income of Farm Household

1) Income Increase by Crop Cultivation
   - a) Rehabilitation of irrigation facilities
   - b) Improvement of water management
   - c) Strengthening Farmers' Organisation
   - d) Uplift farmers' independence
   - e) Improvement of agricultural extension
   - f) Improvement of marketing & rural credit
   - g) Introduction of OFC
   - h) Improvement of paddy productivity
   - i) Effective farmland use

2) Improvement of Employment
   - a) Implementation of vocational training
   - b) Establishment of job information
   - c) Promotion of small-scale business

3) Effective Use of Resources
   - a) Promotion of homestead gardening
   - b) Fruits cultivation in communal land
   - c) Livestock in fallow land and grassland
   - d) Promotion of inland fishery in tank

Basic Approach to Programmes Formulation on the Overall Goal of the Master Plan

38. For development of the agriculture sector in Sri Lanka, emphasis has been put on the agricultural development in the dry and intermediate zones, which produce about 70% of the total crops in the whole country. The Government has envisaged encouraging irrigated agriculture in these zones, with the goal of achieving more profitable agriculture and higher standards of living for rural farm households. The irrigation schemes in the Study area have various problems such as insufficient irrigation water, deterioration of irrigation facilities and unemployment. In the meantime, the farmers have shown a strong desire to increase their incomes through crop cultivation and improvement of employment opportunity. Although a great deal of the Government's effort has been put into agricultural development in the schemes in co-operation with the foreign aid agencies, it is still far from achieving its goals. Under such circumstances, the overall goals of the Master Plan are set as "The improvement of agricultural productivity and farm economy" and "Sustainable development of rural agriculture".

39. The Master Plan is formulated based on "Basic Development Objectives" reviewed form the farmers' viewpoints. Programme formulation is to take into account the following points.

1) Programme implementation through farmers' initiative: To establish a system of farmers' initiative role in the programmes.
2) Comprehensive Development: By only the rehabilitating and improving the irrigation facilities, it is difficult to achieve the increase in income of farm household. A comprehensive approach including the improvement of employment opportunity is required.
3) Programme implementation according to the present development stage: The development programmes will then be formulated in accordance with the present conditions.
4) Equal distribution of the fruits of development: In the formulation of development programmes, over investment in a specific area is avoided and equal distribution of development fruits among the farmers is taken into consideration.

Review of Development Components in the Master Plan

40. The preliminary development components are reviewed to realise the basic development objectives. The results are shown in the table below. Moreover, "research and development programme of cascade system and subsurface water" and "monitoring and evaluation of the project" are proposed for carrying out by the Government institutions.

Development Objectives		Development Components (Preliminary)									
		Awareness/Educational Training	Strengthening FOs	Stable Production/Crop Diversification	Income Increase	Rehabilitation of Irrigation Facilities	Improvement of Farm Road	Improvement of Water Management	Improvement of Marketing	Improvement of Rural Credit	Strengthening Agriculture Extension
1. Income Increase from Crop Cultivation	Rehabilitation of Irrigation Facilities	●	●			●	●				
	Improvement of Water Management	●	●			●		●			
	Strengthening FOs	●	●							●	●
	Promote Farmers' Self-reliance	●	●								
	Improvement of Agricultural Extension		●	●							●
	Improvement of Marketing and Rural Credit		●						●	●	●
	Introduction of OFC			●		●					●
	Improvement of Paddy Productivity			●		●					●
	Effective Use of Farmland			●	●						●
2. Improvement of Employment	Implementation of vocational training		●		●					●	●
	Establish job information system		●		●						●
	Promotion of small-scale business and provision of loan		●		●					●	●
3. Effective Resources Use	Promoting the development of home-garden										
	Fruits growing in the common land				●						●
	Raising livestock in grassland and fallow land				●						●
	Promoting the development of inland fisheries in the tank				●						●

41. A group discussion with the leaders of FO regarding the proposed development components in the Master Plan was conducted in order to review and understand what is the beneficiaries' opinion of the components, and whether it matches up to real situation of the area and whether the development plan is possible to implement. The group discussions were held in twelve places of the irrigation schemes of the Feasibility Study to be described later. There were a total of 190 participants, of which 28 were female and 162 male. The proposed preliminary development components were mostly agreed by the leaders and judged that these have a high potential for the implementation.

42. The proposed development components of the Master Plan and the Government Agriculture Policy are reviewed. The results are as follows. The proposed development components are generally adapted with the Government Agricultural Development Policy.

Adaptability of the Development Components and the Government Agriculture Development Policy

	Government Policy	Development Components of Master Plan
6 Year Development Plan (1999-2004)	a) Change to Commercial Agriculture	● OFC promotion by Stable Production/Crop Diversification Plan ● Processing of by-products(Coconut fibre) and other agriculture products in Income Generation Plan
	b) Promotion of Export Crops	● Promotion of Sesame for export in Stable Production/Crop Diversification Plan
	c) Co-operation with Private Sector	● Co-operation with private sector on livestock & fishery in Income Generation Plan
	d) Create Employment in Rural Area	● Improvement of employment opportunity(Vocational training, small-scale enterprise) in Income Generation Plan
Ministry of Irrigation & Power Basic Development Approach*	a) Transfer O&M of Irrigation Scheme	● Smooth transferring of O&M in Rehabilitation Plan of Irrigation Facilities and Strengthening Plan of FOs
	b) Income Increase of Farm Household	● Income increase by crop cultivation and improvement of employment in Stable Production/Crop Diversification Plan and in Income Generation Plan
	c) Comprehensive Development Approach	● Comprehensive Development Plan by 10 development programmes
	d) Effective Resources Use in Cluster and Cascade in the Dry & Intermediate Zones	● Group development by Cascade base in the minor scheme ● Propose Research and Development Programme of Cascade System and Subsurface Water

Note: * Basic Development Approach is expressed by the ministry during the discussion with the Study Team. It is mentioned in the minutes of meeting of the Attachment.

43. The preliminary development components are concluded by the FO leaders and are adaptable to the area's situation. These components are technically possible and also generally conform with the Government Agricultural Development Policy. The development components proposed in the Master Plan are basically adopted as the preliminary and the finally proposed components are as described in the table below.

Final Development Components Applied in the Master Plan

1) Training/Awareness Programmes	7) Improvement of Water Management
2) Strengthening FOs/Rural Development	8) Improvement of Marketing
3) Stable Crop Production/Crop Diversification	9) Improvement of Rural Credit
	10) Strengthening Agricultural Support Services
4) Income Generation Programme	11) Research and Development Programme of Cascade System and Subsurface Water
5) Rehabilitation of Irrigation Facilities	
6) Farm Road Improvement	12) Monitoring and Evaluation

Programme Implementation according to the Present Development Stage

44. The development programmes will be formulated in accordance with the present conditions. The irrigation schemes are classified into the following three stages.

First stage : The stage to rehabilitate irrigation facilities and to improve water management.

Second stage : The stage to improve farm income through crop diversification, increase cropping intensity, and co-operative purchasing and shipping by FOs.

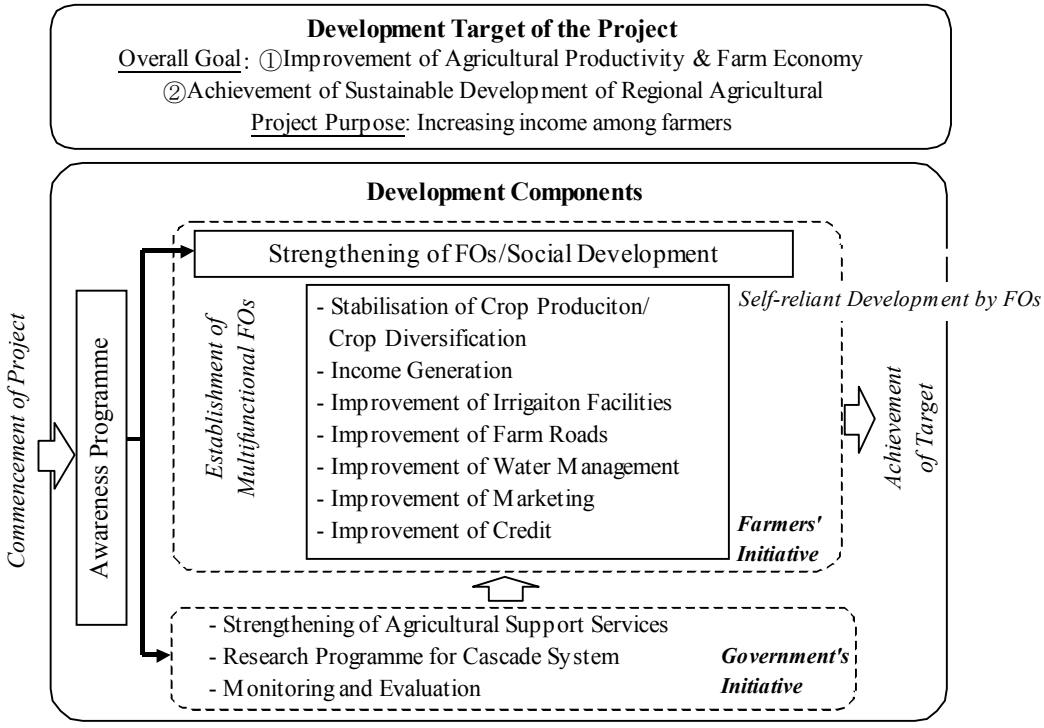
Third stage : The stage of further economic activities has been developed and to develop as an independent enterprise.

Most of the irrigation schemes in the Study area belong to the first stage. Attaragalla Wewa and Moragoda Anicut are the only two schemes in the 2nd stage. Therefore, the proposed development components are applied to the entire scheme except the rehabilitation works in two schemes.

2.7 Development Master Plan on Agriculture

Outline of Development Master Plan on Agriculture

45. Development Master Plan on agriculture is herewith formulated with overall goal of "Improvement of crop productivity and farm economy" and "Sustainable development of regional agriculture", and the basic development objective "Income generation of farm household." Outline of the Master Plan is shown in the figure below.



Outline of Development Master Plan on Agriculture

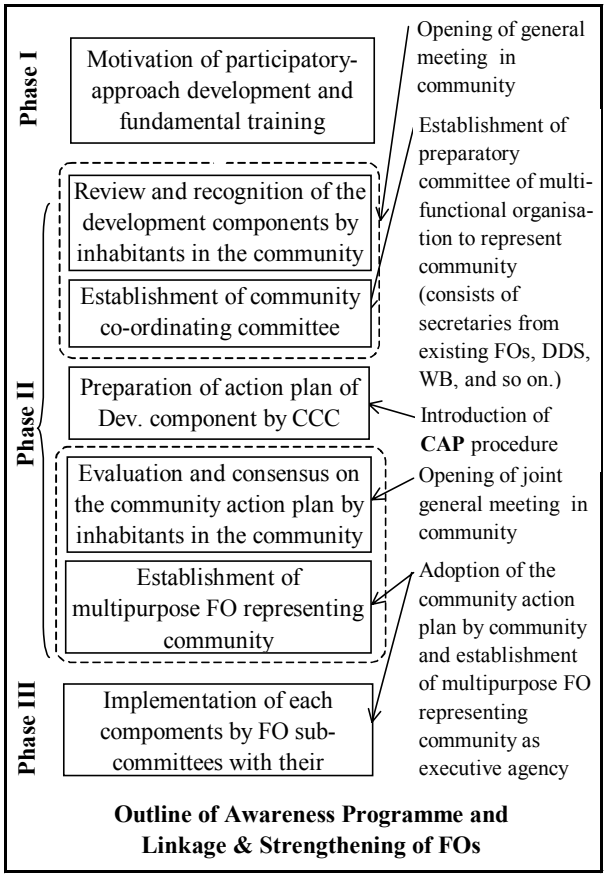
The development project will commence with the awareness programme for both farmers and Government officials and follow the development components for farmers and Government officials. The development components for farmers are to be carried out mainly by FOs. The Government institutions are to support through strengthening agriculture support services and the way to promote self-reliance of FOs.

Awareness Programme

46. The objectives of the awareness programme are the following two points of "Proposed components of the Project are to implemented by initiative of farmer/FO" and "Government institutions are able to approach the Project to promote self-reliance of farmer/FO." Therefore, the target of the Project is the

concerned Government officials and FO/ Community leaders.

47. Implementation procedure of the programme is described in the diagram on the right. Three-phase implementation of the awareness programme is proposed. The overall implementation period is 1.5 years. Procedures of the programme are to be prepared as not only to acquire knowledge and technology but also to get them through actual field activities aiming at reformation of their knowledge on participatory planning relevantly. Succeeding linkage of the strengthened FOs and the programme is to realise the reformation of sense for both sides of farmers and Government officials.



Outline of Awareness Programme and Linkage & Strengthening of FOs

Strengthening of Farmers' Organisation and Community Development

48. The farmers' organisation in the irrigation schemes is to take a wide range of functions as a multipurpose organisation and is proposed to increase farm income and self-reliant development on rural agriculture. FOs have set up four sub-committees, as shown below, under the Board of Management of FO.

Subcommittee	Contents of Activities
Operation and Maintenance of Facilities and Water Management	1) Preparation of annual irrigation schedule and water management. 2) Maintenance of facilities and Management of communal works such as canal cleaning and maintenance of farm roads. 3) Security service for irrigation facilities, etc. 4) Estimate of irrigation service charge and collection of irrigation service fee.
Agriculture	1) Supporting activities for farming, including transmission and notification of information on governments extension services, arrangement of farmers' meetings on extension, arrangement and guidance for group farming such as communal control of pests and diseases, seeding and harvesting, etc.
Business	1) Management of profit activities including cooperative purchasing, agricultural credit services, machinery services, fish farming, etc. 2) Management of credits. 3) Exploitation of new marketing channels. 4) Promotion of income generation including vocational training, small agro-business, and transmitting employment information.
Income Generation /Social Services	1) Improvement of social welfare and health care. 2) Educating activities on home economy and management, drinking-control campaign, etc.

49. Appointment of women's leaders in the sub-committees of FO in the field of provision of public health and family nutrition and income-generation activities is

proposed for promotion of women's participation and manpower use. Establishment of women's banking activities is proposed, such as group saving and mutual aide credit system, in order to encourage rural women to get into employment promotion and business activities, especially to provide initial capital to the group.

Agricultural Production Plan (Stabilisation of Productivity and Crop Diversification)

50. The crops to be introduced are proposed considering marketability, water resources of the irrigation schemes, farmers' intention and farmers' OFC experiences as follows.

Crops to be introduced in the Irrigation Schemes

Introduced Crops	Background of Selection	Crop Season
Paddy	Farmer's Request. Home consumption of the staple food of household	Maha, Yala
OFC・Vegetable		
Sesame	Expected for export market, demand in domestic market, Processing (oil for domestic market)	Yala
Chili	Importing, High demand of domestic market, High farmer's intention	Maha, Yala
Onion	Importing, high demand of domestic market, strong intention in Minor scheme	Yala, Maha (Red)
Pulses	Rotation, Soil maintenance	Maha, Yala
Vegetable (Egg Plant, Capsicum, Pumpkin, etc)	High return crop, Selection on transport and storage capability for marketing.	Maha, Yala

51. Proposed cropping pattern is prepared considering the potential of water resource, the agro-ecological zone of the DOA and the farmers' intention to cultivate paddy. Paddy strengthening pattern for high water resource schemes and OFC promotion pattern for limited water resource schemes are proposed.

Proposed Cropping Pattern

	Water Resources		Agro ecological Zone	Classification	Proposed Cropping Pattern*2	Name of Scheme
	Increase C.I. *1	Potential				
Major	<50%	M	D	MD	OFC	Nachchaduwa
	Nearly 0%	L	D	LD	OFC	Nuwarawewa, Tissawewa, Rajangana, Palukadawewla, Attaragallewea, Abakolawewa
			I	LI	OFC	Magalle Wewa
Medium	Over 50%	H	D	HD	Paddy	Uttimaduwa Wewa, Mahananeriyawewa
			I	HI	Paddy	Hulugalla Wewa, Meddeketiya Wewa
	<50%	M	D	MD	OFC	Thuruweli Wewa, Periyakulama, Maminiya, Wewa Mahabulankulama
	Nearly 0%	L	D	LD	OFC	Eru wewa, Mahagalgamuwawewa
			I	LI	OFC	Moragoda Anicut
Minor	Over 50%	H	D	HD	Paddy	II, IV, VII
			I	HI	Paddy	VIII
	<50%	M	D	MD	OFC	I, III, V, VI
			I	MI	Paddy	IX

*1 C.I. = Cropping Intensity *2 OFC: OFC promotion pattern, Paddy: Paddy promotion pattern
Note: Increment of crop intensity rate in the above table shows potential irrigation area by 75% dependability on without project and with project. Larger figure exhibits larger increment of paddy irrigation area after the implementation of the programme.

52. Extension targets (crop intensity) of paddy and OFC in their promotion patterns are estimated as follows by OFC production size of the Study area, Kurunegala and

Anuradhapura. This production area is equivalent to 19% of annual production area of Kurunegala and Anuradhapura and is hardly an extreme expansion. It is therefore judged possible to attain this figure as an extension target of OFC.

Extension targets of paddy and OFC

	Paddy Promotion Pattern				OFC Promotion Pattern				Paddy	OFC
	Maha		Yala		Maha		Yala			
	Paddy	OFC	Paddy	OFC	Paddy	OFC	Paddy	OFC		
Cultivation Rate	100%	-	90	10%	90%	10%	80%	20%		
Cultivation Area										
Major (ha)	-	-	-	-	12,342	1,371	6,750	1,688	19,092	3,509
Medium (ha)	470	-	404	45	777	86	440	110	2,091	241
Minor (ha)	1,134	-	303	34	993	115	256	104	2,686	253
Total (ha)	1,604	-	707	79	14,112	1,572	7,446	1,902	23,869	3,553

Proposed Income Generating Activities

53. Income generation activities proposed in the Project are prepared considering the farmers' needs and potentials in and around the irrigation schemes: i) home gardening, ii) livestock development, iii) development of inland fisheries, iv) agro-processing and marketing development, v) vocational training, and vi) credit services for income generation. At present, about 24% of total households per village are categorised as poor. Generally, the poor have small benefits from the rehabilitation and improvement of irrigation facilities because holding of irrigated paddy land is less than 0.4ha. From the standpoint of equitable distribution of the development benefits, the income generation will focus on the poor.

54. An income generation programme is proposed to be implemented two-step as shown in the following table by each component and step with the first stage being the easier.

Income Generation Programme

	1st Stage	2nd Stage
Home Garden Development	Cultivation of OFC and vegetables for home consumption under hand watering by the use of wells, canals, tanks, etc.	Expansion of OFC cultivation by using small pump and cultivating in fallow paddy field and highland
	Cultivation of Abalone, Oyster and Straw Mushrooms for local consumption using rice straw /saw dust	Expanding mushroom cultivation for selling urban area (Colombo)
	Cultivation of horticulture crops such as banana, cashew and citrus (lime)	Expansion of horticulture crops in highland
Livestock Development	Milk production using existing cattle and buffalo	Expanding milk production by increasing the number of cows and introducing high quality breed
	Egg production for home consumption	Egg and Broiler for local and urban consumption
		Goat raising
Inland Fishery Development	- Major & medium tanks: rent to fisherman - Minor tank: rent to fisherman or introduction of stock culture by farmers	- Major & medium tanks: introduction of cage culture by farmers - Minor tank: stock culture by farmers
		Ornamental fish culture
Vocational Training	- Encouraging vocational training	
	- Encouraging acquisition of qualification	
	- Providing employment information	
Small Scale Enterprise	Organising metal production	Expanding of metal material
	- Rice milling grinding of maize and chilies - Stoning of rice and sesame	Oil extraction (sesame) for local market
	Marketing business of agricultural products	

55. A revolving loan system and mutual aid credit, proposed in the agricultural credit plan, are proposed to assist the income generation plan. Provincial Department of Agriculture (PDOA), Provincial Department of Animal Production and Health (PDAH), National Aquaculture Development Authority (NAQDA), Divisional Secretariat (DS) and National Youth Service Council (NYSC) are to carry out income generation programmes. It is proposed to establish a Sub-committee for Income Generation under FO in order to effectively and successfully implement the programme.

Improvement of Marketing and Agricultural Credit

56. Proposed marketing improvements are: (i) introduction of group purchasing of farming inputs, (ii) organising producer group of OFCs for establishment of a marketing system, (iii) establishment of a collecting point, iv) establishment of Pola for activating marketing in the area, and ((v) establishment of a marketing information system.

57. Operation of the following three types of financing systems is proposed in the Project for improvement of the rural credit.

Improvement of Rural Credit

Credit System	Financing Object	Outline of Credit
Group Loan System	Applied for purchasing of farming inputs as fertilisers and agro-chemicals	Principally loan for group and managed by FO. Farmer organise group and the representative when apply for loan. Repayment has to be accomplished by corporate responsibility of the group in case of defaulter.
Revolving Loan	Apply for purchasing farm inputs and procuring equipment like rice mills under the income generation programme.	This loan is operated by FO and the fund is the profit obtained by FO's business. If capital is not enough, FO obtains a loan from banks. PMU give necessary support to FO for obtaining loan.
Mutual Aid Credit System	Apply for living expenses and income generation.	Establish a mutual aid association then saving the communal fund by periodical fixed deposit. The assignment of these sums of the regular withdrawals can be made through a "lottery" system or decided by mutual agreement among the members. The number of members will be 10 to 20. FO is to take an education activity but will not be involved in the operation.

Plan for Rehabilitation and Improvement of Irrigation Facilities and Farm Road

58. A water balance study was carried out to assess irrigable area under the Master Plan, applying the paddy strengthening pattern and the OFC promotion pattern for each scheme in accordance with the agricultural development plan. The results are summarised in the table above.

Result of Water Balance Study

(Unit: ha)

Scheme Category	Commanding Area	Maha Irrigated	Yala Irrigated	Total
Major	14,167	13,712	8,448	22,160
Medium	1,509	1,334	999	2,333
Minor	2,509	2,237	703	2,940
Total	18,185	17,283	10,150	27,433

59. The outline of rehabilitation and improvement plan of irrigation and drainage facilities is as follows.

1) Tank: Major rehabilitation works for most of the tanks are bund earth works, riprap protection, desilting, removing aquatic weeds, improvement of sluice, sluice gates and spillway. Bund earth works in the minor schemes are many in the Kala Oya in seven schemes in 2MI-6, 2MI-9, 3MI-6, 3MI-9, 3MI-10, 4MI-13 and 5MI-5.

2) Canal System: Provision of a masonry or reinforced concrete retaining wall is recommended for irrigation canal rehabilitation except for field canals. The canal gradient must be carefully selected to avoid erosion along slope due to high velocity by using proper canal lining materials and thereby preventing sloping failure. Turnout facilities with not only water distribution function but also measuring devices are desirable in order to distribute water fairly. In addition, installation of measuring facilities is proposed at the head of main canals to manage released water from the tank in medium and minor schemes.

60. In most of the major irrigation schemes, farm roads have been already facilitated along the main canal for O&M of irrigation facilities, and they are maintained rather well. Therefore, the need of rehabilitation and improvement for these roads is not so high at present. However, there are very limited farm loads in the area far from the canals, so farmers are obliged to convey agricultural production as well as input by manpower because of poor accessibility to their fields. Based on the findings of the site investigation and the inventory survey, farm roads are proposed for five schemes, namely Nuwarawewa, Magalle Wewa, Maminiyawa, Maha Bunankulama, and Mahananneriya.

Plan for Operation and Maintenance of Irrigation Facilities and Water Management

61. The improvement plan on the water management and O&M of the irrigation facilities proposes the following technical and institutional aspects: (i) responsibilities of O&M for the government and FOs, (ii) improvement of mechanisms for settlement of irrigation disputes, (iii) preparation of O&M plan by FOs themselves, (iv) O&M cost to be borne by FOs considering affordability, and (v) monitoring of O&M activities.

62. All O&M costs of irrigation facilities on D- and F-canals in major irrigation schemes and all facilities in medium and minor irrigation schemes are covered by the Irrigation Service Fee (ISF) collected from the farmers. ISF includes operation cost (Salaris), maintenance cost, and others. The preliminary analysis by the JICA Study Team estimates that the annual O&M cost is Rs. 2,000/ha (Rs. 1,000/ha is farmer's burden) in the major scheme and Rs. 1,500/ha (All by farmer's burden) in the medium and minor schemes.

Research Programme of Cascade System and Subsurface Water

63. Planning of rehabilitation or improvements for a tank system requires assessing and understanding of the entire hydrological characteristics of the cascade. Up to now, with a few exceptions such as the International Irrigation Management Institute (IIMI) study conducted in the Anuradhapura District, there have been very few

researches or experimental activities for hydrology and water balance of a system of cascade. Research programmes for the tank cascade system are proposed in the Project. In addition, research on subsurface water is proposed in the Study area. The subsurface water plays an important role in meeting crop demands when the irrigation intervals are stretched beyond the required limits during droughts.

Proposed Plans for Strengthening of Agricultural Supporting Services

64. Proposed plan for strengthening of agricultural supporting services consist of three sub-sectors: (i) agricultural extension system, (ii) income generation system, and (iii) farmers' organisation support system. The components of the strengthening plan are as follows.

1) Strengthening of agricultural extension system: Strengthening of agricultural extension agencies, seed production and supply system and training of extension staff are proposed. The strengthening of seed production and supply system is: a) promotion and expansion of seed production programme by FO/farmers group, and b) strengthening of Provincial seed farm, Galgamuwa. Maha Illppallama In-service Training Institute is to be strengthened for expanding training of farmers and extension staff in the Project area.

2) Strengthening of income generation system: Strengthening of IFTC for farmers' livestock training and extension system, and Aqua-culture Extension centre of NAQDA.

3) Strengthening of farmers' organisation support system: Agrarian Service Centre (ASC) for farmer/FO support institute is to be strengthened and training of Divisional Officer and Farmer Animator of DAS is also to be implemented. A Farmer Centre for office for Farmer Animator and FO is to be constructed in the community concerning with the Project.

65. Agricultural extension programmes for farmers in each scheme are to be carried out as follows:

Field Programmes	(i) Adaptive trials, (ii) Small-scale demonstration programme, (iii) Cropping pattern demonstration programme, (iv) Large-scale demonstration programme, (v) Productivity increase programme, (vi) Integrated pest management (IPM)
Farmer Training Programmes	(i) Induction farmer training, (ii) Induction farmer guidance, (iii) Farmer training, (iv) Workshop/mass guidance, (v) Campaign, (vi) Study tour

Monitoring and Evaluation

66. It is recommended that the Project should be monitored and evaluated based on the PCM method. The important point of this method is to feedback the results of monitoring and evaluation into projects, so that the operation and management of ongoing and future projects improve, and moreover, not to criticise the projects for their shortcomings. The main purposes of this method are: (i) to optimise the operation and management of ongoing projects, (ii) to ensure accountability to the investors, and (iii) to draw lessons from experience. In principle, project staff (officers of PMU) performs monitoring activities, while external collaborators /

agencies undertake the evaluations.

2.8 Environmental Assessment

Environmental Conservation Plan

67. While the quality in the Kurunegala district has been reported to be within permissible limits, fears have been expressed about that in Anuradhapura district as it shows increased levels of nitrate caused by the excessive use of fertiliser in paddy. Excessive nitrates in surface and ground water should be controlled by rational application of fertiliser and by using more organic manure. The Department of Agriculture's current recommendation for paddy is application of straight fertilisers supplying nitrogen, phosphorus and potassium from individual compounds rather than from mixtures for keeping the quantities of total application low. These countermeasures are to be recommended in the Project.

68. Since most farmers do not know how to use agro-chemicals by kind, they seem to apply excess quantity in some part of the major scheme. There is an urgent need to transfer adequate knowledge on the usage of agro-chemicals and to introduce Integrated Pest Management (IPM) methodologies.

69. In the short and medium terms, it is proposed that the department strengthens its capability, educates farmers in the affected areas on measures they can adopt by themselves. Making available crackers and thunder-flashes, constructing electric fences in critical areas and evacuation of troublesome loners are proposed. In the medium- term, a detailed study on the issue of elephant populations in the area and its environs should be undertaken along with available habitats. Based on this Study a comprehensive management plan should be prepared and implemented without any delay.

Environment Monitoring Plan

70. In the Anuradhapura district, a likely trend of increased nitrates and phosphates in the groundwater has been indicated and requires investigation. It would be very useful to have some baseline survey after two cultivation seasons from the commencement of the programme when conditions are quite different. Subsequent analysis may be carried out in suspect areas twice a year over a period of two to three years to provide project management with information for decision-making. The department of wildlife conservation must station more staff at strategic places and monitor movements of animals constantly.

2.9 Implementation Plan and Cost Estimate

Project Executing Agencies

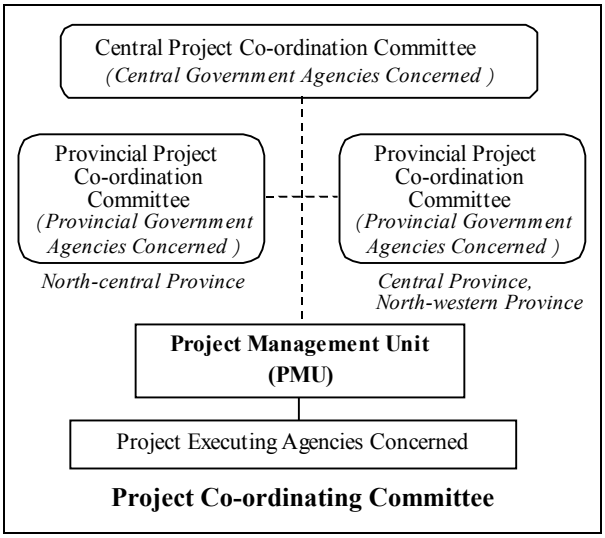
71. The Irrigation Management Division (IMD) of the Ministry of Irrigation and Power (MIP) would be the executing agency of the programmes. In connection with the

implementation of the programme, IMD would co-ordinate all activities of the relevant government agencies and regional organisations. The proposed institutional set-up for the implementation and management of the programmes are listed in the table on the right. In order to co-ordinate all these agencies, the Central Project Co-ordination Committee (CPCC) and Provincial Project Co-ordination Committee (PPCC) are proposed to be established.

Implementing Agencies Concerned

PDOAs	: Provincial Department of Agriculture
IPEU	: Inter Provincial Extension Unit
DOI	: Department of Irrigation
PED	: Provincial Engineering Department
IMD	: Irrigation Management Division
DAS	: Department of Agrarian Services
PDAPH	: Provincial Department of Animal Production & Health
NAQDA	: National Aquaculture Development Authority
NYSC	: National Youth Service Council
NAITA	: National Apprentice & Industrial Training Authority
DS	: Divisional Secretariat
KARTI	: Kobbekaduwa Agrarian Research and Training Institute

72. The Project Management Unit (PMU) would be established in the Project site, and would have direct responsibility for the implementation of the programmes. The organisational structure of PMU consists of seven sub-units, namely Administration Unit, Agricultural Supporting Unit, Construction Unit, O&M of Irrigation Schemes Unit, Income Generation / Social Services Unit, Farmers' Supporting / Credit Unit, and Monitoring and Evaluation Unit for managing the implementation of the programmes effectively. The main tasks of PMU are: (i) preparation of annual work plan (AWP) including budget, (ii) financial management for the implementation of the programmes, (iii) co-ordination of agencies concerned, (iv) implementation of awareness programme for officers and farmers, (v) supervision of implementation and financial status of the programmes, (vi) holding PCM workshop with farmers (FOs) during the implementation of the programmes, and (vii) programme review based on monitoring and PCM workshops. PMU should be opened to farmers for all information obtained through the monitoring and evaluation in order to maintain transparency on the programmes implementation.



Implementation Schedule

73. The entire period required for the Project implementation is estimated as eight years. Prior to the commencement of the development programmes such as strengthening of FO and rehabilitation works, the awareness programme (1 to 1.5 years) should be carried out not only for farmers but also for officers and front line staff. After completion of all development programmes, the programmes should be evaluated,

and the follow-up programme will be implemented for one (1) to one and half (1.5) years.

Cost Estimate

74. The total project cost including all irrigation schemes is estimated to be Rs.2,668 million (US$ 37.6 million), excluding price escalation and G.S.T. (tax). The cost per hectare is estimated at Rs.146,700 (US$ 2,070), and the rehabilitation and improvement costs of irrigation facilities and farm roads account for 60% of total cost. The farmers should contribute 10% of total rehabilitation cost for D and F canals of the major and medium schemes and all canals systems of the minor schemes.

Total Project Costs (Excluded Price Escalation & G.S.T.) – Master Plan

(Unit: Rs.Million)

	Commanding Area (ha)	No. of Farm Households (No.)	No. of FOs (No.)	Project Costs					
				Rehabilitation Cost	Capital for Support Facilities	Awareness and Training Programmes	Administration Cost	Engineering Cost	Total
Major	14,167	18,100	111	1,373	281	145	128	180	2,107
Medium	1,510	1,800	18	115	38	24	15	18	210
Minor	2,509	5,400	78	111	114	73	23	30	351
All	18,186	25,300	207	1,599	433	242	166	228	2,668
Proportional Extent				60%	16%	9%	6%	9%	100%
Cost per Hectare (Rs./ha)				87,900	23,800	13,300	9,200	12,500	146,700
Cost per Hectare (US$/ha)				1,240	330	190	130	180	2,070

2.10 Project Evaluation

Economic Evaluation

75. The project economic evaluation is carried out through estimation of the EIRR, the Benefit Cost ratio (B/C) and benefit minus cost (B-C) for each scheme. The results are summarised in the table on the right. The economic cost includes all investments on the rehabilitation and improvement of the irrigation facilities, setting-up the PMU office, awareness / training programme, and the running cost of the PMU office. The economic benefit includes benefits only from the irrigation. The benefit that is difficult to quantify as income generation programme is excluded.

Code No.	Name of Schemes	EIRR (%)	B/C	B-C (Rs. Million)
1MA-01	Nachchaduwa Wewa	17.2	2.39	523
1MA-02	Nuwarawewa	20.8	2.50	134
1MA-03	Tissawewa	14.3	1.70	23
2MA-01	Rajangana Wewa	9.4	1.26	190
4MA-01	Palukadawela	21.3	2.67	138
4MA-02	Attaragalla Wewa	22.8	3.22	44
4MA-03	Abakola Wewa	15.1	1.87	28
5MA-01	Magallewewa	10.6	1.29	56
1ME-01	Thuruweli Wewa	27.5	3.61	39
1ME-02	Eru wewa	11.0	1.33	2
1ME-03	Uttimaduwa Wewa	21.9	2.58	16
1ME-04	Periyakulama	9.8	1.19	3
1ME-05	Maminiya Wewa	14.7	1.72	22
1ME-06	Mahabulankulama	15.8	1.86	12
2ME-01	Angamuwawewa*1	-	-	-
4ME-01	Mahananeriyawewa	26.1	3.18	39
4ME-02	Mahagalgamuwawewa	5.2	0.78	-5
5ME-01	Hulugalla Wewa	39.6	5.44	34
6ME-01	Meddeketiya Wewa	25.9	3.34	21
6ME-02	Moragoda Anicut	32.3	4.32	39
I	8 Minor Schemes	12.7	1.49	15
II	8 Minor Schemes	7.6	0.99	0
III	10 Minor Schemes	17.0	2.04	49
IV	9 Minor Schemes	17.8	2.09	33
V	10 Minor Schemes	5.4	0.72	-7
VI	11 Minor Schemes	11.6	1.38	14
VII	10 Minor Schemes	11.6	1.37	14
VIII	10 Minor Schemes	12.5	1.48	15
IX	4 Minor Schemes	19.3	2.36	19
All Schemes		13.7	1.38	756

*1 Part of Rajangana irrigation scheme

Farm Budget Analysis

76. Analysis of farm household economy is carried out to evaluate the increased farm income and the bearing potential of O&M cost of the irrigation facilities. The result of the analysis is shown in the table below. Income increase by the Project implementation is due to the increase in crop intensity and yield obtained through the rehabilitation and improvement of irrigation facilities and the strengthening agricultural extension. The increase in non-farm income by the income generation programme is not included in the analysis due to unavailability of information.

Farm Budget Analysis

Holding Size of Irrigated Paddy Land	Without Project			With Project		
	Whole Average	0.4 - 0.8 ha	Less than 0.4 ha	Whole Average	0.4 - 0.8 ha	Less than 0.4 ha
(No. of Sample)	1,500	476	321			
(Distribution %)	100%	32%	21%	100%	32%	21%
I. Irrigated Paddy Area (ha/household)	0.75	0.47	0.21	0.75	0.47	0.21
II. Cropping Area (ha/ household)	0.81	0.64	0.38	1.24	0.81	0.41
III. Balance of farm household economy (Rs./household/year)						
1) Total income	96,800	81,200	66,900	146,600	108,900	77,500
2) Total expense	77,500	65,400	63,600	99,300	78,000	67,700
3) Net income	19,300	15,800	3,300	47,300	30,900	9,800
(Bank deposit)	(1,900)	(1,300)	(1,400)			
IV. Net income increased (Rs./household/ year)				28,000	15,100	6,500
V. Salaris & O&M fee (Rs./household/year)						
1) Major schemes				750	470	210
- Salaries				380	240	110
- Material cost				110	70	30
- Labour cost				260	160	70
2) Medium & minor schemes				1,130	710	320
- Salaries				380	240	110
- Material cost				230	140	60
- Labour cost				520	330	150

77. Farm household economy with Project implementation is increased by 50% of total income per household on average compared to that of the without Project and annual net income increase is approximately Rs. 28,000. Total income of the farm household (32% of whole) with the holding size of irrigated paddy land of 0.4 ha to 0.8 ha increased by 34% and annual net income increased by Rs. 15,000. On the other hand, for small-scale farms of less than 0.4ha, sharing about 20% of whole area, total income increase is only 16% and annual net income increase is as low as Rs. 6,500. The small-scale farms are holding only 0.2 ha of irrigated paddy land on average, which is nearly negligible. There is a need to increase non-farm income of such small-scale farms through the income generation programme.

78. As seen in the table on farm household economy analysis, total amount of salaries, material cost and labour cost ranges from Rs. 210 to Rs.750 in the major scheme and from Rs. 320 to Rs. 1,130 in the medium and minor schemes. It is less than 5% of increased income, and therefore it is considered to be affordable for farmers to bear salaries and the O&M cost.

79. A farmer's share of O&M cost largely depends upon the farmer's "willingness to pay." The O&M cost takes into account the material cost only and does not include labour use by Sramadana. Salaries are also separated from O&M cost. The Team reviewed the farmer's share of O&M cost (Material cost by cash payment) acceptable to the farmers based on the results of the questionnaire survey and RRA survey. A majority of ordinary farmers have accepted Rs. 250/year in the questionnaire survey and majority of FO leaders accepted Rs. 500/year in RRA survey. The material cost under with project is Rs. 150/year in the major scheme and Rs.300/year in the medium and minor schemes. The cost in the medium and minor schemes is almost the same amount as an ordinary farmer is willing to pay if rehabilitation and improvement works of the irrigation facilities are accomplished satisfactorily.

Social/Economic Impacts

80. The following social/economical impacts are expected by the Project implementation.

1) Increase in income of farmer/community and improvement of employment opportunity.
2) Activation of a rural economy by increasing agriculture production and improvement of marketing and rural credit.
3) Alleviation of poverty by the implementation of the income generation programme.
4) Activation of women's activity by the establishment of the income generation/social service subcommittee and the introduction of a mutual aide credit system operated by a women's group.
5) Reduction in social problem (alcohol addiction) by the activity of social service of FO.
6) Improvement of capability of official staff concerned by the implementation of training/education programme.
7) Ripple effect by agricultural extension system and strengthening facility.
8) Ripple effect by the model of participatory development in the Dry and Intermediate zones.

2.11 Conclusions and Recommendations of the Master Plan

Conclusions

81. In the Master Plan study area, eight major schemes, twelve medium schemes and eighty minor schemes are selected. Total irrigation area in the target irrigation schemes is 18,200 ha, the number of beneficiary farm households is 25,300 households (land holders) and total population is 113,000. The overall goal of the Master Plan for the 100 irrigation schemes is set as "Improvement of agricultural productivity and farm economy" and "Sustainable rural agriculture development" and the basic development objective is to "Increase farm household income." Under these objectives, twelve development components are planned. Total project cost is

estimated at approximately Rs 2,668 million (37.6 million dollars) including these development components and excluding the price escalation and GST. The Internal Rate of Return (IRR) of the Project is 13.7% based on the results of the economic evaluation. It is concluded that the Project is economically feasible and possible to implement technically.

82. Increase in farm household income per household, which is the basic development objective, is increased by 50% and annual net income is increased to Rs. 28,000 on average of the entire scheme. On the other hand, for small-scale farms (of less than 0.4ha), sharing about 20% of the whole area, total income increase is only 16% and annual net income increase is as low as Rs. 6,500. These small-scale farms hold 0.2ha of irrigated paddy land on average. The income generation programme is prepared for the small-scale farm.

Recommendations

83. The development components of the Project are prepared based on the needs of farmers confirmed in the RRA workshop and the intentions obtained through the discussion with the leaders of farmers' organisations. The contents of the components are comprehensive development including an effective use of water resources by the rehabilitation and improvement of irrigation facilities, increasing self-reliance of farmers through the awareness programme, activating farmers' organisation by reorganisation into multipurpose FOs and improving employment opportunity through the income generation programme for the poor. The implementation of the Project is to contribute to the self-motivated development of rural agriculture, which is strongly desired by the beneficial farmers. Therefore, the early implementation of the Project is recommended.

84. The precision of the Study in the irrigation schemes was totally the level of the Master Plan study. The following supplemental surveys are recommended for the early implementation of the Project.

a) The cost of the rehabilitation and the improvement of the irrigation facilities estimated in this report improved in the precision based on the results of the Feasibility Study. However, it is required to carry out additional survey for the Project cost in order to estimate them on a level with a standard feasibility study.

b) Generally, the project funded by the external donor agency is to avoid overlapping of the Project area. Some irrigation schemes in this Master Plan have been found to overlap with the other aid projects during the survey period. It is not a problem for the different purposes of the project in this case. However it is possible to meet these cases, so the executing agency of the Project is required to survey on the previous project.

85. A characteristic of the Project that differed with others is putting emphasis on the awareness programme. This programme consists of "Training/practice to increase

the awareness to the participatory development" and "Establishment of the implementation system of the participatory development". Participation of not only the staff of the Ministry of Irrigation and Power but also the staff of the central, the provincial and the district levels in the programme is recommended.

86. The O&M of irrigation facilities and the water management by farmers' organisation of the medium and minor irrigation schemes are not legally clear. The collection of the O&M fee is also not regularised. It is believed that the operation and management and the water management by FO in the medium and minor schemes need to be regularised legally.

III. The Feasibility Study for Priority Irrigation Schemes of the Study Area

3.1 Evaluation and Selection of Priority Irrigation Schemes

87. The Feasibility Study is carried out on the priority irrigation schemes selected in the Master Plan. The following eleven parameters are proposed for the evaluation of each scheme. They are (i) location of the scheme site, (ii) land status, (iii) water resources potential, (iv) deterioration and problems of irrigation facilities, (v) present farmers' participation in O&M of facilities, (vi) present situation of water management, (vii) present activity and its performance of farmers' organisation, (viii) present farmers' economy, (ix) environmental effects, (x) equity development, and (xi) economic viability (EIRR and B-C).

Evaluation for Selecting Priority Schemes

	Cluster	Code No.	Name of Scheme	Score
Major Schemes				
1	Nachchaduwa	1MA-01	Nachchaduwa	70.8
2	Nachchaduwa	1MA-02	Nuwarawewa	58.5
3	Mi Oya	4MA-01	Palukadawela	55.5
5	Kala Oya 1	2MA-01	Rajangana	54.5
4	Mi Oya	4MA-02	Attaragallewa	52.5
6	Mi Oya	4MA-03	Ambakolawewa	51.8
7	Nachchaduwa	1MA-03	Tissawewa	49.3
8	Deduru Oya 1	5MA-01	Magalle Wewa	46.5
Medium Schemes				
1	Deduru Oya 2	6ME-01	Meddeketiya	74.5
4	Nachchaduwa	1ME-03	Uttimaduwa	72.0
5	Mi Oya	4ME-01	Mahananneriya	71.8
2	Nachchaduwa	1ME-04	Periyakulama	71.3
3	Nachchaduwa	1ME-06	Maha bunankulama	70.5
6	Nachchaduwa	1ME-05	Maminiyawa	64.0
7	Deduru Oya 1	5ME-01	Hulugallawewa	63.0
8	Nachchaduwa	1ME-02	Eru Wewa	62.8
9	Mi Oya	4ME-02	Maha galgamuwa	61.5
10	Nachchaduwa	1ME-01	Thuruwila	58.3
11	Deduru Oya 2	6ME-02	Moragada Anicut	55.5
12	Kala Oya 1	2ME-01	Angamuwa	7.5
Minor Schemes				
1	Mi Oya	VII	10 Schemes	74.5
2	Nachchaduwa	III	10 Schemes	65.8
3	Deduru Oya 1	VIII	10 Schemes	63.8
4	Kala Oya 1	IV	9 Schemes	64.8
5	Nachchaduwa	II	8 Schemes	63.3
6	Mi Oya	VI	11 Schemes	59.8
7	Deduru Oya 2	IX	4 Schemes	58.5
8	Kala Oya 2	V	10 Schemes	54.8
9	Nachchaduwa	I	8 Schemes	53.8

88. The evaluation of each scheme was made quantitatively, using the above mentioned parameters. The evaluation of each scheme and group is shown in the above table. As seen from the table, the Nachchaduwa and Mi Oya clusters have many irrigation schemes having high points, in comparison with the other four clusters. The priority schemes would therefore be selected from these two clusters, taking into account the hydrological linkage within the respective cluster. In the Nachchaduwa

cluster, the irrigation schemes having high points with the hydrological linkage are the Nachchaduwa major scheme, and Maha bunankulama, Uttimaduwa and Periyakulama medium schemes. Two schemes - Nachchaduwa major irrigation scheme and Periyakulama medium irrigation scheme where access is easy, would be selected as priority schemes. As for the Mi Oya cluster, it would be proposed to select Palukadawela (major), Mahananneriya (medium), and one cascade system consisting of 6 minor schemes in VII due to their high scores. Although the hydrological group of minor schemes in VII consists of 10 schemes, the six minor schemes of Kallanchiya, Aathikulama, Mailawa, Ihalagama, Tambare and Ihala Nanneriya will be selected.

3.2 Present Conditions of the Priority Irrigation Schemes

Administrative Divisions and Population

89. Administrative division, population and household of the priority irrigation schemes are summarised in the table below.

	Nachcha-duwa Major Irrigation Scheme	Palkadawela Major Irrigation Scheme	Periyakulama Medium Irrigation Scheme	Mahananneriya Medium Scheme	Mahananneriya Minor Schemes (Cascade)	Total
District	Anuradha-pura	Kurunegala	Anuradhapura	Kurunegala	Kurunegala	
Divisional Secretariat	Srawasthipura	Galgamuwa	Thirappane	Galgamuwa	Galgamuwa	
No. of GN	16	12	1	2	4	35
No. of Village	35	18	1	1	10	65
Population	21,860	7,220	1,000	2,200	2,810	35,090
Household	6,810	2,170	210	510	730	10,480
Farm Household	3,230	1,100	180	510	450	5,470

Source: Above information obtained based on FOs' jurisdiction, therefore it is different with data of GN.

Meteorology and Hydrology

90. The whole area of priority irrigation schemes is located in the region, which receives 1,250 – 1,500 mm of the annual precipitation (the region is expected that it receives over 775mm of annual precipitation more than three times in four years). The lowest monthly average temperature is 25.4℃ in January and the highest is 29.2℃ (Anuradhapura, 1959 – 1999). The hydrological features of each tank are summarised below:

Description	Unit	Major Schemes		Medium Schemes		Mahananneriya Small Scheme (Cascade)	
		Nachcha-duwa	Palukada-wela	Periya-kulama	Maha Nanneriya	Total	Average
Catchments area	km^2	611	19	13	36	26	4
Estimated annual runoff	$1,000m^3$	107,756	3,283	3	5,874	3,811	635

Agriculture

91. The main cultivation crop in the priority irrigation schemes is paddy. The table below shows the average paddy cultivation during the past 5 years.

Average Paddy cultivation in the Priority Schemes (1994/95 Maha – 1999 Yala)

Irrigation Scheme	Nachcha-duwa Major Scheme	Palukada-wala Major Scheme	Periya-kulama Medium Scheme	Maha-nanneriya Medium Scheme	Maha-nanneriya Minor Schemes
Maha					
Cultivation Area (ha)	2,540	956	91	158	68
Yield (t/ha)	4.43	3.55	4.15	2.71	3.16
Production (t)	11,252	3,394	378	428	215
Yala					
Cultivation Area (ha)	1,473	433	19	-	5
Yield (t/ha)	3.81	2.66	3.56	-	4.40
Production (t)	5,611	1,152	66	-	22
Annual					
Cultivation Area (ha)	4,013	1,389	110	158	73
Yield (t/ha)	4.20	3.27	4.05	2.71	3.25
Production (t)	16,864	4,546	443	428	237

Source: Inventory Survey by the Study Team (1999)

92. Other Field Crops (OFC) cultivation is mainly carried out under highland condition such as homestead, fields around homestead or shifting cultivation (Chena). Mixed cropping is popular cultivation pattern for maize, vegetable, cereals and beans, though sesame, chilies and soybean are mostly cultivated as single crops. The level of yield is varied by cultivation areas and seasons. Yields of sesame, chilies and soybean are estimated at 0.4-1.0, 1.0-2.1 and 0.6-2.5 t/ha, respectively.

Irrigation / Drainage

93. Irrigation water for the irrigation schemes is supplied from the tank. Normally the irrigation canals consist of the distribution facilities of main canal, distribution canal (D-canal), field canal (F-canal) and drainage canal. The canal extent of each respective scheme is shown in the table below.

Outline of Irrigation / Drainage Facilities in the Irrigation Schemes

Irrigation Scheme	unit	Major Schemes		Medium Schemes		Minor Schemes	
		Nachcha-duwa	Palukada-wela	Periya-kulama	Maha-nanneriya	Mahananneriya	
						Total	Average
Catchments area	km^2	611	19	13	36	26	4.3
Effective storage capacity	1,000 m^3	55,688	7,709	1,674	2,504	839	140
Main Canals	m	40,070	19,700	1,800	3,280	5,240	873
D-canals	m	20,800	11,100	-	-	-	-
F-canals	m	113,600	*	-	-	-	-
Area of Irrigation	ha	2,540	956	91	158	117	19.5

94. The present condition of facilities in the respective schemes is shown in the next table. The operation and maintenance of facilities are carried out by FOs on D-canal and below system in the major scheme and all systems except for tank bund in the medium scheme. There is a case in the medium schemes where tanks are

managed by FOs. In the minor schemes, the operation and maintenance is carrying out by FOs under the technical guidance of the Provincial Engineering Department and the Department of Agrarian Services.

Present Condition of Irrigation Facilities

Schemes	Tanks	Irrigation Facilities
Nachchaduwa	- No serious problem is observed.	- In some portion of canals, slopes inside the canal are scoured, embankment of the canals are broken. - In some portion of D-canals, retaining walls are deteriorated. - Most measuring devices installed at the head of the D-canal are broken.
Palukadawela	- No serious problem is observed.	- Same as the Nachchaduwa scheme.
Periyakulama	- Sluice gates are not functioning well.	- No structure is provided in the canals.
Maha Nanneriya	- No serious problem is observed.	- Some structures on the main canals are damaged.
Maha Nanneriya minor schemes	- Some of sluice gates are broken.	- No structure is provided except the Mailawa scheme.

Farmers' Organisations (FO)

95. Twenty-eight farmers' organisations are organised in the priority irrigation schemes. The present condition of these FOs are as shown in the table below. The major purposes of FO are water management and O&M of irrigation facilities, and to support agricultural activities. FO also carries out various other activities.

Outline of Farmers' Organisation

Irrigation Scheme	Unit	Nachcha-duwa Major	Palkada-wela Major	Periya-kulama Medium	Maha-nanneriya Medium	Mahananneriya Minor Group (Cascade)	Total
No. of FO	(No.)	14	7	1	1	5	28
Total Member	(No.)	2,558	927	52	186	301	4,024
Average Member/FO	(No.)	179	132	52	186	60	142
Year Established	(Year)	1982-1990	1970-1990	1984	1982	1988-1996	1970-1990
Average Joining Rate	(%)	70	72	25	10	56	43

Source: Interview survey of FOs.

Environment

96. Particular environment problems do not exist except for wild elephants in the priority irrigation scheme. Damage caused by the wild elephants has been a serious problem in the community for a long time. The results of several months of farming of paddy and OFC in the field and stored paddy or the results of a few years as banana and coconut trees are damaged in a moment. Damages to residential houses and injuries and deaths of the field workers are also reported.

3.3 Survey for Participatory Planning

Participatory Survey

97. The participatory survey was conducted for positive participation of beneficiaries in the development project and preparation of the sustainable planning. The method of the participatory planning adopted the Project Cycle Management (PCM), which has been developed by the Foundation for Advanced Studies on International Development (FASID), Japan.

PCM Workshop

98. The workshops were held at ten locations in all the priority irrigation schemes. The participants of PCM workshops were equally selected from the personnel concerning the Project. The total number of participants in the PCM workshops in all the irrigation schemes was 490 consisting of 352 males and 138 females. The participants confirmed the following core problems and core objectives of the community in the workshop.

Core Problems and Core Objectives

Schemes/	Work shops	Core Problems	Core Objectives
Nachchaduwa Major scheme	1	Low income of farming community.	Income of the farming community is increased.
	2	Improper socio-economic level.	Socio-economic level improved.
	3	Low social economic level.	Social economic level improved.
Palukadawela Major scheme	1	Poor economy.	Economy improved.
	2	Low economic status.	Economic status improved.
	3	Unsatisfactory economy.	Creating suitable economic level.
Periyakulama Medium		Low socio-economic status of farming community.	Economic status of the farmer community increased.
Mahananneriya Medium		Unsatisfactory socio-economic status.	Socio-economic status improved.
Mahananneriya Minor Cascades	1	Undeveloped economy.	Economy increased.
	2	Undeveloped socio-economy of community.	Socio-economy of community developed.

99. Participants have identified the following six development approaches. Those are: (i) strengthening of FOs, (ii) obtaining enough water supply, (iii) improving agricultural activities, (iv) improving social and moral values, (v) land development, and (vi) improving rural infrastructure. They have selected the following three approaches in all workshops. These are closely connected to each other and they should be implemented at the same time.

Approaches Selected by Participants

1) Strengthening of FOs (including improvement of employment as non-farm income)
2) Obtaining enough water supply
3) Improving agricultural activities (including marketing and agriculture credit)

100. The Study Team has prepared the preliminary PDM based on the results of the PCM workshops. The preliminary PDM is evaluated in the public meeting. The major objectives of the evaluation are the following: (i) whether the preliminary PDM is acceptable to be a development project for the entire community or not, and (ii) reviewing whether the raised action plan is able to be practised. The meeting was held at five locations in the priority irrigation scheme and the participants were 147 in total of which 121 were male and 26 female. The preliminary PDM in the public meeting has accepted almost all the items by farmers.

101. The final PDM adapting to the Feasibility Study was prepared by the Study Team

based on the results of the public meeting. The PDM adapted to the entire priority irrigation scheme is summarised below. The partial modification to the preliminary PDM by the Study Team was done on following items.

1) The protecting system of wild elephants is proposed to be established in FO.
2) Social services such as the improvement of social values and moral, and resolving alcohol addiction are proposed to be implemented as a part of FO activities.
3) The Farmer Centre is proposed to be constructed for strengthening of FO's activities and maintaining communication between the official institution and the community (office for FO and Farmer Animator)

Narrative Summary of the Preliminary PDM

Overall Goal	Sustainable development of rural agriculture is achieved. Agriculture productivity in the rural community is improved.
Project Purpose	Nachchaduwa Major Scheme : Income of farmers is increased. Palkadawela Major Scheme : Suitable economic level is created. Periyakulama Medium Scheme : Economic status of farmer is improved. Mahananneriya Medium Scheme : Socio-economic status is improved. Mahananneriya Minor Cascade : Socio-economic status is improved.
Outputs	Multipurpose Farmers' Organisation is established and strengthening. Proper Irrigation water is distributed according to the schedule - Irrigation facilities are rehabilitated and improved. - Proper water management is conducted by FO. - Irrigation facilities are properly maintained. Agriculture activity is improved. - OFC cultivation is expanded. - Agricultural extension activity is strengthened. - Agriculture inputs and outputs marketing is improved. - Access to credit services is improved. - Elephant damage is decreased. - Deforestation in the catchments area is reduced.
Activities	Strengthen Farmers' Organisations - Conduct awareness and training programmes. - Reorganise FOs to have multifunction. - Carry out income generation through FOs. - Farmer centre is constructed. Supply irrigation water in accordance with schedule. - Rehabilitate and improve irrigation facilities. - Improve water management. - Strengthen O&M of irrigation facilities Improve agricultural activity. - Promote OFC cultivation. - Strengthen agricultural extension activity. - Improve marketing of agriculture inputs and outputs. - Improve credit services. - Promote reforestation in the catchments area. - Establish elephant protection system in FO

102. In addition to the PCM workshop, planning of rehabilitation of the irrigation facilities was conducted by FOs themselves, as a part of a participatory survey. It is concluded that their survey results are technically and economically acceptable.

3.4 Basic Development Concepts of the Priority Irrigation Schemes

Introduction

103. The PCM workshops were held in the priority irrigation schemes. The workshop's participants have determined farmer/community as the target group and adopted three approaches to be tackled during the Feasibility Study as: (i) strengthening of farmers' organisations (including the increment of non-farm income as by improving employment opportunity), (ii) obtaining sufficient irrigation water, and (iii) improving agriculture activity (including improvement of marketing and agriculture credit). The Study Team has prepared PDMs for the respective priority irrigation schemes based on the results of the workshops. The development plan of the priority irrigation scheme is prepared for the concrete development contents based on PDM and the action plan.

104. The Project purpose and activities of PDM of the priority irrigation scheme prepared on the PCM workshop are adaptive to the overall goal, basic development objective and development components of the Master Plan. The development of the Priority irrigation scheme is able to be implemented within the framework of the Master Plan.

Basic Approaches on the Programme Preparation

105. The basic approach set in the Master Plan is adapted for the preparation and the direct opinions on the development obtained in the public meeting are fully reflected in the development plan as described below.

Basic development approach

a) Programme implementation through farmers' initiative.
b) Comprehensive development.
c) Programme implementation according to the present development stage of the irrigation scheme.
d) Equal distribution of the fruits of development.
e) Close communication and maintaining transparency.

Farmers' opinion in the public meeting

1) The plan is to emphasise awareness for both officers and farmers
2) Rehabilitation and improvement works reflecting farmers' intention and the plan were prepared based on the rehabilitation and improvement plan prepared by farmers (FO).
3) The system is for establishing transparency of the rehabilitation and improvement works, and maintaining communication between the executing agencies and farmers.
4) Plan the system for providing various services fairly through FO.
5) O&M of facilities and water management due to unclear relation between landlord and tenant. FO has a function to survey the relation between landlord and tenant.

106. The development project covers two major schemes, two medium schemes and one minor scheme group including 6 schemes. The development component of each scheme includes the strengthening programme of FOs, the rehabilitation and improvement programme of irrigation facilities, and so on. In addition, the programmes such as improvement of government's support facilities and training of officials for capacity building-up are also included in the component, which are necessary to support farmers' activities in all priority schemes. Therefore, it is recommended that the Project is implemented as one unit including all these programmes.

3.5 Development Plan for the Priority Irrigation Schemes

Strengthening Farmers' Organisations

107. An awareness programme is applied for both the "Farmers" and "Official institutions concerned". The objectives of the awareness programme are the following; (i) "Proposed components of the Project are to implemented by initiative of farmer/FO", and (ii) "Government institutions are able to approach the Project to promote self-reliance of farmer/FO". The multipurpose FO is to be established through this programme with self-motivation.

108. The following education and training programmes for fostering leaders of the multipurpose FO are to be conducted. They are carried out separately from the awareness programme.

Education/Training Programmes for FO Leaders

Training Subject	Contents
1) Draft preparation of the Articles of Organisation amendment	Draft preparation of the Articles of Organisation, and knowledge of the systems and the procedures required in the process.
2) Practical training of the basic operation and management of the organisation	Planning, participatory management, practical operation & management of FO, practical financial management, financial resource management, role & systems of official concerned, etc.
3) Training on the income generation activity	Practical; training of the operation/management of the rural credit (Group-loan, Revolving-loan) and co-operative purchasing/selling.
4) Information network formation/Awareness training	Establishing information networks with external organisations for collecting and sharing information in and around the community.

109. The present FOs are to be reorganised as multipurpose functional. The reorganisation is determined in the general meeting of the entire community conducted for the awareness programme. The organisation is to provide various services to farmers/community and to be fostered as an autonomous organ representing the community. Major change in the reorganisation is to set up four subcommittees under the board of management for acting on irrigation, agriculture, business of FO and income generation/social services. An audit section is proposed to be set for maintaining transparency of FO activities and employing volunteers for close communication with FO members.

110. "Agriculture" and "Income generation/Social services" subcommittees are to carry out income generation activities for farmers and the community. Social service activities are to be implemented. The income generation/Social services are to be carried out by the self-motivation of FOs and are to target poverty groups of the community. Necessary information is to be provided through Agrarian Service Centre (ASC) and Farmer Animators. The training facilities of the National Youth Service Council (NYSC) are to be utilised for vocational training, so no extra facility is to be constructed by the Project.

111. Farmer centres are to be constructed for smooth implementation of FOs' activities and for maintaining communication in the community and with the official agencies concerned. Twenty-seven centres are to be constructed in all the schemes except for the Periyakulama medium scheme. The Periyakulama scheme uses the existing farmer centre. The size of the facility is according to the DOA's ongoing plan.

Distribution of Proper Irrigation Water

112. The rehabilitation and improvement of the irrigation facilities of the priority schemes are shown in the table below.

Rehabilitation and Improvement of Irrigation Facilities

Category	Item	Nachchaduwa Major	Palkadawela Major	Periyakulama Medium	Maha Nanneriya Medium	Maha Nanneriya Minor Cascade
Tank	Bund	Embankment, Gravelling, Rip-rap, Filter toe drain	Earth filling, Gravelling, Rip-rap, Filter	Slope protection, Gravelling	Earth filling, Gravelling, Rip-rap, Filter、	Widening bund, Slope protection, Earth filling
	Sluice	Repair concrete works, protection of downstream, Measuring device	Minor repair, Downstream protection, Measuring device	Replacement of sluices	Minor repair, Downstream protection, Measuring device	Repair and replacement of sluices
	Spillway	Repair of concrete works	Minor repair	Rehabilitation of downstream channel	Concrete repair works	Minor repair, Downstream protection
	Others	O&M Road	Bathing steps			De-silting, Bathing step
Main canal	Earthworks	15 km	16.3 km	900 m	3,500 m	3,300 m
	Lining	7 km	16 Nos.	330 m	90 m	
	Structures	180 Nos.	78 Nos.	24 Nos.	60 Nos.	52 Nos.
	O&M Road	26 km	16.3 km	330 m	2,300 m	2,000 m
D-canals	Earthworks	16 km	11.2 km	3,500 m		
	Lining	21 km	5 Nos.	-		
	Structures	230 Nos.	96 Nos.	47 Nos.		
	O&M Road	18 km	11.2 km	-		
F-canals	Earthworks	17 km	0.6 km	2,500 m		
	Lining	38 km	0.8 km			
	Structures	122 Nos.	71 Nos.	22 Nos.		
	O&M Road	45 km	0.6 km			
Others	Small Tank	11 Nos.	18 Nos.		Spillway 7 Nos.	
	Feeder Canal	L.S.	L.S.	600 m		

113. The works for tanks and main canals are to be conducted by constructors and the works for D-canals and F-canals are to be carried out by contractors or farmers. The training courses for rehabilitation and improvement works are programmed in order to reflect farmers' intention to the works as much as possible, and to carry out the works by the farmers. The training courses for the government staff and the farmers are outlined below.

Training Programme for Rehabilitation and Improvement Works

Activities	Period	Subject of training
Training for the government staff	1 day, Pre-construction	Participatory planning, Communication with farmers
	1 day, In the construction	Skill of technology transfer to farmers
	1 day, Post-construction	Hand-over of O&M responsibility to farmers Follow-up programme
Training for farmers	2 days, Pre-construction	Participatory planning, Field investigation, design and cost estimate
	2 days, Pre-construction	Contract for rehabilitation works, Farmers' contribution
	1 day, In the construction	Quality control for earthworks and concrete, Preparation of document for rehabilitation, Field inspection
	1 day, Post-construction	Follow-up programme

114. The water management / O&M training for the government staff and farmers are proposed as follows:

Training Programme for Water Management and O&M of Facilities

Subject	Target	Period	Training Contents
Improvement of Water Management	Officers	1 day Pre-construction	Awareness programme, Communication with farmers
		1.5 days Post-construction	Estimation of water requirement, Preparation of water distribution programme, Skill for gate operation of tank and off-takes, Flow measurement and flow monitoring, Skill of technology transfer to farmers
		1 day	Follow-up programme
	Farmers	1 day Pre-construction	Awareness programme, Communication with government staff, Communication among farmers, Communication with other FOs
		1.5 days Post-construction	Preparation of water distribution programme, Skill for gate operation of tank and off-takes
		1 day	Follow-up programme
Improvement of O&M	Officers	1 day Pre-construction	Awareness programme, Communication with farmers
		1.5 days Post-construction	Preparation of maintenance programme, Monitoring of maintenance activities, Skill of technology transfer to farmers
		1 day	Follow-up programme
	Farmers	1 day Pre-construction	Awareness programme
		1.5 days Post-construction	Preparation of maintenance programme, Organising a patrol, Organising a Sramadana Collection of O&M charge
		1 day	Follow-up programme

Improvement of Agriculture Activities

115. The cultivation area and production of respective crop under without project and with project after the rehabilitation and improvement of the irrigation facilities are presented in the following table.

Cropping Area and Production under With and Without Projects

	Without Project			With Project			Increase (ton)
	Area (ha)	Yield (ton/ha)	Production (ton)	Area (ha)	Yield (ton/ha)	Production (ton)	
Paddy - Maha	3,813	4.1	15,667	3,481	5.0	17,405	1,738
- Yala	1,930	3.6	6,851	2,600	5.0	13,000	6,149
OFC							
Maha - Pulses	-	-	-	125	1.5	189	189
- Chili	-	-	-	108	1.5	163	163
- R. onion	-	-	-	72	15.0	1,080	1,080
- Vegetables	-	-	-	53	10.0	530	530
- Maize	9	2.2	20	-	-	-	-20
Yala - Sesame	97	0.3	26	125	0.9	113	87
- Pulses	51	0.6	28	157	1.5	237	209
- Chili	257	0.6	159	157	1.5	237	78
- B'onion	-		-	125	10.0	1,250	1,250
- R. onion	4	1.0	4	-	-	-	-4
- Vegetables	4	2.0	8	64	10.0	640	632

116. Inter-provincial Extension Unit (IPEU) of the central government and Provincial Department of Agriculture (PDOA) are to conduct following extension activities in order to achieve crop diversification and yield increase. Agriculture subcommittee of FO is to keep close contact with IPEU/PDOA.

Agriculture Extension Activities

Programmes	Objectives
1) Field Trial / Demonstration Programme - Adaptive trials - Small-scale demonstration, cropping pattern, demonstration, large-scale demonstration - Productivity increase programme, IPM programme	- Adaptive trial - To demonstrate recommended practices of paddy and OFC for crop diversification and increase productivity. - Appropriate chemical application
2) Farmer Training Programme - Induction farmer training, induction farmer guidance, farmer training - Workshop, quality seed campaign, study tour	- To disseminate crop diversification and cultivation technique directly to farmers.
3) Seed Production Programme	- To foster seed production farmers.

117. Co-operative purchasing of inputs materials by FOs is proposed. This system is to be carried out by linking to a group loan that is mentioned in the improvement of the rural credit. Awareness and education of FO are to be conducted by ASC.

118. The following improvements on marketing programme is proposed. These activities are to be carried out by FOs (FOs' business subcommittee).

Improvement Programme of Marketing Agricultural Products

Programme	Objectives	Method & Inputs
1) Setting Pola	To activate marketing of farm products by open Polas. To sell small quantity products from home gardens.	● Polas are to be managed by FOs ● Proposed that Pola is to set without any construction.
2) Setting Collecting Point of Farm Products	To set contact points of producers with merchants on outputs marketing.	● Selections of merchants and locations are determined by farmers and Proceeded by FOs. ● ASC/DAS is provide guidance to both merchants and FOs on collecting points and co-operative selling.
3) Establishing Co-operative Selling System	To sell products regularly and develop new markets.	
4) Establishing of Market Information Collection	To collect information of market prices.	● Regular purchasing of KARTI publication. PMU will provide information on purchasing.
5) Improving Quality	To improve quality of products.	● FOs have to collect information of quality and disseminate to farmers.

119. Introduction of the following loan is proposed for improving rural credit. The activity on the rural credit is to be carried out mainly by FOs, and is to be supported by PMU and ASC.

Improvement of Rural Credit

Programme	Objectives	Methods and Inputs
1) Introduction of group loan (cultivation loan)	For purchasing inputs materials. Co-operative purchasing system and linkage	● Mainly loan by private banks. PMU is to request to banks on introduction. ● The system management/operation of farmer sides is carried out by FOs (Business Subcommittees) ● ASC/DAS is to educate FOs on the introduction and training FO leaders on the operation works.
2) Introduction of revolving loan (medium term loan)	For purchasing farm machinery and financing small-scale enterprise.	● Operation & management by FOs (Business Subcommittees). Principally, capital of loan is to be prepared by FOs. If its capital is not enough, FOs obtain a loan from the banks, and PMU supports FOs for obtaining loans. ● ASC/DAS is to provide training for lending works.
3) Introduction of mutual aid credit system	For emergency need on living (sick, accident, etc.) & finance for self-employment.	● Loan from the Women's Bank. ● Mainly operating for women groups. ● FOs (Income Generation/ Social Services Subcommittees) is deal with education but not on operation. ● ASC/DAS's education to FOs.

120. Planting of fruits trees such as mango and jackfruit are to be promoted for the environment conservation in the catchment areas in Periyakulama medium, Mahananneriya medium and Mahananneriya minor schemes. The Agriculture Subcommittee of the FO is to promote these fruits cultivation, and PDOA is to provide technical guidance and seedlings.

121. It is proposed to set a observation point in the elephant infested area and to organise the watching and protecting system among the community people. The Agriculture Subcommittee of the FO is to operate and manage the system and thunder-flashes and crackers are to be equipped with FO.

Proposed Plans for Strengthening of Agricultural Support Institutions

122. The constraints or weaknesses in the agricultural support institutions identified in the present Study, and the proposed agricultural development and income generation plans of the Project dictate that the areas to be addressed for the strengthening of agricultural support institutions for agricultural development should include: (i) institutional strengthening programme, (ii) strengthening of farmers/FOs support institutions and facilities, and (iii) support programmes for income generation. An outline of the proposed plan is presented in the above table.

Support Programs for Strengthening of Agricultural Support Institutions

Support Programs	Institutions
Institutional Strengthening Programmes	IPEU, PDOAs (NCP & NWP)
1) Logistic support strengthening	
2) Staff training programme	
3) Institutional strengthening	
4) Upgrading ISTI, M. Illuppallama	
Strengthening of Farmers/FOs Support Institutions & Facilities	DAS, Kurunegala & Anuradhapura
1) Establishment of "Farmer Centre"	
2) AS Centre strengthening programme	
3) Institutional strengthening programme	
Support Programs for Income Generation	
1) Upgrading of Provincial Seed Farm, Galgamuwa	PDOA, NWP
2) Upgrading of IFTC, Nikaweratiya	PDAPHs, NWP
3) Establishment of AEC, Anuradhapura	NAQDA

Environmental Conservation Plan

123. For the environmental problems in the priority schemes, there are (i) significant and (ii) not significant problems. The former category includes the human-elephant conflict and it concerns the problem of damages by wild elephant. The latter category includes all the others listed in this report such as field drainage, surface water quality, catchments degradation, and silting in minor tanks. These are more easily mitigated through various management options, which the project will recommend and implement and its countermeasures are mentioned in this report.

124. For the development of the priority irrigation schemes, it is recommended to carry out monitoring of water quality, elephant damage, soil erosion, and public health (malaria), as well as the proposed monitoring plan of the Master Plan Study. It is necessary that the executing agency carry out the water quality analysis in suspect areas twice a year over a period of two to three years.

3.6 Implementation Plan and Cost Estimate

Project Executing Agencies

125. The Irrigation Management Division (IMD) of the Ministry of Irrigation and Power (MIP) would be the executing agency of the Project. In connection with the implementation of the Project, IMD would co-ordinate all activities of the Central Government institutions and regional Government institutions. The Project as comprehensive development consists of many development components and each component is implemented by the institution concerned. In order to co-ordinate all

these institutes, Central Project Co-ordination Committee (CPCC) and Provincial Project Co-ordination Committee (PPCC) are proposed to be established. The Project Management Unit (PMU) is to be established under the CPCC and is direct responsibility for the implementation of the Project. The PMU consists of seven units for effective Project management as Administration Unit, Agricultural Supporting Unit, Construction Unit, O&M of Irrigation Schemes Unit, Income Generation / Social Support Services Unit, Farmers' Supporting / Credit Unit and Monitoring and Evaluation Unit.

126. The entire period required for the Project implementation is estimated to be seven years. Prior to commencement of the development components such as strengthening of FOs and rehabilitation works, the awareness programme (1 to 1.5 years) should be carried out not only to farmers but also to officers and front line staff. After completion of all development programmes, the programmes should be evaluated, and the follow-up programme will be implemented for half (0.5) to one (1.0) year.

Cost Estimate

127. The total project cost is estimated to be Rs.805 million (US$ 11.3 million), excluding price escalation and G.S.T. The cost per hectare is estimated at Rs.208,000 (US$ 2,950), and the rehabilitation and improvement costs of irrigation facilities including farm roads account for 62% of total cost.

Total Project Costs (Excluding Price Contingency and G.S.T.)

(Unit : Rs. Million)

		Commanding Area (ha)	Rehabilitation Cost*1	Capital for Support Facilities*1	Awareness and Training Programmes *1	PMU Administration and Loan*1	Engineering Cost*1	Total
Nachchaduwa major scheme		2,540	395.1	67.0	27.5	51.4	49.1	590.1
Palukadawela major schemes		956	58.7	27.6	12.2	19.9	9.8	128.2
Periyakulama medium scheme		91	17.9	1.7	1.6	1.9	2.1	25.2
Mahananneriya medium scheme		158	14.0	4.4	2.3	4.0	2.0	26.7
Mahananneriya minor schemes		117	15.2	9.1	5.2	2.9	2.8	35.2
Total		3,862	500.9	109.8	48.8	80.1	65.8	805.4
Proportional Extent			62%	14%	6%	10%	8%	100%
Cost per Hectare	(Rs./ha)		129,700	28,400	12,600	20,700	17,000	208,400
	(US$/ha)		1,830	400	180	300	240	2,950

Remarks : *1 Including physical contingency Exchange Rate：US$1.0 = Rs. 71

3.7 Project Evaluation

Economic Evaluation

128. The project economic costs for the priority irrigation schemes are estimated to be Rs. 765 million based on the total project cost (financial cost) multiplied by the standard conversion factor (SCF) of 0.95. The direct benefit of the Project is the increase crop yield/production by increase in cropping area, and the irrigation water

supply and the improvement of farming. The estimated annual benefit increase is Rs. 180 million. The Benefit Cost ratio (B/C) and the benefit minus cost (B-C) by the economic internal rate of return (EIRR) estimated on the economic cost and the economic benefit and the discount rate 10% are as follows.

a) Economic Internal Rate of Return (EIRR) : 15.3%
b) B/C (10% discount) : 1.53
c) B – C (10% discount) : Rs.327million

129. The result of the sensitivity analysis is shown in the table below. The Project has no economic viability, if the costs increase 20% and the target yields of crops decrease 10%.

Sensitivity Analysis (EIRR)－Priority Irrigation Schemes

Total Project Cost	Benefit			
	Plan	Benefit delay 1 year	Target crop yield decreased 10%	Benefit delay 1 year & Target yield decreased 10%
Plan	15.3%	13.5%	11.7%	10.4%
10% increased	14.1%	12.5%	10.6%	9.5%
20% increased	13.1%	11.6%	9.7%	8.7%

Financial Evaluation

130. Total project cost including the price contingency and the project cost is Rs.1,396 million. Financing analysis of the project on the total cost is carried out. Procurement items of the cost are shown in the table below. The necessary loan of the external sources is estimated at Rs.1,100 million (US $15.4 million). The repayment of the loan is Rs.56 to Rs.80 million/year from 10th to 30th years. This is to pay by the National budget.

Contents of Procurement of the Project Cost－Priority Irrigation Schemes

(Unit：Rs. Million)

	External Loan	National Budget	Farmers' Share	Total
a) Rehabilitation/Improvement of irrigation facilities *2	470.4	-	30.5	500.9
b) Rehabilitation/Improvement of supporting facility & Equipment *2	109.8	-	-	109.8
c) Awareness/Educational programme *2	48.8	-	-	48.8
d) PMU operation cost & fund for loan *1 *2	21.0	59.1	-	80.1
e) Engineering fee	65.9	-	-	65.9
f) Price contingency	381.2	37.9	17.5	436.6
g) GST（12.5%）	-	149.2	6.0	155.2
Total	1,097.1	246.2	54.0	1,397.3

Note： *1 Fund for revolving loan *2 Including physical contingency.

131. Farm budget analysis is carried out for evaluating the increased farm income and the bearing potential of O&M cost of the irrigation facilities. The result of analysis is shown in following table.

Farm Budget Analysis

Holding Size of Irrigated Paddy Land	Without Project *1			With Project		
	Whole Average	0.4 - 0.8 ha	Less than 0.4 ha	Whole Average	0.4 - 0.8 ha	Less than 0.4 ha
(No. of Sample)	210	68	38			
(Distribution %)	100%	32%	18%	100%	32%	18%
I. Irrigated Paddy Area (ha/household)	0.81	0.46	0.22	0.81	0.46	0.22
II. Cropping Area (ha/ household)	0.96	0.70	0.30	1.63	0.90	0.46
III. Balance of farm household economy (Rs./household/year)						
1) Total income	130,100	93,600	66,900	187,500	133,300	85,500
2) Total expense	97,600	66,200	63,600	116,800	81,200	71,300
3) Net income	32,500	27,400	3,300	70,700	52,100	14,200
(Bank deposit)	(3,900)	(1,300)	(1,400)			
IV. Net income increased (Rs./household/ year)				38,200	24,700	10,900
V. Salaris & O&M fee (Rs./household/year)						
1) Major scheme				900	510	240
- Salaris				410	230	110
- Material cost				200	110	50
- Labour cost				290	170	80
2) Medium & Minor scheme				1,630	920	440
- Salaris				410	230	110
- Material cost				490	280	130
- Labour cost				730	410	200

Note: *1 Irrigated Paddy area, Cropping Area and Farm economy is the results of the Questionnaire Survey by the Team, 1999. The figures are from 1998 Yala and 1998/99 Maha.

132. Under the with project condition, the average gross income of farmers in all priority schemes would increase about 40% from the present level, and the annual net incremental income would average Rs.38,000/household. For the small farmers having an irrigated paddy field less than 0.4 ha, their gross income would also increase about 30%, and their annual net incremental income would be Rs.10,900/ household.

133. As seen in the table on farm budget analysis, total amount of salaries, annual material cost and labour cost per hectare ranges from Rs.240 to Rs.900 in the major scheme and Rs.440 to Rs.1,630 in the medium and minor schemes. It is less than 4% of increased income, therefore it is considered to be affordable for farmers to bear Salaries and the O&M cost. A farmer's share of O&M cost largely depends upon the farmer's "will for paying." The Study Team analysed the farmer's acceptability for sharing of O&M cost (material cost by cash payment) based on the results of the questionnaire survey and RRA survey. Most ordinary farmers have accepted Rs.250/ha/year in the questionnaire survey and majority of FO leaders accepted Rs.500/ha/year in the RRA survey. The material cost with project is Rs.150/ha/year in the major scheme and Rs.300/ha/year in the medium and minor schemes. The cost in the medium and minor schemes is almost the same as an ordinary farmer is willing to pay if rehabilitation and improvement works of the irrigation facilities are accomplished satisfactorily.

Social/Economic Impacts

134. The following social/economic impacts are expected by the Project implementation.

1) Regional economy is activated by increasing the purchasing power of the

beneficiary farmers for increasing income and marketing of agriculture inputs and outputs.
2) Improvement of employment opportunity, increase of non-farm income and alleviation of poverty are to be achieved by the income generation programme.
3) Women's participation is activated and their social status is improved by the establishment of the income generation/social service subcommittee under FO
4) Social problem (alcohol addiction) is reduced by the activity of FO's social service.
5) Damage caused by elephants is decreased by organised protection by FO.
6) Forest devastation and soil erosion in the catchments area are decreased by the reforestation programme of FO.
7) Capability of official staff concerned is improved by the implementation of training/education programme.
8) Ripple effect by agricultural extension system and strengthening facility.
9) Ripple effect by the model of participatory development in the Dry and Intermediate zones.

3.8 Conclusions and Recommendations of the Feasibility Study

Conclusions

135. Total irrigation area in the priority irrigation schemes is 3,860 ha, the number of beneficiary farm households is 5,500 (land holders) and population is 18,000. PCM workshops for the participatory development were held in these schemes. The Project purpose is set as "Social/Economical status is improved" by the concerned personnel including farmers. "Strengthening farmers' organisation", "proper irrigation water is distributed according to the schedule" and "agricultural activities are improved" are adapted as three major activities. The development component following the above activities and the strengthening programme for farmer support services required for the strengthening agricultural extension and promoting the income generation programme are formulated.

136. The financial cost of the entire project is estimated at Rs 805 million (US$ 11.3 million) excluding GST. The Internal Rate of Return (IRR) of the Project is estimated at 15.3% according to the results of the economic evaluation. It is concluded to be economically feasible. These development components are mainly carried out by farmers/FO, and are concluded to be technically possible to implement based on the results of the public meeting. On the other hand, total income per household is increased by 40% and annual net income is increased to Rs. 38,000 on average in the entire scheme. Small-scale farms (less than 0.4 ha) are also estimated to increase by 30% on total income and Rs.10,900 on annual net income.

Recommendations

137. The development of the priority irrigation scheme is proposed to be implemented as the model project for the area of the Master Plan. The special feature of the development plan for the Master Plan area and the Feasibility Study area is the awareness

programme to be carried out for one (1) to one and half (1.5) years. Through this process, the capability on the participatory development of the officers concerned is to be increased and the implementation system is to be established in the official institutions concerned. Therefore it is proposed that the Project in the priority schemes precedes its implementation, establishes the implementation system, and then proceeds to initiate the development of the Master Plan area. In addition, the number of farmer centres proposed in the Master Plan area will need to review in view of utilisation of the centres to be constructed in the Feasibility Study area as the pilot project. It is proposed to provide few numbers on the Feasibility Study area, and review the total number in the Master Plan area based on experience of the pilot project.

138. The development benefit is limited for the landholders in the rehabilitation and improvement programmes and the larger landholders obtain larger benefit. The Project aims at the equitable development in the community and plans comprehensive development including the rehabilitation and improvement programme of the irrigation facilities, the income generation programme for the poverty and the social service programme by FO for the community members. Moreover, it is planned to strengthen and improve the supporting facilities of the relevant Government institution. The Project is proposed to implement a comprehensive development including strength and improvement. The project cost for carrying out the above strengthening and improving of the support facility of the relevant official institutions separately would be over investment. Therefore, the development of the five priority schemes is proposed to be implemented together.

139. The Project Management Unit (PMU) established under the Ministry of Irrigation and Power has direct responsibility for the implementation of the Project. However, many government agencies at central and provincial levels will participate in the implementation of this Project consisting of various programmes. In order to co-ordinate all these agencies at central and provincial levels, it was planned to establish the Central Project Co-ordination Committees (CPCC) in the central government and the Provincial Project Co-ordination Committee (PPCC) in the provincial government. The role of CPCC and PPCC is very important in order to have smooth and effective implementation of the Project. Therefore, it is recommended to establish these co-ordination committees before commencement of the Project.

140. Various official institutions are involved in the implementation of the Project. The mandate of these institutions is not clear and the overlapping of the duties is observed sometimes. Especially regarding the support programme of the farmers' organisation, the demarcation among Department of Agrarian Services, Irrigation Management Department and Irrigation Department is not clear. In order to carry out the Project and make effective use of the project cost (especially on the external loan), the responsible area of the respective official institutions needs to be clarified.