

PART - I GENERAL BACKGROUND

CHAPTER 1 INTRODUCTION

1.1 Authority

This is the Draft Final Report on the Study for Potential Realisation of Irrigated Agriculture in the Dry and Intermediate Zones of Sri Lanka (the Study hereinafter) 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 October 26, 1998. The Report presents the results of all works performed in both Sri Lanka and Japan for the Master Plan and Feasibility Studies.

1.2 Background of the Study

Sri Lanka is mainly an agricultural country. About 40% of its working population is engaged in agriculture, which occupies about 25% of the Gross Domestic Production (GDP). In the dry and intermediate zones covering about 70% of the land area of Sri Lanka, many irrigation schemes have been developed by the Irrigation Department (ID) and the Mahaweli Authority of Sri Lanka (MASL), which contribute to the profitable agricultural development in these zones. Since the 1980s, emphasis has also been laid on rehabilitation of irrigation schemes. However, returns on investments made in major irrigation schemes and settlements have not been commensurate with either the investments, or level of effort exerted by the line agencies in servicing the various requirements of these schemes till recently. Improving management efficiencies of the irrigation infrastructure with beneficiary participation has, therefore, become one of the main concerns of the irrigation agencies during the recent past.

During the past decade, enforcement of regulations has been weakened due to reduced capacity of the state institutions both in terms of limited resources and changes in policy framework resulting in farmers reluctance to pay Operation and Maintenance (O&M) charges. Some of the key factors contributing to the changed policy framework are low returns from paddy cultivation arising from increased production cost and farmers claims over distribution of O&M charges for a specific location based on improvements. As a result, irrigation structures have been subjected to rapid deterioration, illegal tapping of water, and encroachment of reserved areas of the irrigation systems, which finally cause in lowering of agricultural pro-

ductivity.

In the Plan of Public Investment (1995 - 99), the Government put the priority on increasing agricultural productivity and income through the introduction of commercial agriculture, increasing farm products for export, increasing employment opportunities in rural areas, which will contribute to lowering of population pressure in the urban areas, strengthening extension services to the farmers, rehabilitating and improving agricultural infrastructure, etc.

With this background, the Government of Sri Lanka requested the Government of Japan to provide technical co-operation for the execution of the Study for Potential Realisation of Irrigated Agriculture in the Dry and Intermediate Zones of Sri Lanka, which produce 67% of national paddy and 70% of other farm products. JICA responded to this request by dispatching the Preparatory Study Team to confirm the request and conclude the Scope of Work (S/W) for the Study. The Scope of Work and minutes of meetings held during the Study are shown in Attachment - 1 and 2.

1.3 Objectives and Areas to be covered by the Study

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 households through facility rehabilitation, efficient use of water with participatory management, improvement of support services including credit and marketing, and to conduct a feasibility study on the selected priority projects.

The area to be covered by the Study is estimated at about 6,500 km², extending over the four districts of Anuradhapura, Kurunegala, Puttalam, and Matale (see Location Map).

1.4 Progress of the Work

Master Plan Study

(1) Phase 1 Fieldwork in Sri Lanka (from April till July 1999)

- 1) Discussion on the inception report for the Master Plan and Feasibility Studies with MIP and agencies concerned. (Reference: The Minutes of Meeting in Attachment-3)
- 2) Preparation of work plan for technology transfer to the counterpart personnel.
- 3) Execution of socio-rural surveys consisting of inventory survey and questionnaire on irrigation facilities as well as rapid rural appraisal

(RRA).

- 4) Execution of the following field investigations and studies at the project site:
 - a) Selection of 100 irrigation schemes to be studied, in collaboration with counterpart personnel and MIP;
 - b) Review of past and on-going development projects and the case studies;
 - c) Data collection on natural conditions including topography, geology, meteorology, hydrology, soils, and land use;
 - d) Survey of marketing and agricultural support services such as the extension and agricultural credits;
 - e) Field investigation and survey for irrigation and drainage facilities and for rural infrastructures including water supply and roads;
 - f) Environmental survey;
 - g) Collection of data and information on project evaluation and on design and construction costs including laws and regulations related to the construction, design standards; and
 - h) Preliminary selection of priority irrigation schemes.
- 5) Discussion on the results of the phase 1 field survey with MIP and agencies concerned. (Reference: The Minutes of Meeting in Attachment-4)

(2) Phase 1 Office Work in Japan (from August till September 1999)

- 1) Master Plan Study of the 100 irrigation schemes including the following items:
 - a) Clarification of problems and conditions of success for participatory irrigation development;
 - b) Study on inventory survey of irrigation schemes;
 - c) Assessment of development stage of each irrigation scheme;
 - d) Study on prospective business by farmers' organisations;
 - e) Plan of supporting package programme; and
 - f) Preparation of master plan including strengthening of farmers' organisations, promotion of crop diversification, encouragement of income generation, improvement of agricultural support services, rehabilitation and improvement of irrigation schemes, O&M of facilities, environmental effects and conservation plan.
- 2) Selection of priority irrigation schemes.
- 3) Preparation of Interim Report, which includes the results of the Master Plan Study.

Feasibility Study

(1) Phase 2 Fieldwork in Sri Lanka (from November 1999 till January 2000)

- 1) Discussion on the Interim Report and selected priority irrigation schemes with MIP and agencies concerned. (Reference: The Minutes of Meeting in Attachment-5).
 - 2) Execution of the following field investigations and studies at the project site:
 - a) Socio-economy and agricultural production;
 - b) Water resources;
 - c) Rehabilitation/up-grading and O&M of irrigation facilities;
 - d) Agricultural extension system, marketing and agricultural credits;
 - e) Farmers' organisation and community;
 - f) Collection of data and information on procurement of project equipment and material;
 - g) Environmental conservation;
 - h) Implementation and management of project; and
 - i) Cost and benefits of project evaluation.
 - 3) Rapid rural appraisal by organising workshop using project cycle management (PCM) method, group discussion with farmers' leaders and public hearing from farmers.
 - 4) Execution of topographic and canal route surveys.
 - 5) Execution of technology transfer to the counterpart personnel as well as to farmer animators who keep direct contact with farmers through on-the-job training during the fieldwork.
 - 6) Preparation of Progress Report 2 and discussion on the results of the Phase 2 field survey with MIP and agencies concerned. (Reference: The Minutes of Meeting in Attachment-6)
- (2) Phase 2 Office Work in Japan (from March till June 2000)
- 1) Overall review of the study.
 - 2) Feasibility study on the priority irrigation schemes including the following items:
 - a) Agricultural development plan;
 - b) Development plan water resources;
 - c) Plan on irrigation and drainage and basic design of major irrigation facilities;
 - d) Operation and maintenance plan;
 - e) Plan of agricultural supporting package;
 - f) Environmental conservation plan;
 - g) Project implementation plan;
 - h) Procurement plan of project equipment and material, cost estimate and plan of investment; and
 - i) Project evaluation.

3) Preparation of Draft Final Report.

Explanation and discussion on Draft Final Report.and Holding Seminar

(1) Phase 3 Fieldwork in Sri Lanka (July - August 2000)

- 1) Explanation and discussion on Draft Final Report. (Reference: The Minutes of Meeting in Attachment-7)
- 2) Holding seminar as technology transfer.

(2) Phase 3 Office Work in Japan (September - October 2000)

- 1) Preparation of Final Report.
- 2) Preparation of report on technology transfer.

1.5 Acknowledgement

The JICA Study Team would like to express their sincerest acknowledgement to MIP for their kind assistance and co-operation. The Study Team also expresses its heart felt gratitude to the counterpart experts as well as the personnel and officials from the three (3) provinces and four (4) districts concerned who attended to and gave their valuable time for field guidance to the Study Team during the fieldwork in the Study area.

CHAPTER 2 NATIONAL AND REGIONAL SOCIO-ECONOMY

2.1 National Socio-economy

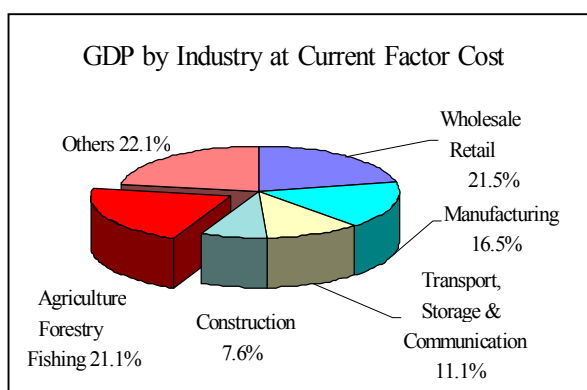
2.1.1 Land and Population

Sri Lanka is an island country with an area of 62,705 km² (excluding inland waters), of which 29 % is arable land or cultivated with permanent crops. Basic indicators for the national socio-economy are presented in Table 2.1.1. In 1998, the total population of the country was estimated at 18.8 million with a population density of 299 persons/km², which had increased at an average growth rate of 1.2% per annum during the period from 1989 to 1998.

Total labour force was estimated at about 6.7 million in 1998. Of these, 91% are employed population. In 1996, the structure of employment comprised 41% for services, 37% for agricultural sector, 15% for manufacturing, and 7% for other sectors such as construction and trade. A high unemployment rate is a long-standing problem in the country, which occupies over 9% of total labour force. The unemployment rate in the urban areas indicates a higher figure than that of the rural areas, and the unemployment rate of females, consisting of one third of total labour force, is also high compared with that of males.

2.1.2 National Economy

The Gross Domestic Product (GDP) is estimated to be Rs. 1,015 billion in 1998 at current prices (see Table 3.1.1). The per capita GDP is approximately Rs. 54,000 or US\$ 840. Of GDP at current prices in 1998, about 21.5% comes from the wholesale and retail trade sector followed by 21.1% from the agricultural sector and 16.5% from the manufacturing sector.



Since 1989, Sri Lanka in collaboration with the World Bank and the IMF has pursued a structural adjustment programme which sets target macro economic indicators, and goals for restructuring of the manufacturing sector. In addition, the Sri Lankan Government performed the five-year Public Investment Plan (1995-1999) on a rolling plan basis. Under this rolling plan, support was continued for the structural adjustment programme and continuation of the goals of reduction of the fiscal deficit, promotion of economic infrastructure projects and further privatisation of public sector production and distribution facilities.

The Sri Lankan economy received a severe setback in 1996 with real GNP rising by only 3.2 %, nearly half that of the previous year, largely due to a severe drought. However, the economy recovered strongly in 1997, with all major sectors showing significantly higher growth rates and an overall growth rate of 6.8 %, or double the rate of growth that of the previous year. In addition, several other indicators such as the decline in inflation rate and the unemployment rate; a surplus in the balance of payments; and a reduction in the overall budget deficit from 9.4% of GDP to 7.4 % led to an overall improvement in macro economic conditions. This was notwithstanding the external environment, which was beginning to be affected by the global recession and the Asian economy crisis.

2.1.3 Agriculture

The country is divided into Dry, Intermediate and Wet Zones. The Dry Zone covers the north, east, and the southeast of the island, occupying three quarters of the total area of the country. In the Dry Zone, rainfall is less than 1,900 mm annually, and less than 500 mm during the Yala season. The Wet and Intermediate Zones cover the central highlands and the southwest part of the country. In the Wet and Intermediate Zones rainfall exceeds the above limits. In the Dry Zone, major crops are paddy, sugarcane, and other subsidiary food crops grown by small landholders. On the contrary, tree crops such as tea, rubber, and coconuts are cultivated on an estate basis in the Wet and Intermediate Zones.

Agriculture is still the mainstay in Sri Lanka's economy, accounting for 21% of GDP. About 75% of the country's population live in rural areas and are engaged in agriculture related activities. In addition, much of the manufacturing, transport, and service sector activities are related to the supply of agricultural inputs and to the marketing and processing of agricultural outputs. GDP growth rates of the agricultural sector were 3.3% in 1994 and 1995, -4.6% in 1996, 3.0% in 1997, and 2.5% in 1998. This was due to the low production of rice, tea, and coconuts mainly caused by drought and low international prices of Sri Lanka's major export commodities. In recent years, the growth of agricultural sector is at a standstill.

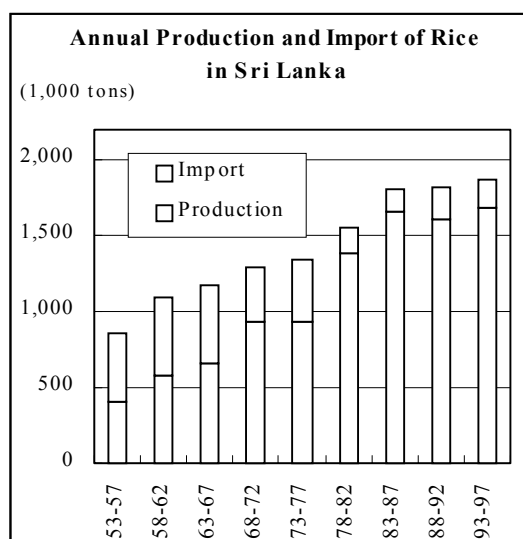
The total cultivated area in the country is about 1.4 million ha. Plantation crops (tea and rubber) account for 0.4 million ha, paddy about 0.7 million ha, subsidiary food crops (coarse grains, roots and tubers, pulses, oil seeds, spices, sugarcane, etc.) about 0.2 million ha, and other crops, fruits, and vegetables about 0.1 million ha. Sri Lanka is still a rice importing country, and about 168,000 tons of rice was imported in 1998.

Imports of Major Crops

| | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1994-98 |
|-----------------------|-------|-------|-------|-------|-------|-------|--------|--------|-------|-------|---------|
| Quantity (1,000 tons) | | | | | | | | | | | |
| - Rice | 316 | 172 | 133 | 237 | 209 | 58 | 9 | 341 | 306 | 168 | 176 |
| - Wheat | 726 | 577 | 670 | 709 | 771 | 865 | 1,057 | 913 | 789 | 880 | 901 |
| - Sugar | 320 | 305 | 358 | 370 | 394 | 491 | 418 | 381 | 545 | 444 | 456 |
| Value (Rs. Million) | | | | | | | | | | | |
| - Rice | 3,396 | 1,758 | 1,589 | 2,852 | 2,386 | 655 | 122 | 5,118 | 4,331 | 2,621 | 2,569 |
| - Wheat | 4,964 | 3,791 | 3,303 | 4,549 | 5,609 | 5,825 | 10,155 | 11,267 | 8,128 | 8,133 | 8,702 |
| - Sugar | 4,326 | 5,173 | 5,139 | 4,952 | 5,621 | 8,875 | 8,737 | 8,026 | | | |

Source: Annual Report 1998, Central Bank of Sri Lanka, April 1999.

The annual production of rice, from 1993 to 1997, averages about 1,680,000 tons, and its production has stagnated from mid 1980s. In addition, production of other field crops (OFCs) is also stagnated or even sometime it decrease. One of the problems in rice cultivation, as well as, in the cultivation of OFCs, is decline in profitability, due mainly to the increase in prices of farm inputs and labour, stagnation of yields, and farm-gate prices. The farmers' incomes have also decreased due to the decline in crop profitability.



2.2 Regional Socio-economic Background

2.2.1 Population Characteristics

The Study Area falls within the four districts of Kurunegala (North Western Province), Anuradhapura (North Central Province), Matale (Central Province) and Puttalam (North Western Province). The four districts (the region) together have a total population of 3,078,000. The population of Kurunegala district is 1,378,000, accounting for more than one third of the total population of the four districts. There are 771,000 housing units in the four districts. The average household size for the four districts is 4.4.

The level of education in the four districts remains fairly low with only 10.3% passing the Ordinary Level and only 4.1% passing the Advanced Level examinations. Only a very low 0.8% of the entire population has graduated with a University degree. Further, a significant 5.8% has had no schooling at all. On the contrary, literacy rate is as high as 90%.

**Level of Education in Kurunegala, Anuradhapura,
Matale and Puttalam (1994)**

| | |
|------------------------------------|---------|
| No schooling at all | 5.80% |
| G.C.E (Ordinary Level) - Primary | 79.00% |
| G.C.E (Ordinary Level) - Secondary | 10.30% |
| G.C.E. (Advanced Level) | 4.10% |
| University degree | 0.80% |
| Total | 100.00% |

Source: Department of Census and Statistics, 1994

According to the data available with the Department of Census & Statistics, the unemployment rate in the four districts is 9.8%. The economically inactive population is as high as 51.2%, with those involved in household activities and studies accounting for 46.5% of this figure. Over 90% of the population are classified as rural, and approximately 70% are employed in the primary sectors. 45% are engaged in agriculture and fisheries and 25% of those falling within this category are females. The data on employed workers in four districts are presented in the following table:

**Balance of Employment in Kurunegala, Anuradhapura,
Matale and Puttalam (1994)**

| | |
|---|--------|
| Agriculture | 45.0% |
| Sales workers | 7.7% |
| Clerical and related workers | 6.2% |
| Professional, Technical and related workers | 6.0% |
| Service workers | 5.7% |
| Administration and Management | 0.8% |
| Unspecified | 2.3% |
| Others | 26.3% |
| Total | 100.0% |

Source: Department of Census and Statistics, 1994

It is interesting to note that women accounted for a significant percentage of white-collar workers (includes all workers other than those engaged in a agriculture, fisheries and production, and service workers). Moreover, 100% of midwives, over 91% of nurses, and over 58% of all teachers are females.

2.2.2 Industries of the Region

Although the region can basically be classified as a rural area, there is much industrial activity. However, compared to those engaged in agricultural activities the number of people involved in industrial activity are relatively low, ranging from 15% to 20% of the labour force. There are a number of government agencies involved in industrial development activities in the region. The Ministry of Industrial Development and the Board of Investment are the two main Central Government agencies that promote industrial development in the region.

The Board of Investment has set up 120 industries in the region. 41 Garment Factories have been established under the Garment Factories Programme. Under Section 16 and 17 of the BOI Law (Normal Law) 79 Industries including production of Fabricated Metal, Machinery and Transport Equipment, Food, Beverages, Tobacco and Non-Metallic Mineral Production have been set up. The Industrial Services Bureau of the North Western Province, in addition to the above, has set up 4 Industrial Parks. The industries located in the above Industrial Parks deal with a variety of products as listed below:

Industries located in the Industrial Parks

| | |
|---|---|
| 1) Rice Milling and Processing | 12) Mineral Water |
| 2) Fruit Dehydration | 13) Garment |
| 3) Soya Products | 14) Textile (Spinning, Finishing and Weaving) |
| 4) Foliage, Fruit and Vegetable Exports | 15) Diamond Cutting |
| 5) Coir Products (Brushes, Curling, Mattress, Compressed Fibre and Twisted Fibre Manufacturing) | 16) Tyre (Retreading and Rebuilding) |
| 6) Coconut Oil Milling | 17) Foam Rubber Products |
| 7) Timber and Timber Products | 18) Leather Products |
| 8) Wood Carving | 19) Fiberglass Products |
| 9) Cashew Processing | 20) Aluminium Products |
| 10) Fisheries (Freshwater, Prawn and Ornamental) | 21) Electrical Goods |
| 11) Livestock (Dairy, Goat and Poultry) | 22) Industrial Paints |
| | 23) Ornamental Ceramics, and |
| | 24) Plastic Bottles and other Plastic Items. |

A number of agencies are involved in providing support services, such as, credit facilities, introducing appropriate technology, skills, entrepreneurship and business training and the setting up of sales centres for the marketing of goods.

2.3 Government Policies for Agricultural Development

The present agriculture development goals are outlined in the Six - Year Development Programme (1999-2004). The goals emphasise improving agricultural productivity, enhancing farmer income and ensuring a continued supply of food at affordable prices. Intensive actions to be taken for the purpose of the programme are listed below:

- a) Identify causes for stagnant yields of major food crops and develop strategies for improving yields,
- b) Public sector to be confined to breeding, varietal testing and certification of seed and to encourage private sector participation in commercial seed production,
- c) Promotion of private sector participation in small-scale agricultural processing/value added industries,
- d) Partnerships to be encouraged, and
- e) Import of potatoes, chillies, onions and other major high value crops to

continue to be liberalised.

The priority items outlined in the Six - Year Development Programme (1999-2004) for the irrigation sub-sector are as follows:

- a) Increase productivity and efficiency in the use of water,
- b) Follow an integrated resource management programme of command and source areas,
- c) Carry out assessments of water resource development potential,
- d) Commercialise small scale farming, and
- e) Manage to hand-over irrigation systems to beneficiaries.

In the meanwhile, the new approach of the government envisages sustainable development in the rural. The activity involvement of private sector entrepreneurs in the rural economy is recognised as an essential pre-condition for successful rural development. The goals and objectives of the regional development are as follows:

- a) Realise sustainable production in rural area and create sustainable production/employment opportunities for rural youth,
- b) Improve economic, social and environmental infrastructure in the rural sector,
- c) Improve the rural economic base, so as to support rural people and alleviate poverty in the rural sector, and
- d) Promote the development of new regional centres in the country to exploit potential resources and offer solutions to critical issues, such as, unemployment and regional disparities.

CHAPTER 3 PRESENT CONDITIONS OF THE STUDY AREA

3.1 Location, Administrative Divisions and Population

(1) Location and Administrative District

The Study area is located in the Dry and Intermediate Zones of Sri Lanka, and falls within the four districts of Kurunegala, Puttalam, Anuradhapura, and Matale (see Location Map). Total area is estimated to be approximately 6,500 km². Anuradhapura, the capital of NCP, is located just on the northern boundary of the Study area, and is connected to Kurenegala (120 km), Dambulla (70 km), Kandy (140 km) and Colombo (210 km) by a good road network. Kurunegala, the capital of NWP, is located in the southern part of the Study area, and is also connected to Dambulla (50 km) and Colombo (90 km). The national roads (A10, A28, A12, A13, A9 and A6) run nearly along the boundary of the Study area, and connect these major towns in and around the Study area. Railway runs also from Anuradhapura to Kurenegala, and connects between Colombo and these two towns.

The Study area consists of 30 Divisional Secretariats (DSs) and 1,385 Gurama Niladari Division (GNs). One GN covers one to two villages that have no government office and no autonomous organisation.

(2) Population, Household and Labour

The Study area has a total population of 1,275,000, more than 90% being Sinhala Buddhists and 5% Muslim. The population is divided equally among the sexes, and 14% is below 14 years of age. The economically active population is about 65%. Over 18% have studied above grade 10 and less than 7% have had no schooling at all. Female-headed families form 17.5% of the total households, and there is a dependent population 35-40%. The labour force accounts for 52% of the population. Over 45% are engaged in agriculture, 25% are production and related workers and 6% each is involved in clerical, sales and service activities.

There are 292,500 housing units in the Study area, and the household size is 4.3. Around 40% of the households have mud floors and walls, and cadjan roofs. The floor area of 25% of the houses is less than 25 square meters, and 20% of the houses have no toilet facilities. 70% of the households use well water for drinking and kerosene for lighting. Moreover, over 90% of the households in the Study area still use firewood for cooking.

3.2 Natural Conditions

3.2.1 Topography and Geology

While the topography of the North Western Province is undulating to flat with a

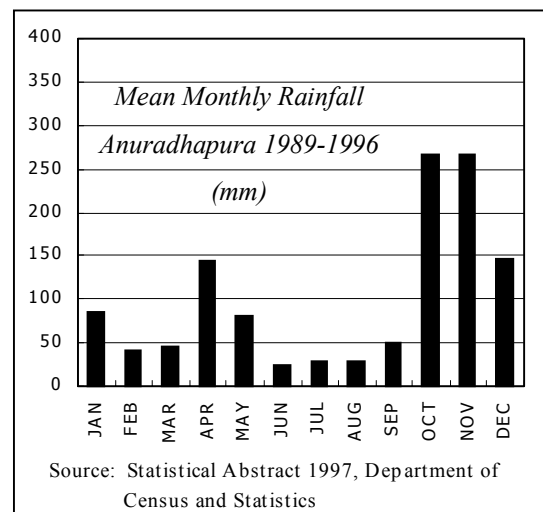
predominant slope towards the west and northwest, there are variations in micro-topography. There are isolated peaks of eroded remnant rocks in the south, with elevations of around 300 m (above mean sea level, omitted hereinafter). The terrain gradually descends towards the west into valleys and flat flood plains with elevations down to 60 m.

The Province is underlain by three principal geological formations: granitic gneiss; biotite neiss; and Miocene limestone in the coastal region. Only the surface mantle of soil and weathered rocks provide an aquifer suitable for development of agrowells. Deeper aquifers occur in hard rock, and cannot be penetrated by manual methods. Precambrian rocks underlie the North-central Province which is located in the north of the country where the Central Highlands turn into flat to undulating terrain, and where slopes seldom exceed 4%.

3.2.2 Meteorology and Hydrology

(1) Climate

The Study area has a tropical monsoon climate. Mean annual rainfall in the Dry Zones is between 1,000 and 1,500 mm, while 75% probable annual rainfall is 600 to 900 mm. The north-east monsoon period (Maha season) between October and March provides the most reliable rain for crop production and irrigation water collection. The south-west monsoon (Yala season) from the end of April to September is generally dry. The inter-monsoon period from March to early May provides rainfall but its total and distribution are highly variable. The monthly temperatures are in the range of 25-29°C.



(2) Hydrology

The Study area is traversed by four major rivers such as Malwathu Oya, Kala Oya, Mi Oya and Deduru Oya, which originate in the higher rainfall areas of the central uplands and flow to the west.

The Malwathu Oya is located in the North Central Province. The river rises in the Inamaluwa and Ritigala mountains, and runs in a north-westerly direction. The Malwathu Oya basin is rather flat or slightly rolling with some isolated hills. In the upper reaches, there are two existing tanks constructed in ancient times; Nachchaduwa and Nuwarawewa.

The Kala Oya is the river providing water for the Mahaweli System 'H' area. In the upper reaches, there is the Kalawewa tank, and from which a certain amount of water is diverted to the north to Nachchaduwa and Tissawewa tanks through a transbasin canal (Yoda Ela). Average annual runoff is estimated at 163 MCM at the Kalawewa Tank.

The Mi Oya is located in the North-Western Dry Zone. The river originates in the hilly area of the Pallekele Forest Reserve, east of Dambulla in the Central Province and flows to west. The catchment area is about 557 km² at the Inginimitiya Reservoir. Average annual runoff at this reservoir is estimated at 105 MCM.

Deduru Oya has its source in the foothills of Matale and flows through Kurunegala and Puttalam Districts and reaches the sea at Chilaw. The total area of the river basin is estimated at 2,622 km².

(3) Hydrogeology

The main water bearing aquifer comprises weathered rock overburden with an average thickness of about 12 m. At the end of the Maha, the water table is usually at or near the surface but during the Yala it falls to 5 m or more except for the area that is influenced by a nearby tank. This aquifer is tapped by wells for agriculture as well as domestic supplies. Extraction rates in the Yala from agrowells of 5 m diameter are commonly 50 m³/day, but there are large variations by locations. Tubewells, which penetrate fractured crystalline rock, provide a more reliable source of water for domestic purposes. Water quality is generally good within acceptable limits for both irrigation and drinking purposes.

3.2.3 Soils and Vegetation

The Study area is principally situated under three Agro-ecological zones, which are 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. Annual rainfall in IL1 is less than 1,016 mm (40 inches). The Low-country Intermediate zone 1 is situated in the southern part of the Study area and Low-country Intermediate zone 3 is in the mid-part of Kurunegala district. The northern part of Kurunegala district to Anuradhapura district is under Low-country Dry zone 1.

Natural vegetation of the Study area belongs to the tropical semi-evergreen forests in the intermediate zone and dry mixed evergreen forests in the dry zone. The original natural forest has been destroyed by shifting cultivation (Chena) and the present vegetation in the intermediate and dry zones in the Study area is mostly the secondary vegetation. Trees in the dry zone are mainly *microphyllous* or *mesophyllous* and consist of both evergreen and deciduous species.

In relation to soil groups and vegetation, typical vegetation of dry mixed evergreen

forest is in the reddish brown earth. The vegetation in the low humic grey soil is not much different from that of associated with reddish brown earth or non-calcic brown soil, however, general stands are poorer in some cases due to periodical water logging and richer in case of favourable moisture contents. In the non-calcic brown soil, the natural vegetation is dry mixed evergreen. The growth is generally poorer than that in the reddish brown earth, although composition of species is almost the same. Under the alluvial soils, the richest and the worst vegetation occur in the dry zone, due to the high water table or the very clayey texture. Tall trees with the other *mesophytic species* are found on this soil.

3.3 Agriculture

3.3.1 Present Land Use

Land use information was obtained from the Land Use Planning Office and publications of the Survey Department. The total land area of the Study area is estimated at 5,600 km² (excluding large inland water areas) consisting of 29% of Anuradhapura District, 13% of Matale District, 65% of Kurunegala District, and 6% of Puttalam District. The present land use in the Study area with those in four districts concerned is summarised in the following table.

Present Land Use

| Districts/Divisions | Farm Land | Forest | Grass-land | Inland Water | Homestead & Others | Total *2 |
|--|-----------|--------|------------|--------------|--------------------|----------|
| Area by Land Use Categories (km ²) | | | | | | |
| Study Area *1 | 3,523 | 818 | 9 | 407 | 844 | 5,601 |
| Anuradhapura District | 3,059 | 3,015 | 17 | 526 | 561 | 7,178 |
| Matale District | 870 | 801 | 56 | 41 | 228 | 1,996 |
| Kurunegala District | 3,764 | 258 | 1 | 192 | 562 | 4,777 |
| Puttalam District | 1,276 | 1,011 | 42 | 213 | 374 | 2,916 |
| Proportion (%) | | | | | | |
| Study Area *1 | 62.9 | 14.6 | 0.2 | 7.3 | 15.0 | 100.0 |
| Anuradhapura District | 42.6 | 42.0 | 0.2 | 7.3 | 7.9 | 100.0 |
| Matale District | 43.6 | 40.1 | 2.8 | 2.1 | 11.4 | 100.0 |
| Kurunegala District | 78.8 | 5.4 | 0.0 | 4.0 | 11.8 | 100.0 |
| Puttalam District | 43.8 | 34.7 | 1.4 | 7.3 | 12.8 | 100.0 |

*1 Out of 30 Divisions related to the Study area, Nuwaragam P.E. and Nochchiyagama

Divisions are included only 10% and 20% in the Study area, respectively.

*2 Excluding large inland water areas.

3.3.2 Land Holding and Land Tenure

(1) Land Holding

There are two distinct settlement types in the area, and lands holding of farmers defer between them.

- a) Purana village: The settlements are hundreds of years old, and are originally located near the most accessible sources of fresh water for agriculture and domestic use. Agricultural holdings in Purana villages consist of both paddy land and rainfed upland.

- b) Settlements (Colonies): The settlements have been launched by government development interventions, dated from before the independence (1947). The colonies are based on irrigation schemes, mostly in major irrigation schemes. The settlers were allocated land in the schemes and the allotments of various sizes contain paddy land, rainfed upland and homesteads.

Previous studies of IFAD and ADB projects describe land fragmentation in both Purana villages and settlements. The expanding population has become less and less accessible to land with a reliable year-round supply of water, and to maintain an appropriate standard of living, especially for newly established households.

(2) Land Tenure

The government legally recognised two categories of land ownership; (i) privately owned land and (ii) the government owned 'Crown' land. In addition, agricultural land and cultivated land are cultivated under four different conditions.

- a) Privately owned land: land cultivated by the owner
- b) Tenant land: privately owned land cultivated by a tenant
- c) Permit land: Crown land cultivated under a permit
- d) Non permitted land: land cultivated by encroachers without any legal status to their claim

The situation of land tenure in the Kurunegala district of the Study area is, 44.4% privately owned land, 10% under colonisation land, 31.6% permitted land and approximately 8% government owned crown land, and 6.0% is classified as encroached land.

In the Anuradhapura district, reliable data on privately owned land was not available but an average percentage of the government land in the Study area is about 10%. Average permitted land is about 15% in the Study area and 16.3% in entire district, and encroached land is 5.8% and 4.3%, respectively. Over 342,000 acres of land has been applied for the legal permits and is now in the process of being regularised. The permit is generally issued at a maximum of two (2) acres per applicant in case of agriculture land.

3.3.3 Agricultural Production

(1) Paddy Cultivation

Main crop in the Study area is paddy, especially for medium and small-scale farmers. Cultivation area and cropping intensity of paddy in the Study area and four districts are shown in the following table and figure. Total cultivation area of paddy in the Study area in 1996/97 Maha and 1997 Yala is estimated to be 71,200 ha which consist of 26,700 ha for major and medium irrigation schemes, 28,200 ha for

minor scheme, and 16,300 ha for rainfed field. Cropping intensity of paddy cultivation at the same seasons is estimated to be 96%.

Paddy Cultivation in 1996/97 Maha and 1997 Yala

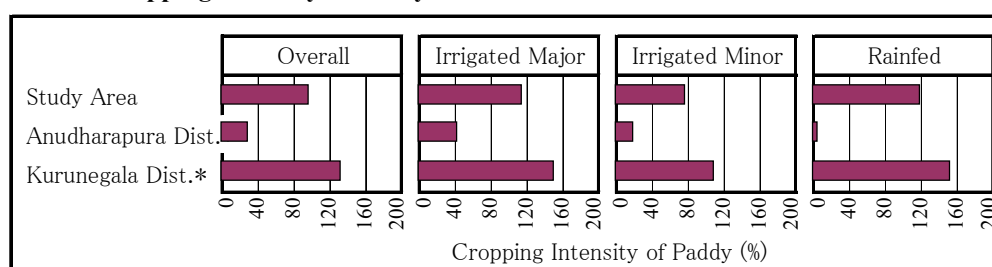
(Unit: 1,000 ha)

| Districts/Divisions | 1996/97 Maha | | | | 1997 Yala | | | | Annual Total | | | |
|---------------------|--------------|-------|----------|-------|-----------|-------|----------|-------|--------------|-------|----------|-------|
| | Irrigated | | Rain-fed | Total | Irrigated | | Rain-fed | Total | Irrigated | | Rain-fed | Total |
| | Major | Minor | | | Major | Minor | | | Major | Minor | | |
| Asweddumized Area | | | | | | | | | | | | |
| Study Area*1 | 24.6 | 42.1 | 17.0 | 83.7 | 24.6 | 42.1 | 17.0 | 83.7 | 49.2 | 84.2 | 34.0 | 167.4 |
| Anuradhapura *1 | 29.7 | 39.6 | 2.6 | 71.9 | 29.7 | 39.6 | 2.6 | 71.9 | 59.4 | 79.2 | 5.2 | 143.8 |
| Kurunegala | 12.5 | 35.0 | 29.8 | 77.3 | 12.5 | 35.0 | 28.9 | 76.4 | 25.0 | 70.0 | 58.7 | 153.7 |
| Sown Area | | | | | | | | | | | | |
| Study Area*1 | 17.0 | 22.4 | 13.3 | 52.7 | 11.0 | 9.8 | 7.0 | 27.8 | 28.0 | 32.2 | 20.3 | 80.5 |
| Anuradhapura *1 | 9.6 | 6.0 | 0.1 | 15.7 | 3.0 | 1.2 | 0.0 | 4.2 | 12.6 | 7.2 | 0.1 | 19.9 |
| Kurunegala | 11.3 | 23.9 | 25.8 | 61.0 | 7.5 | 14.0 | 18.1 | 39.6 | 18.8 | 37.9 | 43.9 | 100.6 |
| Harvested Area | | | | | | | | | | | | |
| Study Area*1 | 16.9 | 19.9 | 10.5 | 47.3 | 9.8 | 8.3 | 5.8 | 23.9 | 26.7 | 28.2 | 16.3 | 71.2 |
| Anuradhapura*1 | 9.4 | 5.9 | 0.1 | 15.4 | 2.9 | 1.2 | 0.0 | 4.1 | 12.3 | 7.1 | 0.1 | 19.5 |
| Kurunegala | 11.2 | 21.5 | 22.6 | 55.3 | 6.4 | 11.9 | 15.4 | 33.7 | 17.6 | 33.4 | 38.0 | 89.0 |

*1 Excluding Mahaweli System 'H'

Source: Agricultural Statistics of Sri Lanka 1997, Department of Census and Statistics, October 1998.

Cropping Intensity of Paddy Cultivation in 1996/97 Maha and 1997 Yala



* Excluding Mahaweli System 'H'

Note: Cropping Intensity = Total Sown Area of Maha & Yala / Asweddumized Area x 100

Source: Agricultural Statistics of Sri Lanka 1997, Department of Census and Statistics, October 1998.

Major crop in the Study area is paddy. Cropping area, production and unit yield of paddy by district in the Study area are shown in the following table.

Paddy Production in 1997 Yala and 1997/78 Maha

| Districts/Divisions | 1997 Yala | | | | 1997/98 Maha | | | | Annual Total | | | |
|-------------------------------|-----------|-------|----------|-------|--------------|-------|----------|---------|--------------|-------|----------|---------|
| | Irrigated | | Rain-fed | Total | Irrigated | | Rain-fed | Total | Irrigated | | Rain-fed | Total |
| | Major | Minor | | | Major | Minor | | | Major | Minor | | |
| Net Harvested Area (1,000 ha) | | | | | | | | | | | | |
| Anuradhapura*1 | 2.3 | 1.0 | - | 3.3 | 23.4 | 28.7 | 1.7 | 53.8 | 25.7 | 29.7 | 1.7 | 57.1 |
| Kurunegala | 6.4 | 11.9 | 15.4 | 33.7 | 12.1 | 32.6 | 27.7 | 72.4 | 18.5 | 44.5 | 43.1 | 106.1 |
| Whole Country | 128.0 | 40.0 | 54.0 | 222.0 | 232.0 | 129.0 | 139.0 | 500.0 | 360.0 | 169.0 | 193.0 | 722.0 |
| Production (1,000 tons) | | | | | | | | | | | | |
| Anuradhapura*1 | 8.1 | 3.2 | - | 11.3 | 100.6 | 122.3 | 5.6 | 228.5 | 108.7 | 125.5 | 5.6 | 239.8 |
| Kurunegala | 25.0 | 31.2 | 33.0 | 89.2 | 44.3 | 123.2 | 85.3 | 252.8 | 69.3 | 154.4 | 118.3 | 342.0 |
| Whole Country | 530.0 | 110.0 | 140.0 | 780.0 | 930.0 | 460.0 | 390.0 | 1,780.0 | 1,460.0 | 570.0 | 530.0 | 2,560.0 |
| Unit Yield (ton/ha) | | | | | | | | | | | | |
| Anuradhapura*1 | 3.5 | 3.2 | - | 3.5 | 4.3 | 4.3 | 3.3 | 4.3 | 4.2 | 4.2 | 3.3 | 4.2 |
| Kurunegala | 3.9 | 2.6 | 2.1 | 2.6 | 3.7 | 3.8 | 3.1 | 3.5 | 3.7 | 3.5 | 2.7 | 3.2 |
| Whole Country | 4.1 | 2.9 | 2.5 | 3.5 | 4.0 | 3.5 | 2.8 | 3.6 | 4.1 | 3.4 | 2.7 | 3.5 |

*1 Including Mahaweli System 'H'

Source: Agricultural Statistics of Sri Lanka 1997, Department of Census and Statistics, 1998.

The production of paddy in 1997 Yala and 1997/78 Maha in Anuradhapura and Kurunegala districts is estimated to be 240,000 tons and 342,000 tons, respectively. Anuradhapura district has shown a higher unit yield, which is estimated at 4.2 tons/ha, compared with 3.2 tons/ha for Kurunegala district.

Almost all farmers in Anuradhapura and Kurunegala Districts have used new improved varieties such as BG350 and BG300, and the cultivation of traditional varieties is negligibly small. Broadcasting, which accounts for 90% of total sown area in both districts, is common, especially in the Yala season. Most of land preparation in Anuradhapura has been done by tractor, while 30-40% of sown area in Kurunegala district has been carried out by animal power. Application of inorganic fertiliser consisting of N, P and K is prominent. Use of chemicals for weed and pest and disease control is the common practice. The fertilisers and agro-chemicals have also been used commonly in the area, and the use of weedicides is increasing year by year along with rising labour charges.

(2) Other Field Crops

The following table shows production of OFC and vegetables in Anuradhapura and Kurunegala districts in the 1997 Yala and 1997/98 Maha.

OFC and Vegetable Cultivation in 1997 Yala and 1997/98 Maha

| OFC & Vegetables | 1997 Yala | | | | | | 1997/98 Maha | | | | | |
|------------------|-----------------------|--------|--------|------------------|--------|--------|-----------------------|--------|--------|------------------|--------|--------|
| | Cultivation Area (ha) | | | Production (ton) | | | Cultivation Area (ha) | | | Production (ton) | | |
| | Study Area | A'pura | K'gala | Study Area | A'pura | K'gala | Study Area | A'pura | K'gala | Study Area | A'pura | K'gala |
| Maize | 340 | 200 | 180 | 300 | 200 | 140 | 5,180 | 7,210 | 1,100 | 2,250 | 3,340 | 440 |
| Green Gram | 1,070 | 140 | 1,020 | 480 | 60 | 460 | 2,060 | 610 | 1,820 | 1,000 | 410 | 830 |
| Cowpea | 790 | 250 | 700 | 420 | 170 | 350 | 2,170 | 1,720 | 1,430 | 1,120 | 930 | 640 |
| Black Gram | 420 | 420 | 110 | 260 | 280 | 50 | 1,770 | 4,580 | 270 | 720 | 2,370 | 90 |
| Gingelly | 4,620 | 5,840 | 790 | 1,950 | 2,630 | 400 | 270 | 350 | 100 | 200 | 240 | 50 |
| Manioc | 870 | 180 | 1,530 | 8,880 | 1,070 | 13,910 | 1,470 | 1,030 | 1,750 | 14,070 | 6,280 | 17,120 |
| Chillies (Green) | 1,500 | 860 | 1,080 | 5,210 | 4,100 | 3,200 | 3,700 | 5,610 | 720 | 16,010 | 19,470 | 2,270 |
| Others | 3,950 | 1,300 | 4,610 | 20,060 | 8,040 | 21,130 | 5,300 | 5,600 | 4,520 | 27,830 | 19,720 | 25,590 |
| Total | 13,560 | 9,190 | 10,020 | 37,560 | 16,550 | 39,640 | 21,920 | 26,710 | 11,710 | 63,200 | 52,760 | 47,030 |

Source: Census and Statistics Department in Kurunegala and Anuradhapura Districts

Over 30 kinds of other field crops (OFC) and vegetables have been cultivated in the Study area. Of these, main crops grown in the area are Greengram, Gingelly (Sesame) and Chillies in the Yala season, and Maize, Greengram, Cowpea, Black Gram, Manioc (Cassava) and Chillies in the Maha season. Generally, the farmers have cultivated these OFCs and vegetables at the high lands and under the rainfed condition. But some farmers have sown these crops in the paddy fields and under the irrigated condition. In Rajangana major irrigation scheme, OFC's cultivation using irrigation pumps at the high lands is done widely. Unit yield of OFCs in the Study area is shown in the following table.

Unit Yields of OFC and Vegetables

| OFC & Vegetables | 1997 Yala | | | 1997/98 Maha | | |
|------------------|------------|--------|--------|--------------|--------|--------|
| | Study Area | A'pura | K'gala | Study Area | A'pura | K'gala |
| Maize | 0.9 | 1.0 | 0.8 | 0.4 | 0.5 | 0.4 |
| Green Gram | 0.4 | 0.4 | 0.5 | 0.5 | 0.7 | 0.5 |
| Cowpea | 0.5 | 0.7 | 0.5 | 0.5 | 0.5 | 0.5 |
| Black Gram | 0.6 | 0.7 | 0.5 | 0.4 | 0.5 | 0.3 |
| Gingelly | 0.4 | 0.5 | 0.5 | 0.7 | 0.7 | 0.5 |
| Manioc | 10.2 | 5.8 | 9.1 | 9.6 | 6.1 | 9.8 |
| Chillies (Green) | 3.5 | 4.8 | 3.0 | 4.3 | 3.5 | 3.1 |
| Others | 5.1 | 6.2 | 4.6 | 5.3 | 3.5 | 5.7 |

Source: Census and Statistics Department in Kurunegala and Anuradhapura Districts

Perennial crops including spices and fruits are cultivated in form of mixed cultivation, home garden and monoculture. However, the form of monoculture is very rare and home gardening and mixed culture is practised by a majority of farmers. Crops such as coffee, cacao, pepper, cloves, and betel leaf are cultivated in parts of the Study area.

3.3.4 Animal Husbandry

Livestock is very important component for farming community, although role of animal power for drafting is replaced by machinery in some extent. However, economic and social roles of the livestock sector are increasingly important to rural development. On the other hand, application of livestock by-products, such as, organic fertiliser for all kinds of crops is highly recommended for increasing productivity and reducing high cost of chemical fertilisers.

The Study area is important for the livestock industry in the country as shown in the following table. Average production of cow and buffalo milk in the Study area was 1,440,000 litres/month and eggs were 3,750,000 nos./month in 1998.

Population and Production of Livestock in 1998

| | Study Area | Anuradhapura | Kurunegala |
|------------------------------|------------|--------------|------------|
| Cattle | 177,900 | 117,900 | 198,000 |
| Buffaloes | 135,500 | 67,800 | 142,700 |
| Goats | 55,600 | 34,500 | 58,500 |
| Sheep | 150 | 530 | 1,960 |
| Pigs | 8,320 | 3,060 | 9,330 |
| Poultry | 809,000 | 170,000 | 1,880,000 |
| Milk Production (lit./month) | 1,440,000 | 1,800,000 | 1,760,000 |
| Egg Production (no./month) | 3,750,000 | 950,000 | 9,870,000 |

Source: Department of Census and Statistics, Anuradhapura and Kurunegala Districts.

Technical services for livestock development, such as, supply of materials, animal health care and artificial insemination services are carried out by the Department of Animal Production and Health (DAPH) through the Veterinary Surgeons Centres (VSC). The Department is carrying out a "Heifer Calf Project" in Kurunegala and Anuradhapura districts, which subsidises 50% of concentrated feed for improved heifer calves by the agricultural instructor (AI) from the birth to 30 months old, in order to increase the quantity of milk.

The Goats development programme is conducted in Anuradhapura district. IFAD sponsored PRDP (Participatory Rural Development Project) covers sixteen (16) Divisional Secretary divisions, and ADB sponsored IRDP (Integrated Rural Development Project) covers five (5) DS divisions. Under the programme, goat units have been distributed to farmers. The goat units have two (2) to five (5) females with one (1) male. Kurunegala district is also implementing a similar project on goat and dairy cattle with the IFAD founded NWP Participatory Rural Development Project.

3.3.5 Inland Fisheries

Inland fisheries in the Study area are carried out in minor and major irrigation tanks and reservoirs. Fish culture is a mainstream of development approach to rural communities and individuals, in order to generate income, as well as, improve the nutritious status of people residing in the area. An inland fishery is a rather new subject as a development component and it has been revived in 1994. Dumbbell Inland Fishery Breeding Centre has been producing and distributing fish fry and fingerling. Tilapia, carps, and local fishes are bred in ten 20m x 20m ponds in the centre.

The centre provides for two (2) major programmes in the Study area. They are 'Fish fry culture in cage' and 'Table fish culture in pond'. In 'Fish fry culture in cage' fish fry is cultivated in a fixed floating cage until they grow to fingerling stage (about 5 cm) in small-scale tanks and then distribute them. In this programme, 5,000 and 9,000 fish fries were distributed in Anuradhapura and Kurunegala districts in the last six months of this year, respectively.

'Table fish culture in pond' is to provide fingerlings to seasonal and perennial tanks. Necessary material and equipment for fish culture, fish fry & fingerling and fishing net are to be provided by the centre for free only at the initial stage and sold later on. The centre distributed 27,200 fingerlings to seasonal tanks and 27,650 for perennial tanks in the last six months.

3.4 Irrigation

3.4.1 General

The percentage of irrigated land in Sri Lanka is about 60% of the total arable land. The major portion of the irrigated land is planted with paddy. Some 65% of the irrigated land comes under major irrigation schemes, which are defined as schemes with command area of 80 ha or more. Total extents of paddy fields in the Study area are summarised below.

Paddy Field in the Study Area

| District | Irrigation Scheme | | | | Total | | Rainfed | Total |
|--------------|-------------------|------------|--------------|------------|-------|------------|------------|------------|
| | Major Scheme | | Minor Scheme | | | | | |
| | Nos. | Area in ha | Nos. | Area in ha | Nos. | Area in ha | Area in ha | Area in ha |
| Anuradhapura | 20 | 13,000 | 980 | 13,100 | 1,000 | 26,100 | 300 | 26,400 |
| Matale | 1 | 200 | 80 | 1,200 | 81 | 1,400 | 700 | 2,100 |
| Kurunegala | 14 | 12,400 | 3,500 | 25,200 | 3,514 | 37,600 | 15,400 | 53,000 |
| Puttalam | 1 | 1,200 | 80 | 700 | 81 | 1,900 | - | 1,900 |
| Total | 36 | 26,800 | 4,640 | 40,200 | 4,676 | 67,000 | 16,400 | 83,400 |

Source: Department of Census and Statistics, Department of Agrarian Services

There are about 4,700 schemes (67,000 ha) in the Study area irrigated by tanks, anicuts and pumps. 36 major irrigation schemes cover 40% of the irrigated area. Minor irrigation schemes are scattered throughout the Study area. The minor schemes support 120,400 farm holdings operating 40,200 ha. Anicut schemes are more common in the intermediate zone than in dry zone. The command areas are usually developed for paddy cultivation.

3.4.2 Water Source

(1) Surface Irrigation

Storage reservoirs and diversion weirs are the two systems of irrigation, which have generally been adopted as traditional systems in Sri Lanka. The irrigated cultivation practices have blended to evolve the two main cultivation seasons of the country, Yala and Maha, taking advantage of south-west and north-east monsoons, respectively.

Irrigation reservoirs, commonly called tanks (wewa / kulama) serve the two-fold purpose of impounding water for storage and detention of flood run-off. Earth dam is the most commonly adopted type structure in Sri Lanka. The water when required is released to the commanding area downstream through a gated structure made out of stone, brick or concrete.

(2) Agrowell

Agrowells is a popular way to obtain water in upland areas to irrigate small areas (0.2-0.4 ha) with 7-8 metres depth and an average diameter of 5 m. An estimated 5,000 agrowells have been installed in the NCP in the past three years. The digging of agrowells is completely unregulated and a concentration of wells is likely to have an impact on the performance of the adjacent tank and other wells.

3.4.3 Irrigation

Major schemes have complex canal systems consisting of main, branch, distributary, and field canals and irrigation water is distributed through the canals down to each field. In minor schemes, water is usually branched directly from the main or

sluice canal to field. Most of these are earthen canals, although a few lined canals have been introduced recently. In such systems, controlling and measuring devices were installed to supply water when needed at the farms in correct quantities.

Water is the limiting factor in irrigation schemes, particularly during the dry season. Uncertainty in seasonal rainfall has discouraged the use of improved varieties and other inputs, which affects the yield particularly in small irrigation systems. Conflicts appear to be unavoidable between the upstream and the tail-end farmers within a canal over equitable water distribution. Mitigation measures to avoid conflicts in water supply including careful planning of the distribution system, good water management and rotation systems are one of urgent requirements.

Except for few minor schemes, most minor schemes are found in tank-cascade systems, where a series of small reservoirs are constructed. Any excess water flowing from one tank in such a chain is collected in the next downstream tank. Generally, the size of the reservoirs increases as one moves downstream of the valley.

3.4.4 Operation and Maintenance

(1) Participatory Irrigation Management Policy

In 1988, the government adopted the participatory irrigation system management policy. As declared in a Cabinet Paper, full responsibility for O&M and resource mobilisation of field canals and distributary canals of the major irrigation systems is to be turned over to Farmers Organisations. In return, farmers would be exempted from payment of the irrigation service fee. The government would retain responsibility for O&M of the headworks and main systems.

There are two goals of the policy:

- a) Improvement of productivity of the irrigation schemes through management by farmers. The idea is based on a premise that farmers have enough information, ability, and intention to manage the system to better serve crop needs.
- b) An increase share of O&M expenditure will be borne by the farmers. Transferring a portion of the O&M responsibilities to the farmers would contribute in relieving pressure on the government budget.

INMAS: The Integrated Management of Major Irrigation Schemes (INMAS) program began in 1984 under the newly created Irrigation Management Division (IMD) with the co-operation of the Irrigation Department (ID). INMAS has been applied to 48 (initially and reduced to 35 later) large schemes in the country to accelerate farmers' involvement in irrigation system management.

The INMAS programme has dealt only with larger schemes and has not included

the medium schemes. Therefore, the Irrigation Department created the Management of Irrigation Schemes (MANIS, now referred to as WAPHAULA) programme to serve the needs of the medium schemes in 1986. The basic organisation and objectives of MANIS are the same as those of INMAS.

(2) Staffing and Organisations

1) Major and Medium Irrigation Schemes

As for the ID, Deputy Director's Range Offices are located in both Kurunegala and Anuradhapura. Each Range Office administrates several Irrigation Engineer's Offices, where rehabilitation and O&M works as well as technical guidance to farmers are carried out. Technical staff of Irrigation Office, headed by an Irrigation Engineer, are a Technical Assistant (TA), Work Supervisor (WS), and Maintenance Labour (ML). They execute O&M in co-operation with FOs.

Farmers are organised into legally recognised autonomous organisations. Normally, Farmer Organisations are made up of field channel groups, each of which selects a Farmer Representative to lead the group and to represent them to outsiders. The Farmer Representatives within a Farmer Organisation form the Farmer Organisation Committee that manages the Organisation. The President and other office bearers of the Farmer Organisation are selected from the Farmer Representatives.

Each INMAS scheme has a Project Management Committee (PMC) consisting of representatives of the Farmer Organisations and of the government agencies concerned with irrigated agriculture. A government official generally chairs these committees, but farmers make up a majority of the members. The PMC is responsible for preparing seasonal plans, including carrying out water allocations to different parts of the schemes, and for solving problems related to irrigation and others.

2) Minor Irrigation Schemes

A person who is appointed by the Kanna meeting is engaged in the operation of tank sluice gates. He is called as a "Yaya Representative"

(3) Water Management

A "Kanna Meeting" (a seasonal cultivation meeting) is held before every seasonal cultivation, twice a year, to decide the cultivation schedule, such as extents and location fed by tank water, starting and ending dates of irrigation, operation method of sluice gates on a tank, manner of rotational irrigation among distributary canals, and so on. With respect to major and medium irrigation schemes, prior to the

Kanna Meeting, a Pre-Kanna Meeting is held. The attendance of the Kanna Meeting varies depending on the category of schemes as shown below.

Attendance of Kanna Meeting

| | Major Schemes | Medium Schemes | Minor Schemes |
|------------------------|---|--|---------------------------|
| FO Meeting Chairman | FO Leader | FO Leader | N.A. |
| Participants | FO members | FO members | |
| PMC Chairman | RPM of IMD | Chaired by TA of ID | N.A. |
| Participants | IE and TA of ID AI, DO, FO leaders | FO leaders, Farmer representatives | |
| Kanna Meeting Chairman | Divisional Secretary or District Secretary | Divisional Secretary | Divisional Officer of ASC |
| Participants | Grana Niladari, Bank, Insurance, IMD, ID, DOA, DAS, Land, Commissioner FR, Farmers | Grana Niladari ID, DOA, DAS, FR, Farmers | Grana Niladari Farmers |

(4) Responsibilities of O&M

Under the participatory management policies of the government, it is intended to hand over some of the system management responsibilities at and below the distributary canal level to farmers in major and medium irrigation schemes. Farmers themselves have to manage minor irrigation schemes, under technical guidance of the Provincial Engineering Department (PED) and DAS.

The following table indicates the responsibility of O&M for each scheme category:

Responsibilities of O&M

| Description | Major | Medium | Minor |
|---|---|---|---------------|
| Organisation of Decision making for O&M | Farmers meeting PMC Kanna Meeting | Farmers meeting PMC Kanna Meeting | Kanna Meeting |
| Water Distribution | | | |
| - Tank Sluice | ID | ID / FO | Farmers |
| - Main / Branch Canals | ID | ID / FO | Farmers |
| - Distributary Canals Head Gate | ID | ID / FO | Farmers |
| - Field canals Head Gate | FO | FO | Farmers |
| Maintenance | | | |
| - Tank | ID | ID | Farmers |
| - Main / Branch Canals | ID | ID | Farmers |
| - Distributary Canals | FO | FO | Farmers |
| - Field Canals | FO | FO | Farmers |

As for the major and medium irrigation schemes, the responsibility of O&M for the distributary canals and below is being handed over to farmers under INMAS and MANIS programmes. Hand-over can take place either formally or informally. Under formal hand-over an agreement is signed between the agency and the relevant FO specifying the responsibilities to be fulfilled by the parties concerned. Informal hand-over is a verbal agreement between the two parties. Some of medium schemes are fully operated and maintained by FOs without official hand over.

Full hand-over under in which all of responsibility and cost of O&M are farmers'

burden has not took place in any of the schemes and the progress has stopped at a joint management stage. In particular, there is a reluctance on the part of agency and farmers to have full responsibilities for maintenance handed over to the FOs. Payments continue to be made by the agencies for O&M activities to FOs that have taken over responsibilities, either informally or formally.

(5) Operation

An important issue in participatory management is how efficiently FOs distribute water to farmers and to what levels FOs are responsible for operation. As for major and medium irrigation schemes, the irrigation department operates the headworks and main canal system gates, while some distributary canals and almost all field canals are operated by farmers or by FOs and agency employees jointly.

In major irrigation schemes, ID staff according to operation schedule decided at the kanna meeting controls sluice gates. The rotation rules among the distributary canals are also decided at the meeting and informed by FO leaders in writing. ID operates the heads of distributary canals in accordance with the rotational rules. The FO sets the rotation rules after discussing it at a FO general meeting, but it depends on the availability of water. In general, it can be said that the less water available, the more regulation of water distribution would be applied by rotation operation.

The sluice gate control in medium irrigation scheme is carried out by the FO members or labours (Jalapalaka) employed by FO under technical guidance of the irrigation department officials. Farmers themselves carry out the water distribution in minor irrigation system. Water distribution depends on experience of gate operator, and he adjusts the sluice gates upon request of farmers, in some schemes.

(6) Maintenance

There are two major maintenance activities carried by FOs: weed clearing and desilting. FOs are expected to clear the weeds from their own field canals. Clearing distributary canals had been the duty of the irrigation agency in most major and medium irrigation schemes but now these activities are done by FOs. FOs are expected to desilt their field canals by themselves. Desilting of distributary canals is generally done

Maintenance Activities by Farmers

| | |
|---|---|
| Weed clearing from distributary canals: | Farmers carry out the distributary canals jungle clearing in most cases under all programmes; agency involvement in the distributary canals cleaning is minimal. |
| Desilting distributary canals: | The involvement of FOs in the distributary canals desilting is similar to involvement in the distributary canals clearing. |
| Minor repairs to distributary: | The agencies carry out a major portion of the work done. |
| Maintenance tasks of field canals: | FOs or the farmers carry out most of the field canals maintenance, such as jungle clearing and desilting. Farmers were responsible for these activities even before participatory management. |

by FOs and in some cases on contract basis with the government agency. Besides these major activities, FOs are also expected to attend to small repairs, including undertaking minor earthworks such as bund filling, and oiling and greasing of canal gates.

(7) O&M Cost

According to the IDA paper, O&M cost per ha is predicted to be Rs. 830 in 1998. It is assumed that 40% of total amount (including temporary staff salaries) is set apart for overheads, with the remaining 60% available for O&M. The available money source for O&M of 60% is divided as follows:

The above table indicates that estimated O&M cost for distributary and field canals is some Rs. 150 per ha. On the other hand, according to budget for INMAS programme in 1998, O&M cost allocated to FOs for distributary and field canals is reported to be some Rs. 80/ha.

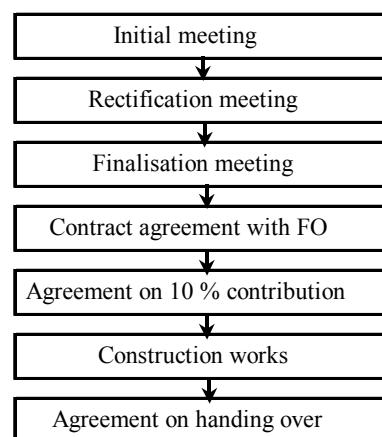
It is remarked that some extents of O&M cost are allocated to FO although the responsibility of O&M has been handed over to FOs because FOs do not have sufficient funds for O&M. ID allocates the cost of allowance to gate operator sometimes. Allocation of funds for maintenance, particularly for distributary canals jungle clearing and desilting, is made by ID annually.

Allocation for O&M Works

| Percentage | O&M Areas |
|------------|-------------------------------|
| 20% | Headworks |
| 40% | Main / Branch Canals |
| 30% | Distributary and Field Canals |
| 10% | Internal Roads |

3.4.5 Farmers' Participation in Rehabilitation Work

In the rehabilitation projects performed with foreign fund assistance in the Study area, the participation of farmers in the works have been promoted, which are featured by 10% contribution for the construction works and meeting with farmers. The procedure of rehabilitation work by farmers' participatory approach is shown in the figure on the right.



Rehabilitation in all schemes was proceeded by a pre-rehabilitation meeting. At the initial meeting, the government officials gather farmers for awareness to the rehabilitation works. After the meeting, field investigation is carried out by the government officials and the preliminary plan is presented at the rectification meeting, in which requests from the farmers are to be incorporated in the plan. Based on the agreed definite plan, the officials finalise the plan with cost estimate. The plan is discussed at the finalisation meeting to get the

final consent of the farmers.

Contracts are given to both FOs and private contractors. FOs were entrusted with contracts up to Rs. 250,000 and mainly below the main canal. Private contractors had been hired for contracts in headworks and main canals. One of the conditions for selecting a scheme for rehabilitation is the 10% contribution in construction. In most schemes, farmers have contributed the 10% voluntary labour contribution, which is a mandatory requirement of the project.

Rehabilitation works undertaken either by FO or a private contractor is supervised by the government officials. From time to time, FO must procure such construction materials, as cement, sand, aggregates, and so on, so that the work can be carried smoothly.

After the rehabilitation work is completed, the agreement of hand over is made between the government officials and FO leader. In the document, the responsibility of both government and FO for O&M of the irrigation system is specified. The feature of the scheme is also shown in the document so that FO can operate and maintain the system properly.

3.5 Marketing and Processing Facilities

(1) Processing and Storage Facilities

Rice consumed in the village and rural areas are milled within these areas. Marketable surplus of rice are handled by unhulled rice and milled by large-scale millers outside the area (mainly located in the Gampaha district). Each village has several small rice mills, and a substantial milling capacity for paddy processing presently exists in the Study area. The mills, all privately owned, range from large commercial enterprises to small domestic units. Processing of the raw rice is the rule, though par-boiling facilities are available in some of the larger mills. The recovery of raw rice at about 65% is satisfactory. Each village has also one or two grinding machines for chillies and corns.

With exception of the Paddy Marketing Board, the villages in the Study area have almost no storage facilities. Most of products have been stocked in the farmers' houses and sold them to dealers, individually.

(2) Pola

The most important market for locally grown fruits and vegetables is the periodic market fair called 'Pola'. Pola is a place where farmers, traders and consumers gather to sell or buy merchandise and is held on two or three scheduled days of the week. The Polas in the area are operated at different locations on a rotational sequence enabling the traders to visit every Pola on separate days of the week. All

Polas in and around the Study area are under the purview of relevant Provincial Councils. The management of the Pola is awarded to private individuals through a public tender on an annual basis.

(3) Milk Collecting Centres

The MILCO, Anuradhapura District Milk Producers Co-operative Society Ltd. and Nestle are the three major competitive milk collectors in the Study area. They are having freezing facilities to store at a time and transport the collection to their relevant factories by lorries. Their collecting system and capacity are described below:

1) Kiriya Milk Industries of Lanka (Pvt.) Ltd. (MILCO)

MILCO has two regional offices covering Anuradhapura and Kurunegala districts. The milk is brought to the village collecting points (centres) by the farmers in cans and transported to the chilling plants in trucks (lorries) within about 2 hours. The total collection on July 1, 1999 was 3,250 litres at Anuradhapura and 2,475 litres at Kekirawa. The farmers are paid according to the fat and solid non-fat content of the milk supplied. The average price paid for a litre of milk is about Rs. 13.50. By way of support services, MILCO provides (i) a ready market for the milk, (ii) an insemination programme in a few places, and (iii) good quality studs and cows to some of the farmers at 50% the cost. They are from the Digana farm, and are a cross between the temperate and Indian varieties. An insemination programme is also being implemented in some areas.

2) Anuradhapura District Milk Producers Co-operative Society Ltd.

There are 7,789 registered members in the Society, but only about 2,500 to 3,000 members are active. The milk is collected at 126 collecting centres and transported to the chilling station by about 10,000 litres daily. During the low season the production drops down to about 7,000 litres a day.

The Society provides a number of support services to its members. It provides (i) a ready market, (ii) pays a reasonable price, (iii) provides free training, veterinary services, (iv) medicine and nutrients at reasonable prices, and (v) studs and artificial insemination at 50% cost.

3) Nestle Lanka Limited

There are over 5,000 registered farmers in Anuradhapura district. The Company also has 230 village collecting centres and 25 chilling plants. Aluminium cans are sold to the farmers. Milk collected at the centres is

brought to the chilling plants and sent to the factory in Pannala in 1 ½ to 3 hours by truck (lorry). Payment for the milk supplied is made on the fat and solid non-fat content and they range from Rs.9.0 to Rs.13.5/litre for neat cattle milk (average Rs.11.5). The total collection per day amounts to 9,000 litres. But during the peak season it goes up to 35,000 litres. Payments to farmers are made once in two weeks. By way of support services the Company provides interest free loans to buy animals and also free transport. The cost of the cans is deducted in two monthly instalments.

3.6 Rural Infrastructure

Rural infrastructure can be divided into 6 sub-sectors, namely, (i) Domestic Water Supply and Sanitation, (ii) Electrification, (iii) Roads, (iv) Health Care, (v) Education, and (vi) Community Centres.

The present conditions of rural infrastructure in the Study area are summarised as indicators in the following table:

| Rural Infrastructure in the Study Area | | |
|--|---|------------|
| Sub-Sector | Indicators | Study Area |
| (1) Domestic Water Supply & Sanitation | Adequate potable water | 21.1% |
| | Piped born water supply | 13.3% |
| | Protected well | 56.0% |
| | Sealed latrines | 17.5% |
| | Permanent latrines | 72.5% |
| (2) Electrification | Houses having electricity | 32.5 % |
| (3) Roads | A class roads length in Kms./1000 persons | 0.3 |
| | B class roads length in Kms./1000 persons | 0.5 |
| | C class roads length in Kms./1000 persons | 0.5 |
| | D class roads length in Kms./1000 persons | 0.8 |
| | Rural roads length in Kms./1000 persons | 6.3 |
| (4) Health Care | Persons per a Hospital | 16,130 |
| | Persons per a Clinic | 4,773 |
| (5) Education | Persons per a Primary School | 3,306 |
| | Persons per a Secondary School | 5,252 |
| | Literacy rates - Adults | 90.3% |
| (6) Community Centres | Persons per a Community Centre | 2,023 |

Source: Provincial Commissioner of Local Government

- 1) Domestic water supply and sanitation: In the Study area, approximately 56% of the households have access to drinking water from protected well. In Kurunegala, Matale and Puttalam districts, a lot of wells were rehabilitated with IDA, UNICEF, GTZ and DANIDA (Denmark).
- 2) Electrification: Electricity supply is increasing rapidly in the areas around the provincial capitals and along the national roads, however, the households having access to electricity are only 32.5% of the whole Study area.
- 3) Roads: Away from the depopulated areas in the Study area, road access is relatively developed.

- 4) Healthcare: Health infrastructure is relatively satisfactory.
- 5) Education: Educational facilities have met quantitatively the rural basic requirement.
- 6) Community Centres: The Government is now constructing the Community Centres consisting of three types, (i) Samurdhi Centres, (ii) Gramodaya Mandala, and (iii) Praja Mandala.

3.7 Marketing and Prices

3.7.1 General

The agricultural marketing system for the non-plantation sector in Sri Lanka has undergone major changes over the past decade. Such changes have made a great impact on the returns to the agricultural producer and also on agricultural production. The major changes are:

- The decreasing role of public sector agencies directly involved in marketing of agricultural produce such as the Co-operative Wholesale Establishment (CWE) and the Paddy Marketing Board(PMB);
- The withdrawal of most subsidies on inputs and effective support prices for agricultural outputs as well as the withdrawal of public sector in purchasing from farmers;
- The liberalisation of imports so that domestically produced commodities can freely competes with the imported products.

The major effect of these changes is that farmers are now more open to market forces and its associated price fluctuations as well as the competition from imports. As the farmer had operated for many decades with price supports and input subsidies behind a protective wall of import licenses and tariffs, the farmer is still adjusting to the new production environment.

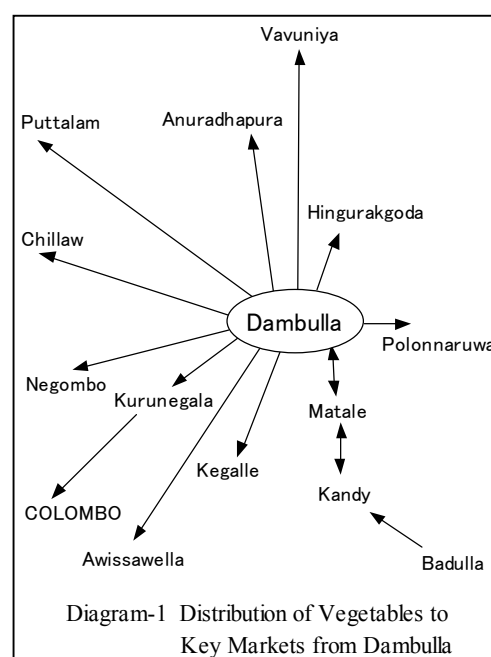
3.7.2 Marketing of Agricultural Products

Private trade rules the marketing of all field crops in the country as well as in the Project area. The private traders handle about 98% of the rice trade with Colombo as the main wholesale market. There is also a number of regional rice trading centres. Paddy in the Project area is sold by farmers either to assemblers or to collectors or directly to millers. Assemblers and collectors send the produce to the Kandy, Kegalle or Colombo wholesale markets. Rice moves from the wholesale markets through petty traders to the retailer. Mark ups at the retail level are normally between 5-10% and the wholesale retail price spread is about 20%.

Storable field crops are procured in the rural areas by assemblers or resident traders who sell these to commission agents or deliver to local Polas. Surveys in the Project area indicate that only about 55% of paddy are marketed. Resident and

itinerant traders collect vegetables and fruits at various collection points along the roads and Polas. The farmers have the choice of selling produce at the rural Pola to itinerant traders with lorries, and they sell it at collection points along the roads or near major producing areas or at the few local assembly markets.

The Project area borders Dambulla, a major transshipments centre that obtains grain, vegetables and fruits from all parts of the country as illustrated in the figure on the right. Traders from Dambulla also frequently send their lorries to the Project area to buy vegetables from producer Polas.



3.7.3 Marketing of Farm Inputs

Seeds used by the farmer may be his retained seeds, seeds purchased from another farmer, seeds purchased through formal suppliers or seeds from other sources such as landlord, or merchants who contracted for crop. The seed industry has undergone major changes as part of government policy to privatise existing operations. Only in the case of paddy, government is involved in seed production of about 15% of total amount. The farmer obtains most of his seed requirements from private sector sources mainly from the village or town store.

Fertiliser is marketed through 15 registered importers and the Agrarian Service Centres (ASC). Most farmers obtain their fertiliser needs from the private traders, dealers, and agents of fertiliser importers in the town or village. The role of the ASC has been declining in recent years following the withdrawal of subsidies on inputs. Fertilisers with the exception of urea are free of subsidies. There is an active trade in cattle manure in the Project area.

Agrochemicals are marketed through a chain of importer/packer, distributor and local agents and there is more and more competition as list prices are frequently discounted. Vegetable producers in the Project area are the largest consumers of agrochemicals and farmers in the Project area obtain their requirements from local traders or agents.

3.7.4 Co-operatives and Farmer Companies

Co-operatives played an important role in the distribution of inputs and the sale of output as well as in agro-processing and post harvest activities. Although they

continue to perform a useful role their importance has decreased with the withdrawal of subsidised inputs to farmers and the operation of public sector guaranteed price and purchase. In the Kurunegala district, there are 20 multipurpose co-operatives with a membership of over 200,000.

Several companies have recently been set up by farmers in the Project area. These companies are commercially organised under company acts. Farm membership is in the form of shares and the company is managed by paid managers. The primary function of these companies is to identify potential markets for products that have comparative advantage. One such company is engaged in paddy seed production, vegetable cultivation, fertiliser sales and ornamental and food fish production. The companies show potential for providing farmers with income generation activities in post harvest and agro processing activities.

3.7.5 Market Access

The Project area has a good network of roads and the survey reveals that the average distance a farmer covers to move his produce for market is about 7.7 km. While the Study area has a good network of gravel roads, D-type roads in the area are unpaved and subject to erosion and seasonal damage by rains. In addition, erosion and cattle grazing have also damaged many of the bund roads used by farmers. Small-scale producers are forced to give up better prices for their produce and to pay higher input costs due to lack of access roads. One C class road that is maintained by the Irrigation Department, is the Tambuttegama-Rajangama road, which is 18 kms and runs through heavily populated farm areas. However, this road needs rehabilitation. Other roads requiring rehabilitation would be identified at the next preparation stage.

3.7.6 Demand and Supply of Agricultural Products and Export Market Potential

Sri Lanka imports rice, maize, sesame, soybean, big onions and dry chillies annually while deal of import of green gram, cowpea red onions are small. There is a small quantity of export of vegetables. At the same time demand elasticity and population growth indicate an annual growth in requirements of rice, big onions and chillies of about 2% and 1% for maize, sesame, soybean and vegetables requirements. Current imports are mainly of rice (150-200,000 tons/year), maize (about 80-85,000 tons/year), big onions (75-80,000 tons/year), and dry chillies (15-18,000 tons/year). Provided domestic production is competitive with imports, import substitution potential exists for the above group of commodities. Sesame is both imported and exported in the processed form as well as the seed. Although production volume and current exports are relatively small, the prospect for some increase in exports is favourable.

Demand –Supply Characteristics and Production Potential

| Commodity | Growth in Demand (% p.a.) | Import Substitution | Export Prospects | Export Competitiveness |
|--------------|---------------------------|---------------------|------------------|------------------------|
| Rice | 1.5-2.0 | Yes, 200,000 t | No | Not at present |
| Maize | 1 | Yes, 80,000 t | No | Not at present |
| Sesame | 1 | No | Yes | Yes |
| Green Gram | - | No | No | No |
| Cowpea | - | No | No | No |
| Soybean | 0.7 | Yes, 3000 t | No | No |
| Big Onions | 2 | Yes, 80,000 t | No | No |
| Dry Chillies | 2 | Yes, 18,000 t | No | No |
| Red Onions | - | No | No | No |
| Vegetables* | 1 | No | Yes, selective | Yes, selective |

Vegetables and fruits are currently exported in very small quantities to neighbouring countries and there is scope for selective exports of specialised vegetables to niche markets in Asia especially for the hotel and restaurant trade.

Several studies and pilot programmes have been attempted to analyse the export market potential for Sri Lanka's agricultural products. At present very minimal quantities of agricultural products are exported accounting for less than 1% of production to the Middle East and other neighbouring countries. Among the reasons cited for this poor performance are the following:

- High cost of production
- Inadequate post harvest technology, mainly the handling, cooling and packaging of fruits and vegetables;
- Inadequate production technology, grading and product standardisation;
- Unavailability of export infrastructure for cooling, packing, refrigeration and trucking;
- Air and sea transport not adequately catering to the needs of sub-sector.

3.7.7 Agricultural Prices

Seasonal price fluctuations of farm-gate, wholesale and retail prices are common for all agriculture products subject to production cycles. Prices are the lowest at the time of the Maha harvest and gradually increase till before the next Yala harvest.

The retail price for rice reaches its peak in December and is the lowest in March. Prices fluctuation range is about 10%. Price fluctuation ranges for other field crops are about 8-12% and extremely large for vegetables and fruits. In addition, price gap among regions are neither negligible.

3.8 Community and Farmers' Organisation

3.8.1 Village Community

Sri Lanka has a unique tradition of irrigation built on ancient irrigation works, consisting of a network of tanks and canals and of an agroeco-system grown around

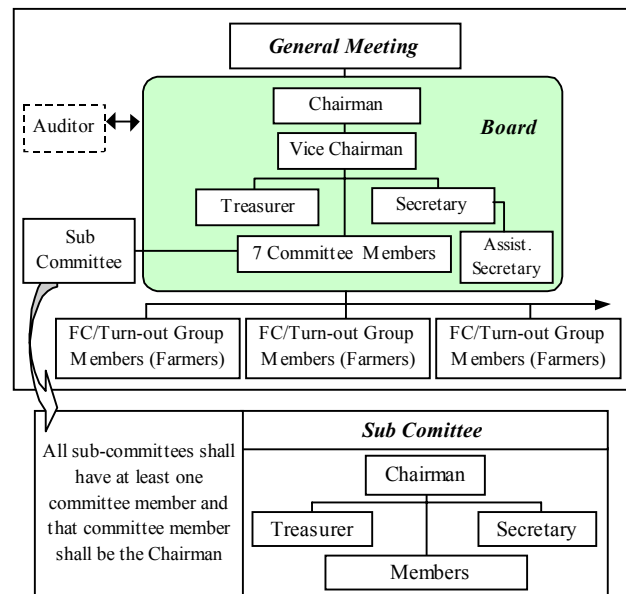
these circumstances. This value system led to an efficient use of the limited water resources, by judiciously distributing, sharing and sometimes sacrificing this valuable resource. Communities in dry or semi-dry area of Sri Lanka generally depend tightly upon their agricultural activities developed with tanks and irrigation works. The traditional villages are highly organised, structured and disciplined within the same race and caste.

3.8.2 Farmers' Organisations

(1) Structure and Activities of Farmers' Organisation

Since the early 1990s, FO has been established in each irrigation scheme in the Study area, aiming mainly at the O&M of irrigation facilities and water management. A typical structure of FO is shown in the figure on the right.

Under the general meeting, each FO has a committee consisting of chairman, vice chairman, secretary, assistant secretary, treasurer, and several board members. Some FOs appoint an auditor who is responsible for internal audit to accounting. These leaders are elected or recommended from the members for a term of 1 year.



At first, the farmer members in each F-Canal block or turn-out group called 'Yaya' select or recommend one or several representatives. Then, the representatives form the committee, and decide each managerial position such as chairman and secretary. Finally, the general meeting approves these appointments. The general meeting is held at least once a year, and the committee meetings are held monthly.

In accordance with the Agrarian Service Act, it is allowed to establish only one FO in a GN division, but actually they have been organised in each village. Any number of persons from one household are able to join FO. FO is organised under voluntary basis and not on a compulsory base. Participating ratio of FO is low, which is estimated at 50% or below. Such a low ratio means that FO does not truly represent the village community. This is due to the lack of farmers' knowledge on FO activities and poor capability of FO's leaders due to lack of practical training. In addition, it is observed that political activities in the rural area have adversely affected farmers joining FO's.

Main objectives of the FOs in the Study area are water management, O&M of the irrigation facilities, and providing agricultural support services to the member farmers. In the Study area, FOs now carry out the water management of D-canals and below in the major schemes and the entire system in minor and medium schemes, but they have poor facilities for maintenance and support services. Almost all FOs collect the admission or entrance fee from members, and in some of the FOs, the members have to pay annual or monthly membership fees of about Rs.10. In addition, some FOs collect shares amounting Rs.500-1,000 on a voluntary base as a stock (FO procures and sells agricultural inputs using this investment and profits from the activities are distributed back to the investors). FOs should report on accounting to the Divisional Officer (DO) of the Agrarian Service Centre (ASC), every month. DO, who is outside the jurisdiction of its FO, is responsible for auditing, once in a year.

(2) Legal Background for Farmers' Organisation

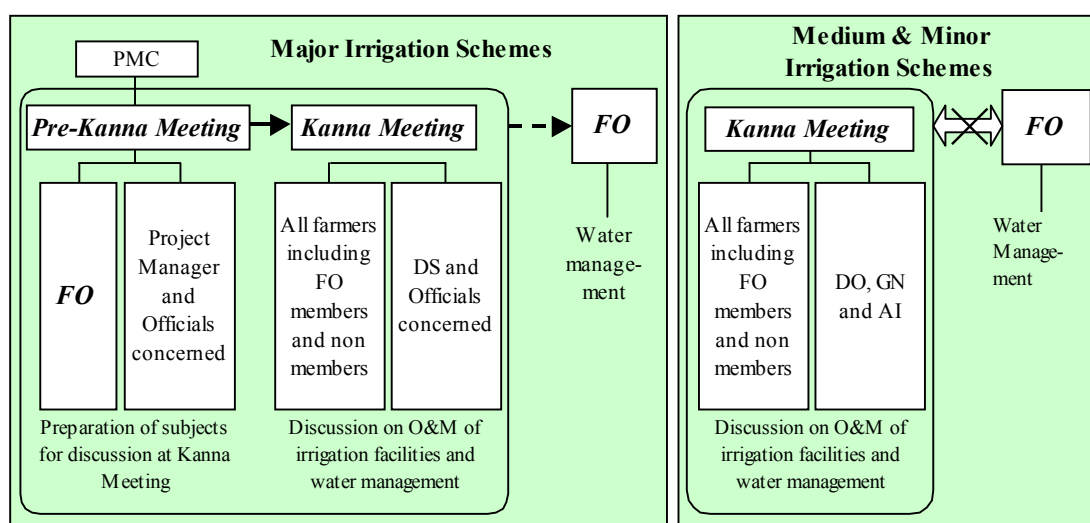
The organisations registered under the Agrarian Service Act are the recognised FO's. The clauses 42, 56A and 56B in this Act provide for the Kanna Meetings, FO's registration and their activities. In addition, the Irrigation (Amendment) Act No.13 of 1994 provides FO's participation to the Pre-Kanna Meeting of the major irrigation schemes. As one of the FO's purposes, clauses 33 (4) in the Agrarian Service (Amendment) Act, No. 4 of 1991 provides for FO's to carry out village level construction work and repairs of irrigation works. However, water management by FO is not provided for in the Act.

Almost all by-laws of the FOs in the Study area have been prepared in accordance with a format prepared by the Department of Agrarian Services. The Government is now promoting the turnover programme for the O&M. In such an event, FOs will require the collection of irrigation service charges from the farmers to cover O&M costs. However, no clauses on collecting irrigation services charges are included in the by-laws. It means that FOs have legally no power to collect them.

In the Study area, the institutions related to the O&M are the Kanna Meeting and FO. The former is the main organ to decide on all matters on maintenance of irrigation facilities and water management, and the latter is the executive organ. There are two types of FOs in terms of their function, though both FOs have the same objectives and organisational structures. First type of the FOs are established in the major irrigation schemes and the other types are in the minor schemes. The diagram below shows the relationship for O&M and water management between the Kanna Meeting and FO.

(3) Relationship between Kanna Meeting and Farmers' Organisation

All of the matters for O&M of irrigation facilities and water management are decided at the Kanna Meeting chaired by DS or DO, under the Agrarian Service Act. In case of major scheme, FOs join officially the Pre-Kanna Meetings with the other government's agencies concerned, and play an important role to prepare the subjects for discussion at the Kanna Meeting. However, FOs in the minor schemes have legally no functions connected to Kanna Meetings, although these FOs have carried out the water management and O&M of the irrigation facilities. FOs of the medium schemes are functionally similar to those of the major schemes.



PMC: Project Management Committee DO: Divisional Officer, Department of Agrarian Services
DS: Divisional Secretary AI: Agricultural Instructor, Department of Agriculture

Relationship between Kanna Meeting and FO

3.8.3 Other Community Based Organisations

There are many community-base organisations (CBO) in the Study area, which have been organised by the villagers themselves or the government agencies concerned. These are the Death Donation Association (DDA, villagers' autonomous organisation), Women's Society (Department of Women's Affairs or NGOs), Youth Club (National Youth Services Council) and Samurdhi Balakaya (Ministry of Samurdhi, Sports & Youth) etc.

Of these, DDA is the most important organisation in the village and covers almost all villagers. The DDA is a mutual-aid association among the members, and is independent of any government agencies. Its objective is to provide funeral services to the members. DDA has a committee consisting of Chairman, Vice Chairman, Secretary, Treasurer and several board members. Their meetings are held monthly. DDA has articles and by-laws, and collects membership fees amounting at about Rs.10/month. Although this association provides the funeral services, there is no specific relationship with temple.

3.8.4 Gender Issues

Sri Lankan women are much free from gender issue comparing with women in the neighbouring countries. Their life expectancy is longer than that of males and their literacy rates are similar to those in the developed countries. They are respected in the family and in society and face no discrimination or oppression. Females account for 50% of the population in the Study area. Their school enrolments are high and performance at examinations is better at public examinations. In fact, both men and women have achieved similar standards in education.

Women constitute only about a third of the work force and unemployment is also higher among women. However, women's participation is very high in professions like teaching (65%) and nursing (90%). They contribute significantly to the family income through participation in 'home-gardening', livestock and poultry farming and other agricultural activities. 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.

The Sri Lanka Women's Bureau was formed in 1978 and today it operates as right hand of the Ministry of Women's Affairs, and executes a number of projects to support women's activities. In addition to government funds, the Bureau's activities, in particular, and women's activities in general, are funded by a number of foreign donor agencies and non-governmental organisations. It is therefore clearly evident that, women would make a significant contribution to the sustainable development of the communities in which they live.

3.9 Agricultural and Social Support Services

3.9.1 Project Related Institution for Agricultural and Rural Development

The introduction of the devolution policy in 1987 promoted the involvement of the Provincial Councils (PCs) in development. Agricultural and rural development activities have currently been implemented both by the central governmental line agencies and the institutions under the PCs in Sri Lanka. However, the development efforts of both the central and provincial government are designed to amalgamate at divisional levels and the activities at division and village levels are integrated to a certain extent as shown in Figure 3.9.1. The line agencies and institutions closely related with the present Project are categorised into the central government institutions and the institutions under the PCs. The central government institutions include: 1) District Secretariat and Divisional Secretariat of the Ministry of Public Administration and Home Affairs, 2) Department of Irrigation Development (DOID) and Irrigation Management Division (IMD) of the Ministry of Irrigation and Power (MOIP), 3) Department of Agriculture (DOA), Agrarian Services Department (DAS) and Department of Export Agriculture (DEA) of the

Ministry of Agriculture and Lands (MOAL), 4) Department of Animal Production & Health (AP&H) and National Livestock Development Board (NLDB) of the Ministry of Livestock Development and Estate Infrastructures (MLDEI), and 5) National Aquaculture Development Authority (NAQDA). The provincial institutions include: 1) Provincial Council, 2) Provincial Ministry for Agriculture, 3) Provincial Department of Agriculture (PDOA), 4) Provincial Department of Animal Production & Health (PDAPH), 5) Provincial Rural Development Department and 6) Provincial Engineering Department (PED).

The constraints for development with these developmental institutions will be the involvement of multitude of institutions sometimes having overlapping mandate. Such duplicated institutions appear to be established under certain political influences and the activities and development coverage of those institutions are subjected to be affected by the changes in the political atmosphere.

3.9.2 Agricultural Research

Agricultural research in Sri Lanka is carried out by a number of central government institutions. MOAL is responsible for research on all crops other than coconut, rubber, tea, and cashew. MOAL, DOA and DEA have the responsibility for research and development on food and horticultural crops and on export agricultural crops, respectively. Research activities on the livestock sub-sector are under the jurisdiction of the MLDEI and those on the fishery sub-sector are under the National Aquatic Resources Research and Development Agency (NARA). The research activities of these institutions are co-ordinated at national level by the Sri Lanka Council of Agricultural Research Policy (CARP). The current research priorities of the crop sub-sector are established by the CARP based on the priority targets in agriculture field: 1) identify causes for stagnant yields in major food crops and develop objective research programmes/strategies aiming at breaking the yield barriers and 2) Identify causes for a wide gap between research and farm yields in the main food crops and develop effective adaptive research and extension programs to reduce this gap.

Institutions located within or close to the Study area that will be the primary technical sources for the Project are Rice Research and Development Institute (RRDI), Batalegoda, Field Crops Research and Development Institute (FCRDI), Maha Illuppallama, Horticultural Crop Research and Development Institute (HORDI), Gannoruwa and Regional Agricultural Research and Development Centre (RARDC), Makandura.

Liaison between the regional research organisations and the PDOA to improve crop productivity in each region is effected through the Regional Technical Working Group (RTWG) organised with major members of research officers, ISTI staff,

DOA senior officers and officers of the PDOAs. The RTWG meets 1.5 to 2 months prior to the commencement of cropping season. The group is to discuss research results, extension progress and problems in the previous season, extension programs in the coming season, research and training needs and to plan future research programmes. FCRDI and RARDC, Makandura are the major research institutes of RTWG in NCP and NWP, respectively. Another linkage activity between research and extension is the formation of a diagnostic team on need basis. The team composed of researchers and provincial and central extension staff makes visits to problem areas during cropping season in order to obtain information on problems and constraints in the adoption of new technology and find solutions, if possible. However, the weakness in the research activities on food crops includes: 1) research-extension linkage is still weak and 2) mechanism to identify farmer's problems and to conduct field-oriented research programmes to solve the problems yet to be established.

3.9.3 Agricultural Extension

(1) Institutions Involved in Agricultural Extension Activities

Major institutions in the Study area are: 1) Extension & Training Division of DOA (IPEU), 2) Extension Development Unit of MOAL, 3) Department of Agrarian Services (DAS), 4) Department of Animal Production & Health, 5) PDOAs of NCP, CP and NWP, 6) PDAPHs of NCP, CP and NWP, 7) DEA, 8) National Aquaculture Development Authority (NAQDA), 9) Coconut Cultivation Board, 10) Cashew Corporation and 11) Agricultural Development Authority (ADA). Among the institutions, IPEU, DAS, PDOAs, and PDAPHs have the most important role in the extension activities and provide a range of extension services in the Study area. The deployments of extension staff of these institutions in the Study area are agricultural instructor (AI) of IPEU and PDOAs, farmer animator (FA)/ agricultural development and productivity Assistant (ADPA) of DAS and livestock development instructor (LDI) of PDAPHs. Allocation of the staff is not enough comparing to area of jurisdiction. FA/ADPA generally has limited ability on extension and other technologies required. Status of staff allocation of each organisation in the Study area is shown in the following table.

**Status of Staff Allocation in the Study Area
for Agricultural Extension**

| Extension Staff | Anuradhapura | Kurunegala | Nawagatte-gama *1 | Galewela *2 |
|-----------------|--------------|------------|-------------------|-------------|
| AI | 30 | 72 | 4 | 2 |
| FA/ADPA | 373 | 811 | 8 | 3 |
| LDI | 31 | 46 | 2 | 3 |

*1; Puttalam District *2; Matale District

Source: Office files of related agencies

Agricultural support service facilities related to the Study area: (i) Agrarian Service Centre (ASC), (ii) In-service Training Institute (ISTI) at Maha Illuppallama, NCP, (iii) Provincial seed farm at Wariyapola and Galgamuwa,

NWP, and 4) Integrated Farmer Training Centre (IFTC) at Nikaweratiya, NWP.

(2) Present Agricultural Extension System

The current extension services in the Study area are provided through an administrative structure basically based on three levels of government: national, district, and divisional in case of the central organisation and provincial, district and divisional in case of provincial organisations as shown in Figure 3.9.2. Under the present agricultural extension system, all the activities of the institutions involved are supposed to be amalgamated at divisional level, specifically at the ASC, which was established to accommodate multiple functions. The current extension framework and research-extension linkage of the crop sub-sector is illustrated in Figure 3.9.3 and the extension management system including the formulation process of the seasonal extension programmes and the in-service training system of field officers (AIs) under DOA and PDOAs are shown in Table 3.9.1.

The crop sub-sector extension programmes of the PDOAs and IPEU are being executed in the Study area in recent years. They are the demonstration farm for paddy in large plot (with provision of fertiliser on loan), demonstration farm for OFC and crop diversification, seed production programme, demonstration on high yield of paddy and integrated pest control programme and further presented in Tables 3.9.2

3.9.4 Rural Banking and Credit

The GOSL's rural credit sector policy of establishing a widespread rural banking network as a measure to make rural credit more accessible to the rural people has been pursued by the Central Bank of Sri Lanka (CBSL). With the persuasion of the policy in the past, wide ranges of rural credit schemes have been introduced by the banking sector in the country. The rural credit facilities in the Study area are operated by the three categories of institutions, the formal institutions, semi-formal institutions and informal institutions. The major formal institutions include: 1) Central Bank of Sri Lanka (CBSL), 2) Central Bank of Ceylon (CB), 3) People's Bank, 4) Wayamba (North Western Province) Development Banks (WDB) and 5) Raja Rata Development Bank in NCP. The representative semi-formal institutions are Thrift and Credit Co-operative Societies (TCCS). Informal institutions are private banks such as Hatton National Bank.

Major institutional credit facilities for rural based economic activities being operated in the Study area are categorised into schemes with CBSL interest subsidy, micro finance & savings schemes and foreign funded rural credit schemes and "Farmers Bank" Scheme of the DAS. The major schemes of the first category include: 1) New Comprehensive Rural Credit Scheme (NCRCS) and 2) Self-

employment Promotion through Micro-Enterprise Credit (Surathura Scheme). The same of the second include: 1) Samurudhi Development Credit Schemes, 2) Thrift and Credit Co-operative Societies (TCCS) Credit Schemes and 3) Sarvodaya Economic Enterprise Development Services (SEEDS). The credit schemes under the third category include: 1) Isuru Project (experiment in poverty alleviation through micro financing), 2) credit components accommodated in the Rural Development Project (ADB) and Participatory Rural Development Project (IFAD). The features of the schemes and the terms and conditions of some schemes are as shown in Table 3.9.3.

It has been discussed that constraints for pursuing the government policy of establishing a widespread rural banking network to make rural credit more accessible to the rural people are multitude. The credit coverage on the agricultural sector, especially on cultivation loans, is extremely limited to the national small-scale farming population. The Isuru Project was a pilot scheme that addressed such constraints through the credit plus approach and achieved the remarkable success.

3.9.5 Seed Production and Distribution

In the National Policy Framework (NPF) prepared by the MOAL in 1995, the provision of the high quality seed and planting material was one of the areas given the utmost priority in the national agricultural policy. Recognising the problems, the government declared the National Seed Policy (NSP) in March 1997 in order to make quality seed available to farmers. In NSP, the gradual withdrawal of the government agencies from the seed production and the privatisation of it are aimed at. Under the new policy, the DOA is mandated to provide necessary support to the private sector, to co-ordinate the seed production process and to satisfy the requirement for the basic seed. The Seed Certification and Plant Protection Centre (SCPPC) of DOA is the institution responsible for the execution of the policy.

In the seed production and distribution system in the country, the research institutions has been responsible for developing new seed and plant varieties and the Seed and Planting Material Development Office (SPMDO) of the SCPPC has the responsibility for multiplication, processing and distribution of them. The production of seeds in Sri Lanka is performed by both the public and private sectors. The paddy and OFC seed production by the public sectors is carried out by the seed farms of the DOA and by the seed growers such as Farmers Organisations (FOs) and individual farmers contracted with the government farms. Currently, 17 government seed farms are operated by the SCPPC. There are two government seed farms at Maha Illuppallama and Nikaweratiya and two provincial seed farms at Galgamuwa and Wariyapola in the Study area. The seed producers in the private sector include co-operatives, private companies, FOs and individual farmers. Among the contracted seed growers and the private sector seed producers, the

contribution of FOs to paddy seed production is increasing. The production volume and share by the sector in 1997 is shown in the following table.

Production of Seeds by Sector, 1997

| | Paddy | | OFC | Vegetables |
|------------------|------------|-----------|------------|------------|
| | Volume (t) | Share (%) | Volume (t) | Volume (t) |
| Public Sector *1 | 5,622 | 53 | 171 | 28.4 |
| Private Sector | 5,000 | 47 | n.a | n.a |
| Total | 10,622 | 100 | - | - |

*1 Include seed production by contract grower

Source: Administration Report 1997, DOA

3.9.6 Social Support Activities

A number of governmental and non-governmental agencies provide social and economic support services to those who are living in the Study area, especially the poor. Most noteworthy service among them is the Samurdhi Programme, introduced in 1995 as a successor to the Janasaviya Programme of the previous government, which aims to reduce the problems of the under-privileged. The programme is implemented through the Samurdhi Offices located in the District and Divisional Secretariats, using Samurdhi Animators. It started as a simple income subsidy scheme, but today it implements an integrated programme covering banking, insurance, savings, training, infrastructure development and provision of self-employment opportunities.

The Social Service Departments of the Divisional Secretariats also provide financial assistance to those suffering from terminal illnesses, construction of homes for the aged and the handicapped and conduct soil and forest conservation programmes. The National Youth Council has set up Youth Clubs to train and assist youth to find employment. The Women's Bureau and non-governmental organisations, such as, Sanasa, Sarvodaya, Mahila Samithi and the South Asia Partnership assist small farmers, the landless peasantry and rural women, through loans and training to set up small enterprises. Finally, there are the donor funded larger projects with social support activity components to help the poor and the under-privileged.

3.10 Environment

3.10.1 Present Status of Natural Resources

(1) Geological Resources

The most valuable geological resource in the area is the phosphate deposit, estimated to be over 40 million tonnes, found around Eppawela. To be of use in short-term crops, conversion of this rock phosphate to the more soluble forms, e.g. superphosphate and di-ammonium phosphate, is necessary.

Groundwater is a source of drinking water to a large section of the population through dug wells. Human health problems have occurred because of the high

fluoride content in parts of the Anuradhapura and Kurunegala districts.

(2) Soils

The reddish-brown earths, occupying the well drained upper and middle slopes of the soil catena, are predominant in the Anuradhapura district and these soils also extend into the northern half of the Kurunegala district. The lower slopes are however, imperfectly drained and along with the upper parts of the valley bottoms are occupied by medium to heavy textured low humic gley soils where paddy is extensively grown in the Maha season. Figure 3.10.1 shows how these soils are distributed in the sloping land form.

In the rest of the Kurunegala area, reddish-brown earths and non calcic brown soils are seen in association, in the upper and middle slopes, while low humic gley soils occupy the lower slopes and upper parts of the valley bottoms (Figure 3.10.2). The well drained slopes support permanent crops and some rainfed seasonal crops as well.

Most soils are erosion-prone and due to the high intensity rainfall, require conservation measures when used for field crops. Soil conservation has not been effectively carried out on most land use classes.

(3) Forests and Forest Reserves

The dominant natural vegetation type is the dry mixed evergreen forest, which is a secondary forest. Riverine forests are found along the banks of some rivers and streams. The 1997 administrative report of the Forest Department indicates natural forest cover on a district basis as shown below.

Area of Natural Forest

| District | Forest area (ha) | % of land area |
|--------------|------------------|----------------|
| Anuradhapura | 296,937 | 41.3 |
| Kurunegala | 24,746 | 5.1 |
| Matale | 84,015 | 42.1 |
| Puttalam | 99,634 | 32.4 |

The dense forest covers 25% of the land area in the Anuradhapura district and only 2% in the Kurunegala district. In the Project area, 15% of the land area is

covered by forest. As of 1997, forest plantations at different locations, where a variety of species have been planted by the department, amounted to 9,350 ha in the Anuradhapura district and 8,970 ha in the Kurunegala district.

(4) Wildlife and Protected Areas

Some of the land areas and the biodiversity contained therein, have legal protection in Sri Lanka. Of these, two categories are found within the Study area, namely, the strict natural reserve (SNR) and the sanctuary. The Ritigala SNR in the Anuradhapura district is an isolated hill rising to over 1,200m, covering an area of 1,530ha. It is unique that therein it shelters as many as 103 plant species, which are usually

associated with the wet zone. Of the two sanctuaries found in the Study area, the Pallekelle-Kahalla sanctuary is located at the meeting point of the Anuradhapura, Kurunegala and Matale district boundaries covering an area of 21,690 ha. The other is the Anuradhapura sanctuary, covering 3,500 ha around the town, embracing the tank systems of Tissawewa and Nuwarawewa.

The elephant population can be found over a large section of the northern half of the Study area. According to estimates by departmental sources at Anuradhapura, the present elephant population in the DS divisions ranges from 615 to 755 as presented in the following table.

Present Elephant Numbers

| Divisional Secretary Division | Elephant Nos. |
|---------------------------------------|---------------|
| Tirappane-Talawa-Nuwaragampalata East | 150-200 |
| Kekirawa-Palugaswewa | 100-125 |
| Galgamuwa | 80-100 |
| Palagala-Galnewa | 125-140 |
| Giribawa | 30-40 |
| Nochiyagama | 70-80 |
| Nawagathagama | 60-70 |
| Total | 615-755 |

The presence of other large mammals such as leopard, sambhur, bear and deer is also reported but they are confined to the more remote forests. All these animals suffer from stress due to habitat reduction. The smaller mammals, reptiles, amphibians and also birds, are common outside forested areas and among habitations. Tanks support a variety of fish species and are used for inland fish production as well. Many species of migratory birds are present here during the winter season of the northern hemisphere, i.e. October/November to March/April.

(5) Surface and Ground Water

The four major rivers flowing in the Study area are Malwatu Oya, Kala Oya, Mi Oya and Deduru Oya. Much of the runoff is utilised for agriculture through various irrigation schemes. Besides runoff feeding tanks during the rainy season, there is the transfer of water into certain tanks from other basins; for example, from the Mahaweli Ganga at Polgolla to System-H and the Anuradhapura tanks.

The inventory survey revealed that 82% of the people in all classes of schemes obtain their drinking water from shallow wells and 14% from deep tube wells. Recently ground water has been used for agriculture through agrowells and overburdened.

3.10.2 Current Environmental Issues

(1) Land Use Planning

Population-growth pressure and expansion of farm land have brought into sharp focus the human-elephant conflict. The elephant in the Project area, has been deprived of a large part of its once extensive home ranges and has now been mostly restricted to isolated patches of forest that have proved to be quite inadequate to

maintain itself in adequate numbers for species survival. The conflict has assumed serious problem at the present time and is bound to increase unless counter measures are not taken.

(2) Fertiliser

On a district basis, over 90% of the sown paddy land in each of the four districts under reference in this study, have been fertilised during Maha 97/98 and Yala 98. The use of organic manure in paddy cultivation is negligible. Use of fertiliser in other field crops, export agriculture crops, fruit and vegetable crops, is also considerably heavy.

When excessive amounts of nitrogen and phosphorus accumulate in enclosed water-bodies, growth of algae is promoted. At advanced stage of algal growth eutrophication sets in, the dissolved oxygen depletes and the waterbody becomes non-functional. Excessive nitrates in the drinking water can also lead to human health problems, particularly in infants. In the Anuradhapura district, the nitrate content in groundwater is reported to be on the high side, though not putting the community at risk.

(3) Agro-chemicals

Pesticides have been extensively used in paddy cultivation in the Project area during Maha 97/98 and Yala 98. Crops such as tobacco and vegetables also use a range of chemicals and these crops are extensively grown during the Maha, particularly in the Galewala area, Matale.

(4) Loss of Top Soil

It has been reported that agricultural productivity has been declining recently due to loss of top soil by erosion over a large area in the Study area according to Maha Illuppalama Agricultural Research Centre. Most catchment areas of small tanks have been encroached by upland rainfed farming without considering proper land use and soil conservation. As a result, tanks are silted to varying degrees. In the rapid rural appraisal, 13% of those farmers in major schemes believed that there was a problem of salinity while in other schemes there did not appear to be such problems.

(5) Problems of Wild Animals

Numerous conflicts between man and wild animals have arisen. Crop damage is one aspect and is caused by the elephant, wild boar, rock squirrel, monkey, toque macaque, rat, porcupine and a variety of birds. Crop damage caused by the elephant is the most. Elephant used to having large home ranges and is known to move back

and forth to seasonal feeding and watering locations. As the carrying capacity in their usual habitats is now insufficient, herds and loners often seek food and water in cultivated areas. The conflict has assumed serious proportions at the present time with loss of life on both sides taking place at regular intervals. Damage to houses is quite common. The presence of elephants in an area will directly and indirectly disrupt social and economic activities in the villages, generally bringing about a fear psychosis among the villagers.

(6) Water Quality

No water analyses have been carried out for the present study. Available data on water quality however, are activity and location specific. Being predominantly an agricultural area, no pollution source can be expected. Analyses carried out in 1998 for the ADB Water Resources Development Project in the NWP (Kurunegala area), indicated surface water (tanks and rivers) and ground water (domestic and agrowells) to be of good quality for agricultural use. No traces of pesticides were found. However, bacteriological tests of ground water showed a high contamination of faecal bacteria and *Eschericia coli*.

In 1993, COWI consult carried out analyses on both surface and ground water in connection with the master plan for water supply and sanitation in the Anuradhapura District. No pesticide residues were detected. However, surface and ground water analyses indicated the presence of nitrates, ammonium and phosphates, likely to be derived from fertiliser application in fairly high amounts. Pollutants were more prevalent in shallow wells than in tube wells. In the smaller, shallow tanks in particular, these nutrients in excess, in agricultural runoff, can lead to algal growth and eutrophication. In the larger tanks the eutrophication processes occur much slowly. If this trend continues, more of the small tanks will be of little or no use for irrigation.

(7) Water-associated Diseases

Cholera has been periodically reported in the Project area without reaching epidemic proportions. Water-washed diseases are diarrhoea in nature and occur when the water supply is limited so that personal hygiene is difficult to maintain.

Water-related diseases are those such as malaria, dengue and Japanese encephalitis, where water provides a habitat for vectors of the diseases. All of these commonly come across in the Project area, while malaria being the most troublesome. Mortality of varying degrees has been associated with all three. Different types of mosquitoes are responsible for the diseases and each has its own partiality towards the water source.

According to the Anti-Malaria Campaign (AMC), the table below shows the inci-

dence of confirmed cases of malaria in the four districts between 1996 and 1998.

Incidence of Confirmed Cases of Malaria

| District | 1996 | 1997 | 1998 |
|--------------|--------|--------|--------|
| Anuradhapura | 29,203 | 24,202 | 13,427 |
| Kurunegala | 8,655 | 5,964 | 5,500 |
| Puttalam | 21,373 | 14,795 | 9,433 |
| Matale | 8,529 | 9,617 | 3,966 |
| Total | 67,760 | 54,578 | 32,326 |

(8) Domestic Energy

According to the inventory survey, over 96% of domestic energy for cooking in the Study area is met from plant products like firewood. This is so also in some urban centres. For example, in Anuradhapura town, there is a great demand for firewood from many small industries such as bakeries and hotels. The district also has brick and tile factories that use firewood. Some of the rice mills are now using paddy husk as a source of fuel.

The supply of firewood is diminishing in the district and this results in price increase each year. The price of a load of firewood delivered in a trailer of a 2-wheel tractor in Anuradhapura town, has increased by Rs. 450 since 1997. Paddy husk is available in large quantities but is used only to a limited extent as a source of energy. In the Kurunegala district, since coconut palm can provide a large amount of combustible material, shortage of domestic firewood has not been reported yet.

3.10.3 On-going Environment Conservation Programmes

In the Anuradhapura, Puttalam and Kurunegala districts, a participatory forestry project, implemented by the Forest Department with assistance from the Asian Development Bank (ADB) and ASaid, is presently in its final year after operating for nine years. Its broad objectives are to educate and interest people in forestry through planting and to increase the tree cover and environmental improvement of forest. The planting programme includes planting in farmers' woodlots, catchments, homesteads, roadsides, places of worship, schools and office compounds.

The department has established firewood lots in each of its several ranges. Reforestation of nearly 5,000ha with timber species has been achieved in the Anuradhapura, Kekirawa and Tambuttegama forest ranges that are in the Project area. In the Kurunegala District some 8,700ha have been planted to different species, both as monocultures and in mixtures of two or more species.

A number of private voluntary organisations are active in the Anuradhapura district in the field of environmental conservation. For example, Ritigala Community-based Development and Environmental Management Foundation (RITICOE) has initiated a variety of activities covering 14 villages around the Ritigala Strict Natural Reserve. The activities include small tank rehabilitation, animal husbandry,

conservation programmes in multi-purpose tree species and oil extraction from kohomba, mee and gingelly seed. In the Kurunegala district, OISCA (Organisation for Industrial, Social and Cultural Advancement), focuses on school tree planting programmes.

The NWP Water Resources Development Project, through minor and small tank rehabilitation, is also concerned with long-term agricultural productivity in its target areas by supporting soil and water conservation measures in catchment areas. The NCP Participatory Rural Development Project (IFAD/SIDA/UNOPS) has included conservation concepts in its programmes. The NCP Rural Development Project supported by ADB also has several environmental components.

At district level, environmental co-ordination is effected through the monthly meetings of the District Agricultural Committee (DAC) and the bimonthly meetings of the District Environmental and Forestry Committee (DEFC). Parallel committees operate at divisional level as well.

3.11 Previous and On-going Projects related to the Study Area

3.11.1 Previous and On-going Projects

There are four previous projects and seven on-going projects related to the Study area. These are outlined as follows, and details are shown in Table 3.11.1.

| Previous and On-going Projects | | | | |
|--|---|-------------------|------------------------------|-----------|
| Projects | | Financial Sources | Implementing Agencies | Period |
| <u>Previous Projects</u> | | | | |
| 1) National Irrigation Rehabilitation Project (NIRP) | | IDA/EC | ID/MIP | 1992-1999 |
| 2) Major Irrigation Rehabilitation Project (MIRP) | | IDA | IMD & ID / MIP | 1985-1994 |
| 3) Kurunegala Rural Development Project (KRDP) | | IDA | MFPEA & NI*1 | 1979-1986 |
| 4) Second Rural Development Project (SRDP) | | IDA | MFPEA & NI*1 | 1981-1991 |
| <u>On-going Projects</u> | | | | |
| 1) North Central Province Rural Development Project | | ADB | Provincial Gov., ID, & MASL | 1996-2003 |
| 2) North Central Province Participatory Rural Development Project | | IFAD | RDD/MPPI*2 | 1996-2002 |
| 3) Mahaweli Restructuring and Rehabilitation Project | | IDA | MASL | 1998-2003 |
| 4) North Western Province Dry Zone Participatory Development Project | | IFAD | RDD/MPPI, Provincial Council | 1993-2001 |
| 5) North Western Province Water Resources Development Project | | ADB | MIP | 1992-2000 |
| 6) Integrated Management of Major Agricultural Scheme (INMAS) | | GOSL | IMD/MIP | - |
| 7) Management of Irrigation System (MANIS) | | GOSL | ID/MIP | 1986 |
| Note | *1 MFPEA & NI: Ministry of Finance, Planning, Ethnic and National Integration | | | |
| | *2 RDD: Rural Development Division MPPI: Ministry of Planning and Policy Implementation | | | |

3.11.2 Case Study

In the past, farmers had operated and managed tanks and other irrigation facilities independently without any support from the government. Their know-how and

experience of operation and maintenance had been improved and carried over as a heritage. Recently, however, such self-operation and maintenance by farmers has stagnated and as a result all the facilities have been deteriorated and agricultural productively has declined. Presently, operation and maintenance of irrigation facilities as well as agricultural supports are generally prone to rely upon support from outside agencies or organisations. The following points are listed as major reasons for above stated situation as the results of the case study of the past and on-going projects in the Study area.

1) More Reliance upon Outside Support Agencies or Organisations

Discrepancy of Water Management View Point between Farmers and Government Agencies

Since the 1950s, Government of Sri Lanka has gone with several agricultural development policies for the purpose of increasing of agricultural production. Under the development policies, agricultural sector has obtained remarkable success especially for rice production and self-sufficiency has been almost achieved in the mid 1980s. The policies on the other hand have led farmers prone to rely upon government more and more particularly regarding irrigation systems. For an example, Government of Sri Lanka has intended to improve water management and O&M of irrigation facilities through systematisation of Cultivation Committee and Project Implementation Committee, enactment of irrigation acts and agrarian acts and establishment of farmers' organisations. The situation above was established for the purpose of supporting farmers' independence from government agencies or organisations outside, however, reliance of farmers on them has increased disregarding to the government intention. The Government of Sri Lanka has envisaged an intention that farmers should operate and maintain irrigation facilities by themselves but farmers have an opposite concept relying upon supports from outside.

Farmers Participatory Approach and Lost of Initiation

Recently, numbers of development projects have been implemented under support of foreign funds. Participatory approach of beneficiaries has employed by the projects to activate their own contribution and to achieve sustainable development. Notwithstanding the policy, top-down decision making processes are obviously predominant. Consequently under such situation of the project, farmers have had less understanding of responsibilities as a member of farmers' organisation and lost self-motivated endeavour for development of agriculture and rural community and therefore shifted themselves to rely upon support systems outside

more and more.

2) Complicated Farmer Supporting System by Agencies and Organisations Concerned.

Many government agencies such as DAS, DS, ID, IMD, Samurudhi Office and so on have provided farmer supporting services recently for irrigation schemes. More involvement is there in major schemes. In addition, Ministry of Plan Implementation and Parliamentary Affairs also provides a supporting service. Among numerous numbers of supporting services provided to farmers or farmers' organisations as stated above, some services are insufficient or overlapped each other. In most of cases, the services are too complicated or without co-ordination among agencies concerned or one-directional to stimulate farmers' self-motivation for development.

A study undertaken by the ARTI, in 1998, on 'The Turn Over Processes in NIRP Schemes' shows that in selecting irrigation projects for rehabilitation, technical criteria, such as, rainfall, spilling history, command area, degree of siltation, head-works and downstream structures are generally given priority. Yet, a number of equally important social criteria are ignored. The research also stated that none of government involvement could be allowed unless based on need of the beneficiary and that only need, plan, concept and intention of farmers' could activate project.

There are many previous and on-going projects related to the Study area, as mentioned earlier. Most recent projects have put emphasise on civil works such as rehabilitation of irrigation facilities and road improvement. In addition, a careful study of the various projects that are being implemented shows that, instead of designing interventions 'top down', these projects incorporate 'bottom up' initiatives. Apart from their actual performance at the field level, this seems to be an essential prerequisite if sustainability of projects is to be achieved. It has to be emphasised that as much as farmer participation is a necessary requirement, the support and co-operation of government, non-governmental agencies, and the private sector are essential if any development project to succeed.

PART - II MASTER PLAN STUDY

CHAPTER 4 SELECTION OF IRRIGATION SCHEMES TO BE STUDIED

The study of Master Plan is carried out on 100 irrigation schemes (major, medium, and minor schemes) selected from the Study area. The selection was made according to the following procedures.

1) Selection Criteria

- a) MIP has worked out the development policy that irrigated agricultural development should be planned in the context of watersheds, with major, medium, and minor schemes¹ taken in an integrated manner. Then, in line with this policy, IMD/MIP has divided the Study area into 6 clusters (basins) with economic centres pre-nominated therein in order to establish development sub-programmes for each cluster. The selection considered the clusters linking with major, medium, and minor irrigation schemes concerned.
- b) The selection put the ongoing projects or schemes aside.
- c) The selection neglected quite minor schemes covering less than 10 acres (4 hectares).
- d) At the selection of minor schemes, tank cascade (chain of tanks) system were considered if they belong to.

2) Selection Process of Irrigation Schemes

Major and Medium Schemes: In accordance with this policy, IMD selected 32 major and medium schemes as candidate from the clusters as described in Table 4.1. From these candidates, 8 major and 12 medium schemes were finally selected based on the criteria above as well as discussion with IMD.

Minor Schemes: As for the minor irrigation schemes, over 90 candidate schemes were selected at first based on topographic maps of 1:50,000 and list of minor tanks² obtained from the Department of Agrarian Services. From these candidates, 80 minor schemes were finally selected based on the criteria above as well as discussion with IMD. The 80 minor irriga-

¹ Major Scheme: covering irrigation area of 400 ha or more, Medium Scheme: covering irrigation area of between 80 - 400 ha, and Minor Scheme: covering irrigation area of 80 ha or less

² Minor Irrigation Data Book, Anuradhapura, Matale, Kurunegala and Puttlam Districts, Water Management Division, Department of Agrarian Services. (These data books contain almost all minor irrigation schemes.)

tion schemes were divided into 9 hydrological groups including at least one cascade system and several independent minor tanks.

The selected schemes are shown below, and details are given in Tables 4.2 and 4.3, and Figures 4.1 to 4.9.

Candidate Schemes by Each Cluster

| Clusters | Major Schemes (ha) | Medium Schemes (ha) | Minor Schemes (ha) |
|--------------|-----------------------|------------------------|-----------------------|
| Nachchaduwa | Nachchaduwa 2,540 | Thuruwila1 227 | I 8 schemes 303 |
| | Nuwarawewa 1,134 | Eru Wewa1 34 | II 8 schemes 278 |
| | Tissawewa 365 | Uttimaduwa 93 | III 10 schemes 412 |
| | | Periyakulama 91 | |
| | | Maminiiyawa 211 | |
| | | Kawarakkulama 90 | |
| | | | |
| Kala Oya 1 | Rajangane 5,668 | Angamuwa - | IV 9 schemes 349 |
| Kala Oya 2 | | | V 10 schemes 179 |
| Mi Oya | Attaragallewa 956 | Mahananneriya 158 | VI 11 schemes 318 |
| | Abakolawewa 462 | Mahagalgamuwa 193 | VII 10 schemes 260 |
| | Palukadawala 410 | | |
| Dedulu Oya 1 | Ridi Bendi Ela 2,632 | Halugalewewa 121 | VIII 10 schemes 271 |
| Dedulu Oya 2 | | Meddeketiya 98 | IX 4 schemes 139 |
| | | Moragoda Anicut 194 | |
| Total | 8 schemes 14,167 | 12 schemes 1,510 | 80 schemes 2,509 |

CHAPTER 5 INVENTORY OF THE IRRIGATION SCHEMES

5.1 General

The present condition of each scheme is determined mainly through the inventory survey, questionnaire survey, and RRA implemented during the Phase-I Fieldwork. The surveys administered are outlined below, and their results are summarised in Table 5.1.1. The detail method of study and the results are in Appendix-B. The study method is summarised as follows.

(1) Inventory Survey

The inventory survey of the existing irrigation schemes was carried out in order to grasp the present situation of irrigation schemes including deterioration of facilities, method of O&M, water management system, FO's activities related to O&M, etc. One hundred (100) irrigation schemes were investigated. The questionnaires used for the investigation consist of two parts, i) hardware aspects, such as, dimension of irrigation facilities and degree of deterioration, and ii) software aspects, including O&M of facilities, activities of farmer organisations, etc. The investigations were done through interviews of government staffs of Divisional Secretary offices, Field offices of the Irrigation Department, Agrarian Service Centres, Grama Niladhari, Agriculture Instructors, and the farmer organisations concerned.

(2) Questionnaire Survey

The main purpose of this survey is to assess the agronomic and socio-economic conditions and to understand farmer's views about future activities in the Study area. A sample size of 1,500 families were selected for the investigation on the basis of the irrigation schemes as shown below:

Number of Samples of Questionnaire Survey

| Scheme | Irrigation Area | No. of Sample Family | No. of Response |
|--------------------------|-----------------|-----------------------------|-----------------|
| Major irrigation scheme | Over 400 ha | 8 schemes x 50 families | 400 |
| Medium irrigation scheme | 80 ha - 400 ha | 12 schemes x 25 families | 300 |
| Minor irrigation scheme | Below 80 ha | 80 schemes x 10 families | 800 |
| Total | | 100 schemes -1,500 families | 1,500 |

The sample families were selected randomly from each irrigation scheme, in co-operation with Grama Niladhari. The enumerators visited each sample family and filled out the questionnaires through interview with the family. Prior to the implementation of the survey, the Survey Team trained interviewers.

(3) RRA

The purpose of Rapid Rural Appraisal (RRAs) is to understand human, natural and social resources, problems and constraints for development, and the development needs of each irrigation scheme in the Study area. One RRA was conducted for each irrigation scheme for a total of 100. Two one-day sessions are allocated for each RRA. The RRA were conducted as follows.

First Session of RRA (1st Day)

- a) Interviewing the Grama Niladhari: Collecting basic information and the statistical
- b) Meeting with leaders of FO: The present situation of FO
- c) Semi-structured interview survey and discussion with the younger generation: Collecting information of the issues of the young generation.
- d) Each team gather and exchange the results of the survey.

2nd Session of RRA (2nd Day)

- a) Workshop is held with leaders of FO, women's society, and farmers: Identify the community issues, Development need, identify organisation, personnel concerning development.

The results of the workshops are described in Chapter 6.

5.2 General Background of Irrigation Schemes

5.2.1 General Situation

(1) Population and Households

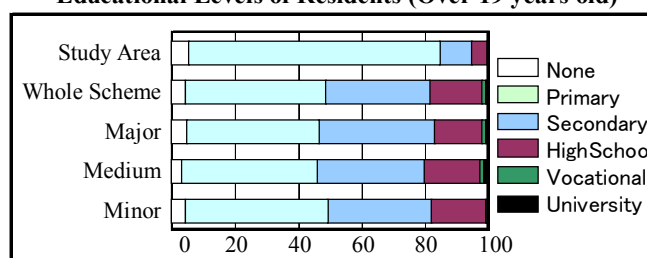
Total farm households and population in all schemes are estimated to be 25,300 and 113,000, respectively. Labour force among family members is defined as those between ages 15 years to 60 years. The average number of labour force per farm household was 2.9, which consisted of 1.5 males and 1.4 females. Labour force by irrigation schemes also differed and was 3.2, 2.9, and 2.8 in major, medium, and minor irrigation schemes, respectively. In major and medium schemes, there were more males than females in the labour force, however, they were equal in number in minor schemes.

Population and Household

| Category | Total Farm Household | Population | Family Size | Labour Force (15-60 years old) |
|-----------|----------------------|------------|-------------|--------------------------------|
| Major | 18,110 | 82,800 | 4.5 | 3.2 |
| Medium | 1,800 | 7,800 | 4.4 | 2.9 |
| Minor | 5,430 | 22,800 | 4.2 | 2.8 |
| All Total | 25,350 | 113,400 | 4.2 | 2.9 |

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

Educational Levels of Residents (Over 19 years old)



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

(2) Educational Level

The population in all schemes had relatively high educational levels in comparison with general population in the Study area. About 33% had passed the GCE/ordinary level (O-level), and 16% had passed the GCE/advanced level (A-level) examinations.

(3) Land Holding and Land Tenure

The land holding size of farmers in the major, medium, and minor schemes averages 1.79ha, 1.77ha, and 1.34ha, respectively. Less land is owned, and more land is leased in the major scheme. Average area of paddy under irrigation per household is 1.16ha in the major schemes, but it's about a half that, 0.66ha, in the minor schemes.

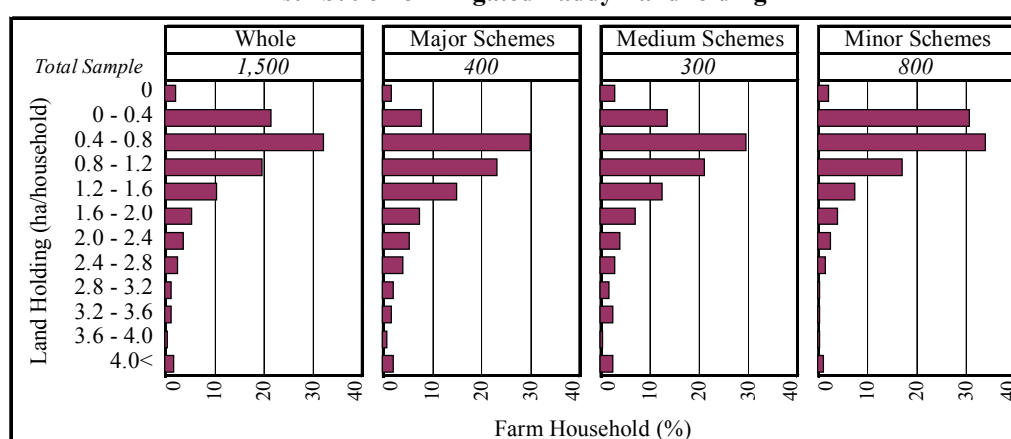
Land Holding and Land Tenure

| | Land Holding per Farmer | | | | | Land Tenure per Farmer | | | |
|--------|-------------------------|-----------------|------------------|----------------------|---------------|------------------------|---------------|-------------------------|-----------------|
| | Paddy Field | | Highland (ha) | Others *1 (ha) | Total (ha) | Own land (%) | Leased (%) | Tenure "Ande" (%) | Encroach (%) |
| | Irrigated (ha) | Rainfed (ha) | | | | | | | |
| Major | 1.16 | 0.03 | 0.12 | 0.49 | 1.79 | 75 | 18 | 6 | 1 |
| Medium | 1.05 | 0.03 | 0.20 | 0.48 | 1.77 | 82 | 8 | 5 | 5 |
| Minor | 0.66 | 0.05 | 0.16 | 0.46 | 1.34 | 86 | 5 | 6 | 3 |
| Whole | 0.75 | 0.05 | 0.16 | 0.47 | 1.43 | 85 | 7 | 6 | 3 |

*1: Grassland, homestead, Source: Questionnaire Survey carried out by the Study Team in 1999.

The distribution of the irrigated paddy land holdings is shown below. In entire scheme, the size of 0.4ha to 0.8ha/household is shared 30%. The 0.4ha to 1.2ha/households have a majority share in the major schemes and 0ha to 0.8ha is more in the minor scheme.

Distribution of Irrigated Paddy Landholding



Source: Questionnaire Survey by the Study Team, 1999

(4) Farm Machinery and Livestock Raising

Farm machinery and equipment owned by households were very low. Overall number of tractor and sprayer were more in the major scheme and water pumps

are more in the minor scheme.

Livestock is not a major activity in the irrigation schemes. Average holding of buffalo and cattle was 1.8 per household, mainly cattle. However, a very few households were running poultry farms. Therefore, income from livestock forms only a minor portion of household income.

Farm Machinery and Livestock Raising in the Irrigation Schemes

| | Farm Machinery / Household | | | | Livestock per Household | | | | |
|--------|----------------------------|-------------|---------|------------|-------------------------|-------------|-------|------|---------|
| | 4-W tractor | 2-W tractor | Sprayer | Water pump | Buffalo | Cattle/ cow | Goats | Pigs | Chicken |
| Major | 0.05 | 0.16 | 0.54 | 0.16 | 0.20 | 0.89 | 0.12 | 0.01 | 2.58 |
| Medium | 0.03 | 0.17 | 0.41 | 0.15 | 0.39 | 0.93 | 0.04 | 0.04 | 0.56 |
| Minor | 0.02 | 0.09 | 0.35 | 0.20 | 0.57 | 1.36 | 0.28 | 0.05 | 0.66 |
| Whole | 0.02 | 0.10 | 0.37 | 0.19 | 0.52 | 1.27 | 0.23 | 0.04 | 0.80 |

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

5.2.2 Agriculture

(1) Crop Cultivation Extent

The table below shows the cropping extent of 1998 Yala and 1998/99 Maha.

Cultivation Area of Crops per Farm Household (1998)

(Unit: ha/household)

| Schemes | Paddy - Irrigated | | Paddy - Rainfed | | OFC | Vegetables | Others*2 | Total |
|---------|-------------------|------|-----------------|------|------|------------|----------|-------|
| | Maha | Yala | Maha | Yala | | | | |
| Major | 1.07 | 0.57 | *1 | *1 | 0.02 | 0.01 | 0.08 | 1.75 |
| Medium | 0.68 | 0.36 | *1 | - | 0.07 | 0.04 | 0.08 | 1.23 |
| Minor | 0.41 | 0.07 | 0.01 | - | 0.06 | 0.02 | 0.10 | 0.67 |
| Whole | 0.49 | 0.14 | 0.01 | *1 | 0.06 | 0.02 | 0.09 | 0.81 |

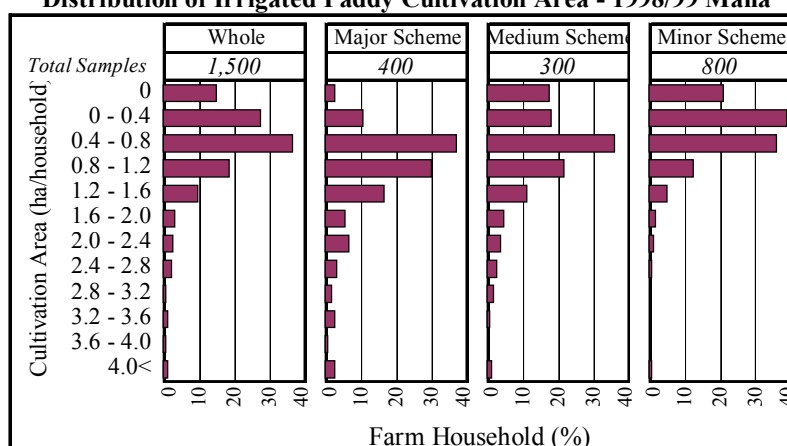
*1 Negligibly small

*2 Others include banana and coconut.

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

One of the significant features seen in the table was the very low level of land cultivated with irrigated water in the minor schemes in Yala. Only an average 0.07 ha of land was cultivated in

Distribution of Irrigated Paddy Cultivation Area - 1998/99 Maha



Source: The questionnaire Survey by the Study Team, 1999

Yala 1998 as compared to 0.57 ha in major schemes and 0.36 ha in medium schemes. In a majority of the minor schemes, either all or a majority had not been cultivated due to insufficient water supply.



Paddy Land



Paddy Transplanting

Other field crops cultivated also vary by season and field conditions. In the survey year of 1998, maize, sesame, and vegetables were cultivated in none or very few samples in the major and the medium schemes, and big onion and red onion were also few in all three schemes. Chilli was cultivated in more than 50% of sample schemes. Among the sample schemes, banana and coconut tended to be cultivated more in wet and intermediate zones. The cultivated extents on banana and coconut did not vary among the schemes.

Fallow land area per household is shown in the table. Generally, farmers in the schemes own considerable area

Fallow Land Area (ha/Household)

| Land/Schemes | Major | Medium | Minor | Whole |
|-------------------------|-------|--------|-------|-------|
| Fallow land Area - Maha | 0.09 | 0.38 | 0.26 | 0.26 |
| - Yala | 0.59 | 0.69 | 0.60 | 0.61 |
| Homestead Area | 0.43 | 0.43 | 0.42 | 0.42 |

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

of fallow land and do not utilise it effectively. Especially in the medium and minor irrigation schemes, there are large areas of fallow land due to limited water resource.

(2) Crop Yields

Average yield of the irrigation schemes is shown in the table to the right and the distribution of yield of irrigated paddy cultivation is shown below. Paddy yield of all schemes is 3.5ton/ha on

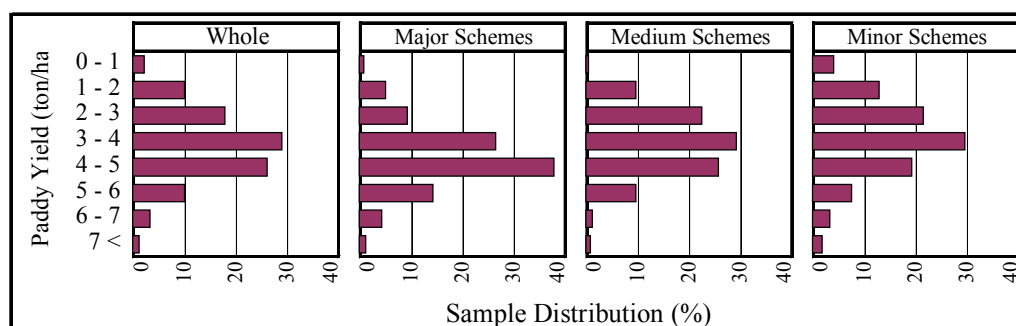
Unit Yield of Crops – 1998 (ton/ha)

| | Major | Medium | Minor | All |
|------------------------|-------|--------|-------|------|
| Paddy Maha - Irrigated | 4.10 | 3.59 | 3.41 | 3.49 |
| Paddy Yala - Irrigated | 3.84 | 3.28 | 3.51 | 3.52 |
| Paddy Maha - Rainfed | - | 2.09 | 3.17 | 3.53 |
| Maize | - | 1.67 | 1.26 | 1.31 |
| Sesame | 0.44 | 0.43 | 0.62 | 0.54 |
| Beans/Peas | 0.91 | 0.68 | 1.76 | 0.77 |
| Chilies | 0.64 | 0.58 | 0.91 | 0.85 |
| B. Onion | - | 6.45 | 8.12 | 7.96 |
| Red Onion | 1.00 | 0.70 | 1.90 | 1.64 |
| Vegetable | 7.39 | 4.97 | 4.72 | 5.12 |

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

average. Generally, the major schemes have more favourable water conditions than the medium and minor schemes so it is possible to input production material and to apply water management. Yield of paddy in the minor schemes is largely varied and OFC and vegetable generally have a low yield.

Yield Distribution of Paddy in Maha Season



Source: Questionnaire Survey by the Study Team, 1999

(3) Farming Inputs

Input amount of production materials on paddy cultivation is shown in table below. The major irrigation schemes, which have a secure water supply for cropping, utilised less seed than in the others. The level of seed use of the major schemes was almost the same as recommended by the Department of Agriculture (DOA), which is 100kg/ha. The seed use in the medium and minor schemes is significantly higher and it may be due to insecure water supply for maintaining plant stand.

Fertiliser application is 350 to 370kg/ha despite the low yield level of 3.5ton/ha.

Agro-chemical use also varied according to the schemes and water security. The most commonly used chemical was weedicide followed by insecticides. Under irrigated condition, weedicide was used in both Maha and Yala, and there was no significant difference. However, the level of use under rainfed conditions was significantly lower than under irrigation.

Farm Inputs for Paddy Cultivation (1998)

| | | | Major | Medium | Minor | All |
|----------------|----------------------|------------------|-------|--------|-------|-----|
| Seed | Paddy-Maha-Irrigated | (kg/ha) | 106 | 122 | 136 | 132 |
| | Paddy-Yala-Irrigated | (kg/ha) | 111 | 121 | 134 | 129 |
| | Paddy-Maha-Rainfed | (kg/ha) | - | 209 | 173 | 209 |
| Fer-tiliser | Paddy-Maha-Irrigated | (kg/ha) | 458 | 368 | 334 | 348 |
| | Paddy-Yala-Irrigated | (kg/ha) | 410 | 309 | 380 | 371 |
| | Paddy-Maha-Rainfed | (kg/ha) | - | - | 261 | 347 |
| Agro-chemicals | Paddy-Maha-Irrigated | | | | | |
| | Weedicide | Liquid (lit./ha) | 3.3 | 0.1 | 1.9 | 2.0 |
| | Insecticides | Liquid (lit./ha) | 1.0 | 0.8 | 1.0 | 1.0 |
| | Paddy-Yala-Irrigated | | | | | |
| | Weedicide | Liquid (lit./ha) | 2.9 | 2.2 | 2.0 | 2.1 |
| | Insecticides | Liquid (lit./ha) | 1.5 | 0.9 | 1.0 | 1.1 |
| | Paddy-Maha-Rainfed | | | | | |
| | Weedicide | Liquid (lit./ha) | - | 1.0 | 1.1 | 1.8 |
| | Insecticides | Liquid (lit./ha) | - | - | 0.8 | 1.0 |
| La-bour | Paddy-Maha-Irrigated | (md/ha) | 81 | 82 | 90 | 88 |
| | Paddy-Yala-Irrigated | | 88 | 76 | 101 | 95 |
| | Paddy-Maha-Rainfed | | - | 102 | 87 | 91 |

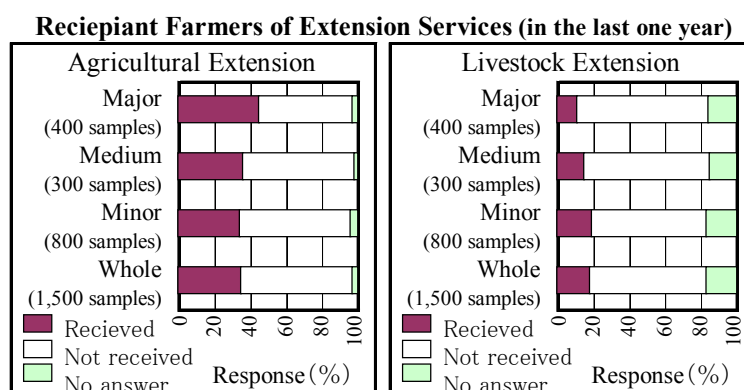
Source: Questionnaire Survey carried out by the Study Team in 1999.

(4) Agricultural Extension

The present farmer's situation on agriculture extension services is shown in the figure to the right.

About 35% of farmer had consultation to Agriculture Instructor (AI). On

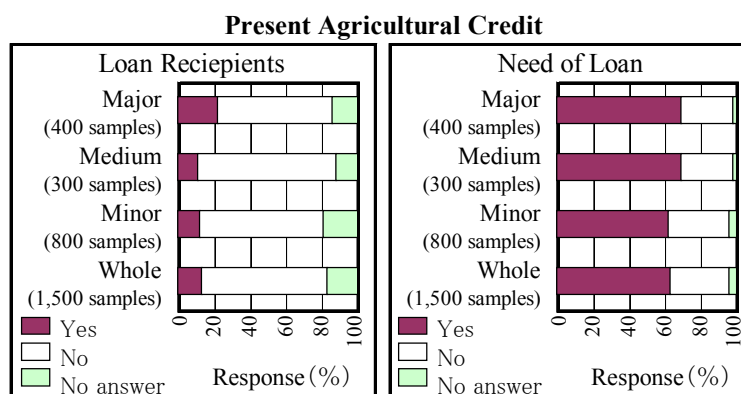
the other hand, on livestock, only 18% of farmer received extension services. Major subject that farmers received on agriculture was use of improved seed, fertiliser and agro-chemical.



Source: Questionnaire Survey conducted by the Study Team in 1999.

(5) Agricultural Credit

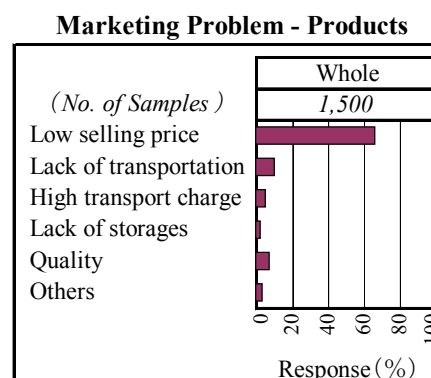
An average of only 13% of farmers in all schemes received a loan. On the other hand, 63% of farmers wants to receive a loan. The purposes of the loan were for crop production (59% of whole), for purchasing of farm machinery and rice miller (22%), for living expenses (7%). About 60% of them expressed difficulty accessing a loan.



Source: Questionnaire Survey conducted by the Study Team in 1999.

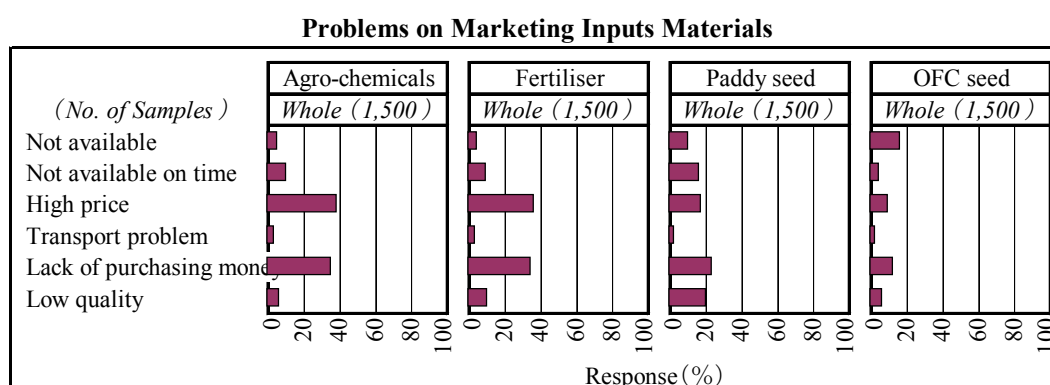
(6) Marketing of Agriculture Inputs and Outputs

The problems on marketing products by the interview survey are raised in the right figure. Low farm-gate prices are raised by 66% of whole sample. However, quality that reflects to the prices was not much of a problem for them. The lack of their products may be a problem of marketing.



Source: Questionnaire Survey conducted by the Study Team in 1999.

Regarding inputs materials, high prices of agro-chemicals and fertiliser, and the lack of finances for purchasing were concerns raised by the farmers. The lack of finance and low quality were the problems raised on the paddy seed.



Source: Questionnaire Survey conducted by the Study Team in 1999.

5.2.3 Irrigation and Drainage Facilities

(1) Catchment, Reservoir and Commanding Areas

The hydrological characteristics of each of the major and medium schemes are as follows:

Hydrological Characteristics of Major and Medium Schemes

| | Code | Scheme Name | Catchment Area (km ²) | Total Reservoir Capacity (MCM) | Reservoir Area (ha) | Commanding Area (ha) |
|----------------|--------|--------------------|-----------------------------------|--------------------------------|---------------------|----------------------|
| Major Schemes | 1MA-01 | Nachchaduwa | 611 | 55.8 | 1,784 | 2,540 |
| | 1MA-02 | Nuwarawewa | 84 | 44.5 | 1,196 | 1,134 |
| | 1MA-03 | Tissa Wewa | 5 | 4.0 | 213 | 365 |
| | 2MA-01 | Rajangana Wewa | 769 | 100.7 | 1,599 | 5,668 |
| | 4MA-01 | Palukadawela | 18 | 9.5 | 360 | 956 |
| | 4MA-02 | Attaragalla Wewa | 41 | 4.5 | 199 | 462 |
| | 4MA-03 | Ambakolawewa | 171 | 6.3 | 291 | 410 |
| | 5MA-01 | Magallawewa | 54 | 8.0 | 284 | 2,632 |
| Medium Schemes | 1ME-01 | Thuruweli Wewa | 38 | 6.4 | 324 | 227 |
| | 1ME-02 | Eru Wewa | 146 | 0.8 | 126 | 34 |
| | 1ME-03 | Uttimaduwa Wewa | 6 | 1.6 | 117 | 93 |
| | 1ME-04 | Periyakulama | 13 | 1.7 | 114 | 91 |
| | 1ME-05 | Maminiya Wewa | 26 | 1.7 | 108 | 211 |
| | 1ME-06 | Maha Bulankulama | 13 | 1.4 | 93 | 90 |
| | 2ME-01 | Angamuwa wewa | 130 | 15.5 | 509 | - |
| | 4ME-01 | Maha Nanneriya | 36 | 2.5 | 135 | 158 |
| | 4ME-02 | Mahagalgamuwa Wewa | 10 | 8.0 | 270 | 193 |
| | 5ME-01 | Hulugalla Wewa | 28 | 1.8 | 100 | 121 |
| | 6ME-01 | Meddeketiyawewa | 10 | 0.8 | 46 | 98 |
| | 6ME-02 | Moragoda Anicut | 101 | - | - | 194 |

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

In detail, the hydrological characteristics for the minor schemes are shown in Table 5.2.1. Average hydrological characteristics of the minor schemes are shown below.

Hydrological Characteristics of Minor Schemes

| No. of Scheme | Catchment Area (km ²) | Total Reservoir Capacity (MCM) | Reservoir Area (ha) | Commanding Area (ha) |
|---------------|-----------------------------------|--------------------------------|---------------------|----------------------|
| 80 | 2.2 | 0.2 | 16.4 | 31 |

Note: Indicate average figures in all minor irrigation schemes.

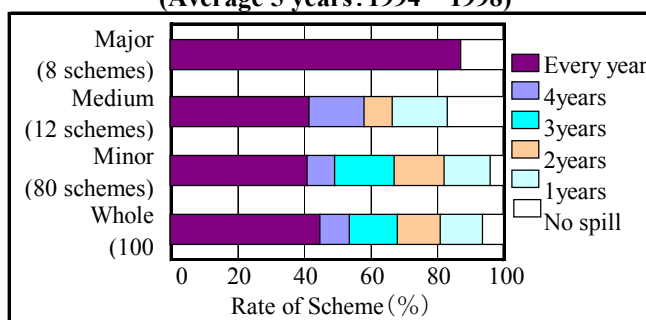
Source: Inventory Survey carried out by the Study Team in 1999.

The medium and minor irrigation tanks are constrained by serious water shortages as over half the tanks fail to be filled with water every Maha season.

(2) Water Usage

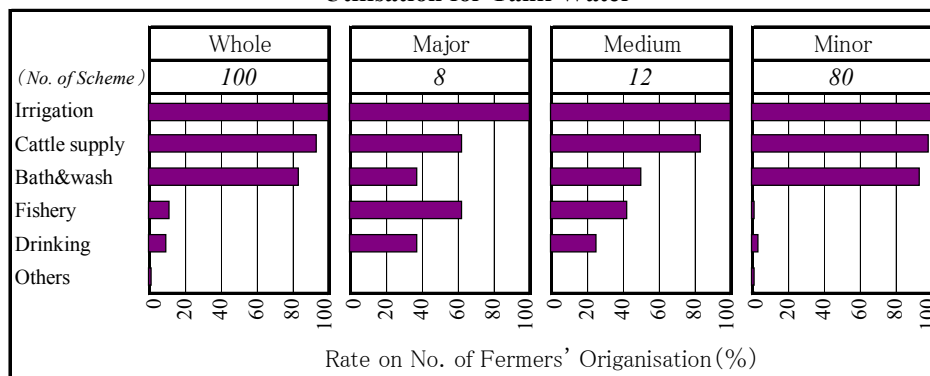
Water in the tanks are utilised for not only irrigation but also other purposes such as livestock raising, bathing and washing, and inland fisheries. Most tanks are not used for supplying drinking water. In the inventory survey, some 750 agro-wells are recorded in the 100 schemes, and they are mainly used for OFC cultivation.

Occurrence of Spill out in Maha (Average 5 years: 1994~1998)



Source: Inventory Survey conducted by the Study Team in 1999.

Utilisation for Tank Water



Source: Inventory Survey conducted by the Study Team in 1999.

(3) Command Area with Cropping Intensity

The total command area in the candidate schemes is about 18,200 ha. The major, medium, and minor schemes have 78%, 8%, and 14% share, respectively.

Commanding Area

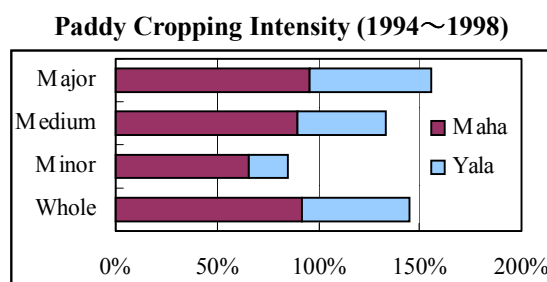
(Unit : ha)

| 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 |

Note: Indicate gross commanding area

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

Average cropping intensities of paddy in the last 5 years in Maha, Yala are shown below. While the Maha crop intensity of paddy in major and medium irrigation schemes are generally recorded at over



Source: Inventory Survey conducted by the Study Team, 1999.

80%, some 30% of the minor irrigation schemes have low intensities with less than 60%. Most major and medium irrigation schemes carry out Yala cultivation, even though the cultivated areas in Yala vary depending on the availability of tank water. About half of the minor irrigation schemas had no Yala cultivation for the last 5 years. It is likely that the cultivation extent in Yala is closely related to the hydrological characteristics of each tank or the location within a cascade system.

(4) Irrigation Facilities in Major and Medium Schemes

1) Water Reservoir (Tank)

Conditions of tanks are as follows:

| Facility | Form of Facility | Problems |
|-------------|---|--|
| Bund | All of tanks are classified into earth fill dam and dam height is below twenty meters. | <p>a) Some of them such as Nuwarawewa, Tissawewa, and Angamuwa, were constructed in ancient times and later renovated.</p> <p>b) Although, the bunds of most tanks are in good condition, some of them have problems of leakage from the bund and slope failure owing to less compaction or wave action.</p> <p>c) Several schemes are affected by silting and the water-grass problem, which causes a decrease in reservoir capacity.</p> |
| Sluice-gate | A tower sluice is adopted for most medium schemes. As for the ancient tanks, a masonry sluice was facilitated. | Some of the sluice gates have lifting problems and/or leakage problems. |
| Spill-gate | Several scheme such as Nachchaduwa, Tissawewa, Eru Wewa, Rajangana, and Angamuwa are equipped with spill-gates made of wood or steel. | <p>Most spill-gates have been constrained by spoiled gate bodies, mechanical trouble for lifting and/or packing seal and leakage. On the other hand, fixed type is functioning generally well, except one scheme.</p> <p>Maha Bunankulama where overtopping of bund takes place occasionally, and is caused by insufficient spillway capacity.</p> <p>The malfunctioning of the apron located downstream of spillway in Tissawewa.</p> |

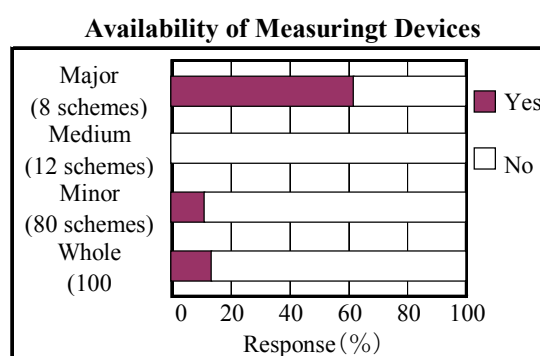
2) Distribution System

In general, the distribution system of major schemes is composed of main canal, D-canal, F-canal, and distribution facilities such as regulator and turnout. A retaining wall made of masonry is provided in certain places in main canals while most distributary and field canals are earth canals.



Major Tank

a) Although most canal systems are functioning normally, the main problems of canals are silting and grass growing due to poor maintenance. Further, leakage and/or canal slope erosion are seen in several schemes, thus canal lining will be required in some places.



Source: Inventory Survey conducted by the Study Team in 1999.

b) Although measuring devices at the head of canals have been installed in most major schemes, they are not functioning due to deterioration of the structures. Installation or improvement of the measuring devices, as well as, continuous recording will be needed in accordance with the water management plan.

c) As far as distribution facilities are concerned, some gates have leakage problems and/or lighting problem, which disturb fair water distribution and saving water. While distribution facilities are equipped in the major schemes, most of medium schemes do not have the facilities yet. Installation of distribution facilities is strongly expected by farmers for water management activities, such as equal water distribution and effective water resources utilisation.

The average canal density of the irrigation schemes is some 65 m/ha. This value could be a target to improve the irrigation canal network.

3) Drainage Problem

In several schemes such as Uttimaduwa and Maminiyawa, the drainage problem observed is due to inadequate cross section of drainage canal, which does not have a capability for spilling water properly. Consequently, the command area is affected by the unnecessary spilling of water. Meddeketiya scheme suffers from salinity in recent years because of inappropriate irrigation practice and a poor drainage system, which causes diminished yield of paddy.

4) Farm Roads

Farm roads are not provided except in major schemes. The Study Team has received farmers' requests for construction of farm roads to improve accessibility of farm tractors and to facilitate conveyance of agricultural production in Nuwarawewa, Maha Bunankulama, and Maminiyawa.

(4) Irrigation Facilities in Minor Schemes

The inventoried minor irrigation schemes had no substantial rehabilitation works for a long time. In most schemes, such tank rehabilitation works as bund re-filling, sluice gate, and spillway, will be urgently required. With respect to irrigation canals, both rehabilitation of channels, as



Erosion of Tank's Bund

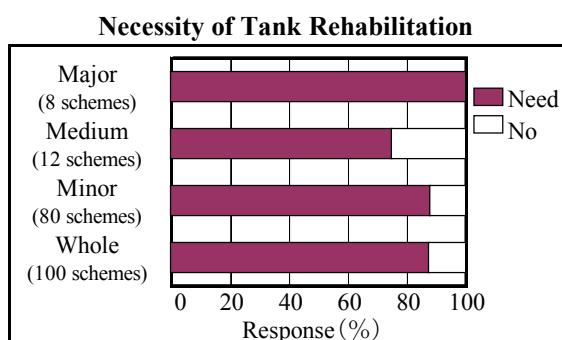
well as, installation of structures will be needed so as to conduct proper water management. Asked whether the turnout with gate is required, most farmer leaders replied that the structures are needed.

(5) Needs for Rehabilitation

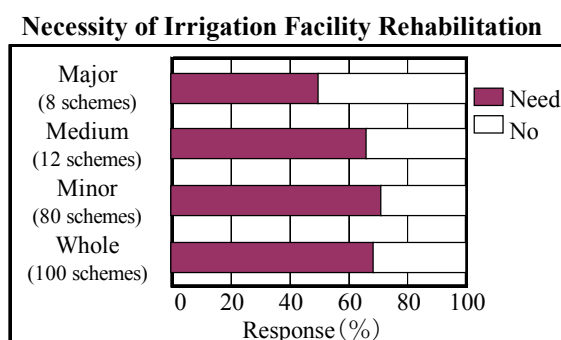
On the basis of the field inspections of major and medium schemes, major points of the rehabilitation for facilities in each scheme are summarised in Table 5.2.2, which also includes general information of water resources and construction/rehabilitation history.

According to the inventory survey, out of 100 schemes, schemes that need to rehabilitate tanks and provide irrigation facilities are 88 (88%) and 69 (69%), re-

spectively.



Source: Inventory Survey conducted by the Study Team in 1999.



Source: Inventory Survey conducted by the Study Team in 1999.

Major points for rehabilitation are summarised below:

Summary of Rehabilitation Works

| Schemes | 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 |

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



Erosion at Turnout

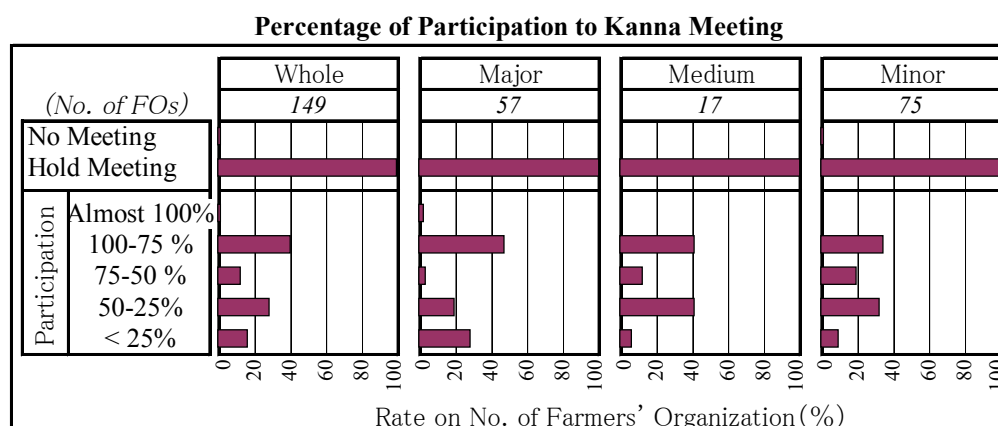


Silting of Main Canal

5.2.4 Operation and Maintenance

(1) Meetings to Decide Seasonal Cultivation

The availability of the meeting (Kanna meeting) with the percentage of farmers' attendance is shown below.

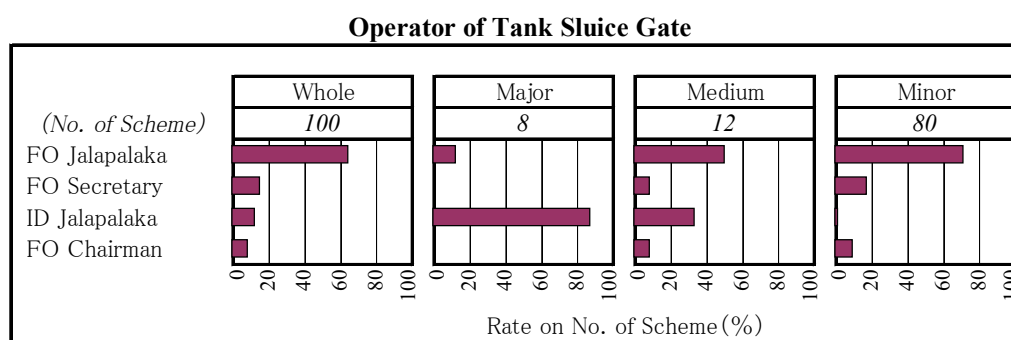


Source: Inventory Survey conducted by the Study Team in 1999.

A Kanna meeting is held to decide the seasonal cultivation schedule. Holding the meeting and the rate of participation are shown in the above figure. Most of the major and medium irrigation schemes hold a pre-Kanna meeting with FO or PMC. It is also observed that the participation rate in the Kanna meetings in the major irrigation schemes is high.

(2) Operation

The method of the sluice operation varies widely reflecting the local condition, such as water resources potential, physical condition of irrigation scheme, and intention of farmers. Although the head works in both major and medium irrigation schemes should be managed by ID officials, it is seen that the medium schemes in Anuradhapura District and area covered by the Galgamuwa IE's Offices in Kurunegala District are managed by FOs under the technical guidance of ID officials. This fact suggests that the whole operation in the medium irrigation schemes will be able to carry out by FOs.

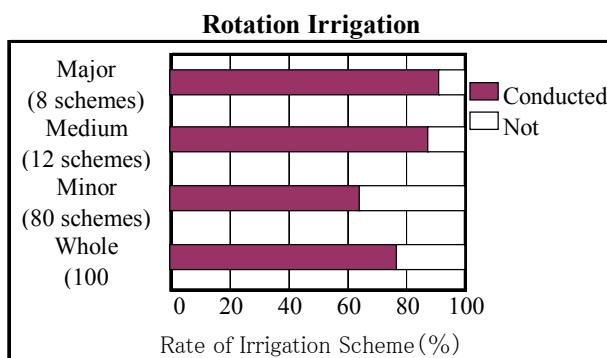


Source: Inventory Survey conducted by the Study Team in 1999.

In the minor schemes, the sluice of the tank is operated by FO office bearers or a gate operator named by a Jalapalaka, while a Jalapalaka employed by ID is in charge of the operation in most major irrigation schemes. Although the outflow is reported to be adjusted according to rainfall, the operation is dependent on the operators' experience due to lack of measurement devices.

Rotation irrigation

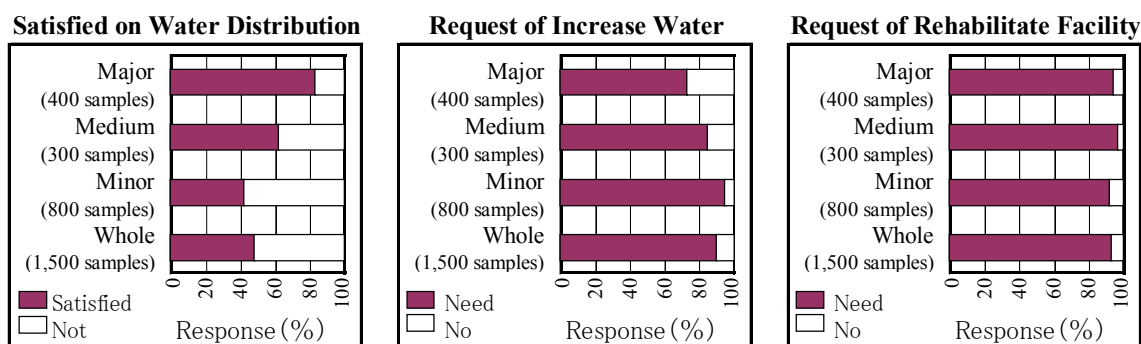
Some 75% of FO leaders reported that the rotation irrigation is conducted within their areas, as shown to the right. The rotation system is discussed at the FO meeting based on the operation rule of head works decided by ID.



Source: Inventory Survey conducted by the Study Team in 1999.

Satisfaction to water distribution

The questionnaire survey indicates that the farmers in the major schemes expressed greater satisfaction about water distribution than in the minor schemes. However, many of them requested more water supply, even in the major schemes demand is high in spite of high satisfaction. The present water supply is satisfied considering the limited capability of the present aged facilities. Increased water supply by rehabilitation is highly expected. 90% of farmer is expecting rehabilitation as the figures shown below.



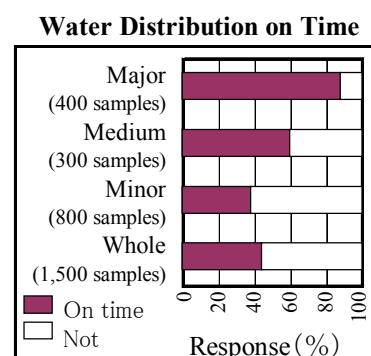
Source: Questionnaire Survey carried out by the Study Team in 1999.

Throughout the field survey, it was revealed that some FO members' complained to the government agencies about the irrigation schedule decided at a Kanna meeting not being implemented.

(3) Maintenance

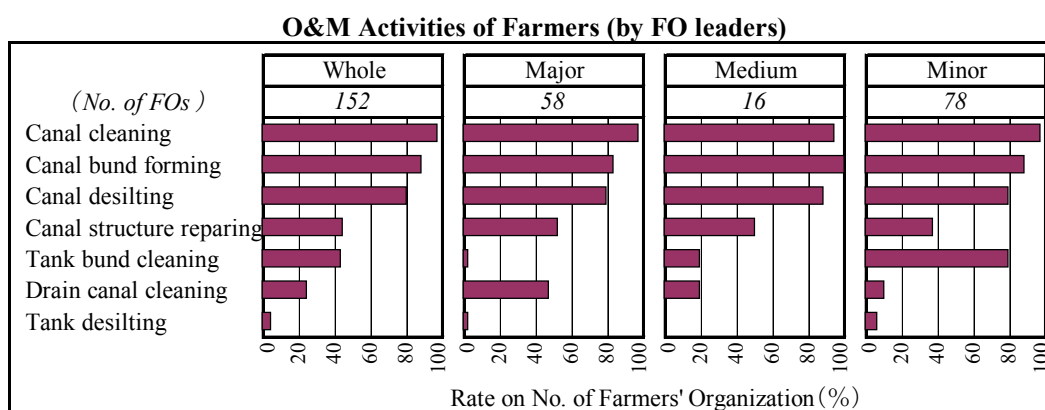
Present farmers' involvement in maintenance work

is as follows. Most farmers are involved in the clearing, desilting, and bund



Source: Questionnaire Survey carried out by the Study Team in

forming of the canals. It is remarked that all FOs in the minor schemes are not involved in the clearing of tanks, even though the FOs are responsible for maintenance of tanks in the minor irrigation schemes.



Source: Inventory Survey conducted by the Study Team in 1999.

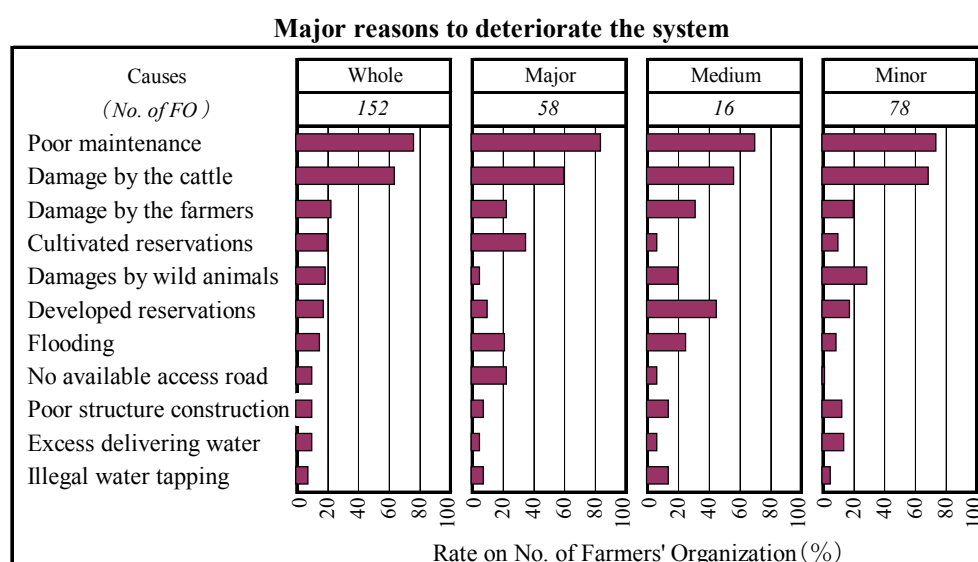
Sramadana is conducted in most irrigation schemes as shown below. However, it can be said that the activities for sramadana decline due to less involvement in agricultural activities, non-owner cultivation, and owners residing outside the schemes.

Sramadana
(Unit: Nos. of FOs)

| Category | Total | Yes | No | No answer |
|----------|-------|-----|----|-----------|
| Major | 58 | 57 | 1 | 0 |
| Medium | 16 | 15 | 1 | 0 |
| Minor | 78 | 77 | 1 | 0 |
| Total | 152 | 149 | 3 | 0 |

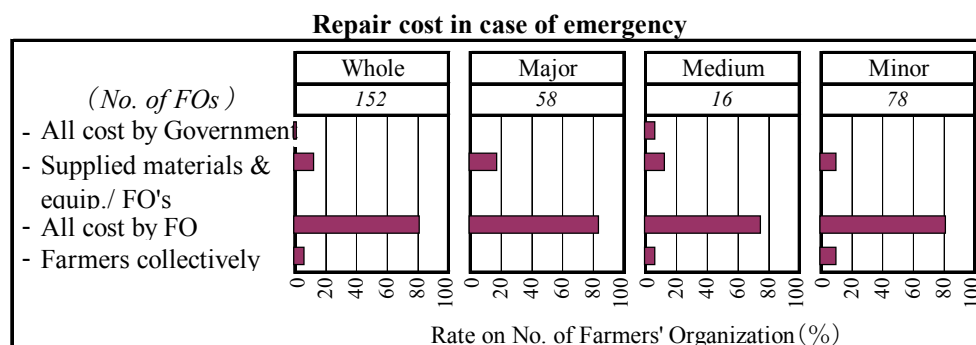
Source: Inventory Survey carried out by the Study Team in 1999.

Some 75% of FO leaders replied that deterioration of the system is caused by poor maintenance. Further, action to protect damage by cattle should be considered.



Source: Inventory Survey conducted by the Study Team in 1999.

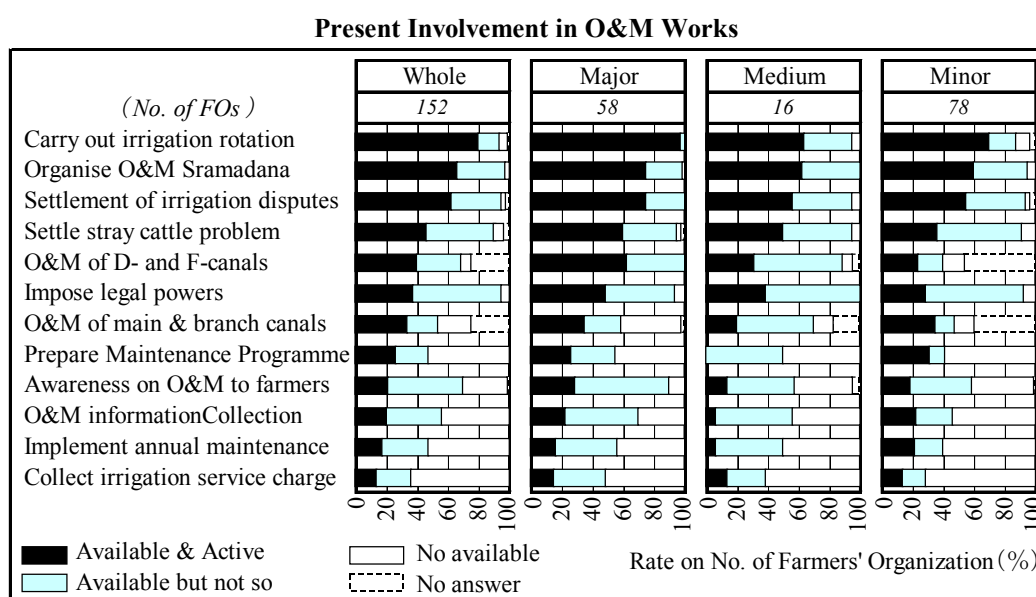
In the event of an emergency, most FOs bears the repair costs, as shown below.



Source: Inventory Survey conducted by the Study Team in 1999.

(4) Involvement of FO in O&M

The following table indicates the involvement of FOs in O&M.



Source: Inventory Survey conducted by the Study Team in 1999.

In connection with involvement in O&M, there is no significant difference between major, medium, and minor irrigation schemes. Farmers' active involvement is found in carrying out irrigation rotation, followed by organisation of sramadana, and settlement of irrigation disputes. As for preparation and implementation of annual maintenance programme and collecting irrigation service fee, both still show a low involvement.

5.2.5 Rural Infrastructure

The present conditions of rural infrastructures in the irrigation schemes are shown below.

Rural Infrastructure in the Irrigation Schemes

| | Road (Length per Village) | | | | | Drinking Water (per Household) | | | | Electrification (lighting) House (%) |
|--------|---------------------------|--------|--------|--------|--------|--------------------------------|-----------------------|---------------|------------|--------------------------------------|
| | A (km) | B (km) | C (km) | D (km) | E (km) | Surface well (%) | Stand Post (Pipe) (%) | Tube well (%) | Others (%) | |
| Major | 0.3 | 0.7 | 3.9 | 3.7 | 2.6 | 88 | 2 | 7 | 3 | 62 |
| Medium | 0.4 | 1.8 | 1.7 | 2.7 | 2.2 | 84 | 1 | 12 | 3 | 43 |
| Minor | 0.4 | 0.4 | 1.7 | 2.7 | 1.4 | 81 | 1 | 16 | 2 | 52 |
| All | 0.4 | 1.1 | 2.3 | 2.9 | 2.0 | 82 | 1 | 14 | 2 | 52 |

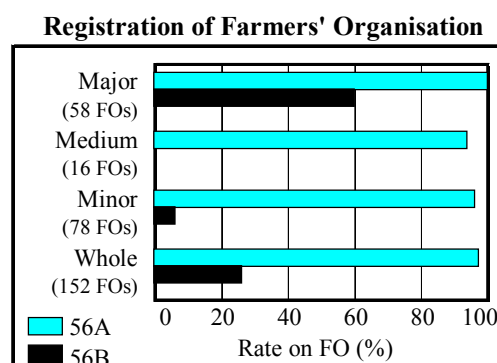
Source: RRA and Questionnaire Survey carried out by the Study Team in 1999

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, it seems that potable water supply availability meets farmers' basic requirements, and the problem is that of water quality. The groundwater contains much calcium. The electrification ratio averages about 50%, but it is as low as 10-20% in several irrigation schemes.

5.2.6 Farmers' Organisation and Village Community

(1) Registration of Farmers' Organisation (FO)

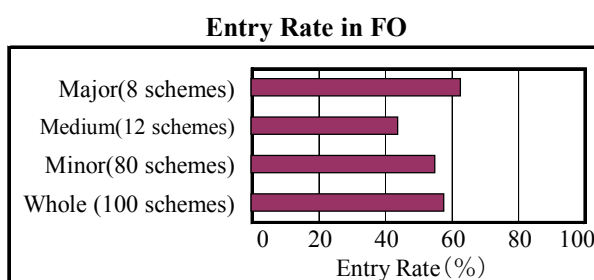
Progress of registration of FOs under the Agrarian Services Act is shown in the following figure. It is observed that the registration of FOs under Clause of 56B has been promoted under the guidance of IMD.



Source: Inventory Survey conducted by the Study Team in 1999.

(2) Entry in FO

The following figure indicates the farmers' enrolment in FOs. The major irrigation schemes have more membership in FOs than in the medium and minor schemes.



Source: Inventory Survey conducted by the Study Team in 1999.

(3) Office Bearers

The office bearers in an FO consist of a leader, a secretary, a treasurer, and an auditor as required. There is also a committee of at least four members. An auditor is present in some half of the inventoried FOs as shown below.

Office Bearers

(Unit: Nos. of FOs)

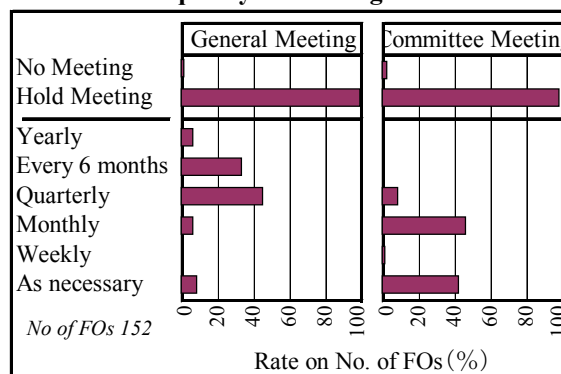
| Category | Total | Available | Not available | No answer |
|-----------|-------|-----------|---------------|-----------|
| Leader | 152 | 152 | - | - |
| Secretary | 152 | 152 | 2 | - |
| Treasurer | 152 | 152 | - | - |
| Auditor | 152 | 78 | 74 | - |

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

(4) Meetings

The frequency of the general and the committee meetings is shown in the figure. Most FOs has a general meeting quarterly or every six months. The Committee meetings, consisting of a leader, a secretary, a treasurer, and the committee are held monthly or according to needs.

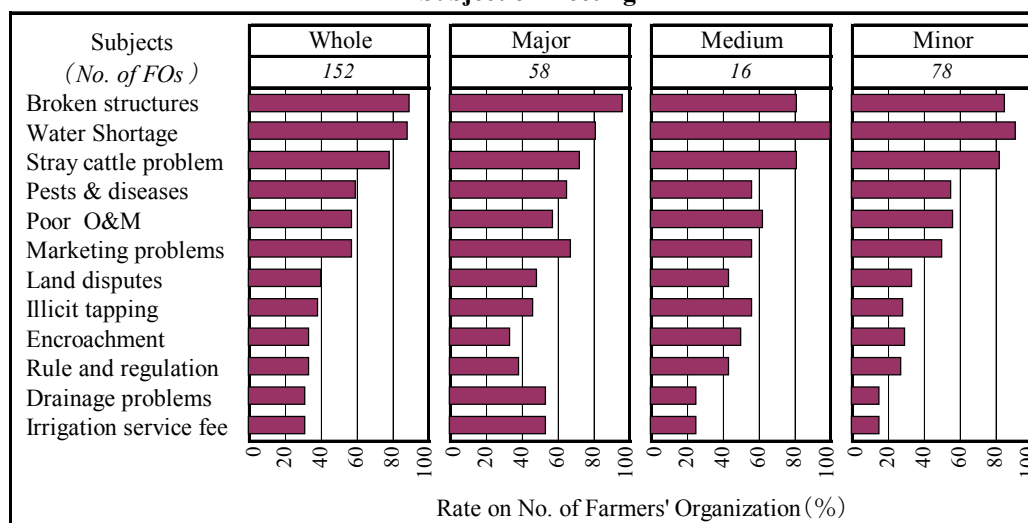
Frequency of Meeting in FO



Source: Inventory Survey conducted by the Study Team in 1999.

The subjects discussed at the meeting are as follows:

Subject of Meeting



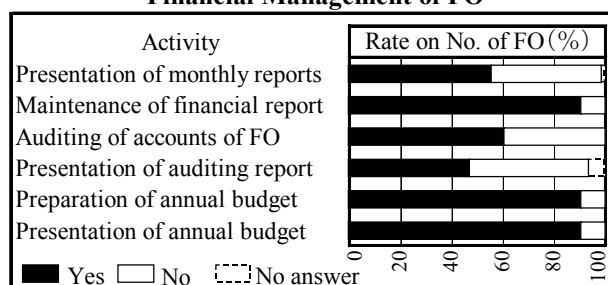
Source: Inventory Survey conducted by the Study Team in 1999.

This figure indicates that main issues for the meeting are related to irrigation, such as damage to structures, irrigation water shortage, and the stray cattle problem.

(5) Financial Management

In connection with the financial management in FOs, it is reported that an annual budget is presented to members in most FOs. Presentation of the audit report needs to be promoted in order to attain transparency of FOs financial status.

Financial Management of FO

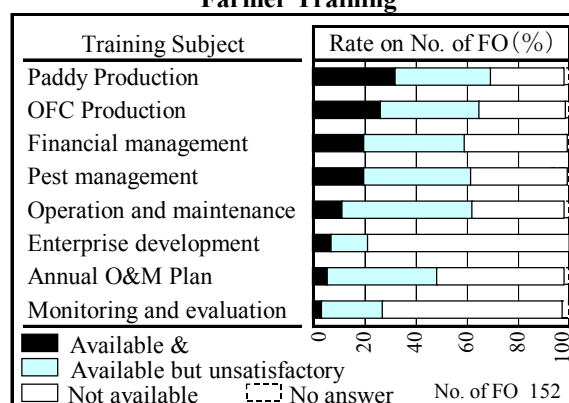


Source: Inventory Survey conducted by the Study Team in 1999.

(6) Training

Present condition of farmers' training conducted by the government officials is summarised to the right. The FO leaders feel more satisfied with the training for agricultural technology, such as paddy production and OFC production than that for operation and maintenance of irrigation facilities. It is also observed that the training for monitoring and evaluation and enterprise development is still at a low level.

Farmer Training



Source: Inventory Survey conducted by the Study Team in 1999.

5.2.7 Farm Economy

The table below shows the average farm budget of the farmers in the irrigation schemes, and the details are shown in Table 5.1.1

Farm Budget (1998)

| | (Unit: Rs/Household) | | | |
|---------------------------|----------------------|----------------|---------------|---------------|
| | Major | Medium | Small | All |
| I. <u>Gross Income</u> | <u>146,870</u> | <u>113,810</u> | <u>89,190</u> | <u>96,780</u> |
| 1) Farm income | 77,850 | 48,740 | 26,930 | 33,630 |
| 2) Non farm income | 63,140 | 61,600 | 60,010 | 60,460 |
| 3) Loan | 4,170 | 1,470 | 1,480 | 1,700 |
| 4) Others | 1,710 | 2,000 | 770 | 990 |
| II. <u>Gross outgoing</u> | <u>122,720</u> | <u>90,170</u> | <u>70,920</u> | <u>77,370</u> |
| 1) Production cost | 52,720 | 25,340 | 13,210 | 17,820 |
| 2) Loan repayment | 1,830 | 460 | 600 | 690 |
| 3) Living expenses | 67,960 | 64,140 | 56,970 | 58,710 |
| - Foods *1 | 40,630 | 37,870 | 33,750 | 34,800 |
| - Other than foods | 27,330 | 26,270 | 23,220 | 23,910 |
| 4) Others | 210 | 230 | 140 | 150 |
| III. <u>Net income</u> | <u>24,150</u> | <u>23,640</u> | <u>18,270</u> | <u>19,410</u> |
| (Bank deposit) | (2,850) | (3,050) | (1,590) | (1,870) |

*1 Including self supply of foods

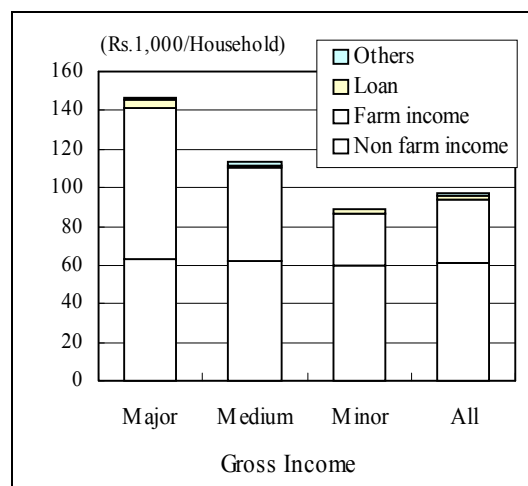
Source: Questionnaire Survey carried out by the Study Team in 1999

The gross income of the farmers is estimated to be Rs.96,800 on an average of the

all schemes, and the gross outgoing is Rs.77,400. Out of total living expenses, food expenses account for about 60%. The net income averages about Rs. 19,400, and of that, about Rs. 1,900 is deposited in the bank. Most of the remaining amount will cover living expenses other than foods.

The farmers in the schemes have significant non-farm incomes obtained from various occupations, which accounts for over 50% of gross income. Amount of non-farm income among the schemes is not significantly different and the amount per household is Rs. 60,000. Main income from other sources are: salaries as government officials (teachers, police, clerk, etc.) and employees of the private sector (garment factory, stores, etc.), wages from working in other farms and casual work in metal and brick industry, income from cottage industry/side business (small shop, sewing and dress making, etc.), self-employment (carpentry, repairing of motorcycle and bicycle), and remittance from family (army, working abroad).

Farm economy by the irrigated paddy land holding size in the entire irrigation scheme is shown below. The small-scale farmer holding less than 0.4ha sharing 20% of whole gets about 30% less gross income than average farmer and also 10% less non-farm income. The living expenses are not significantly different so the net income is much lower. Generally, small-scale farmer is concluded to be poor.



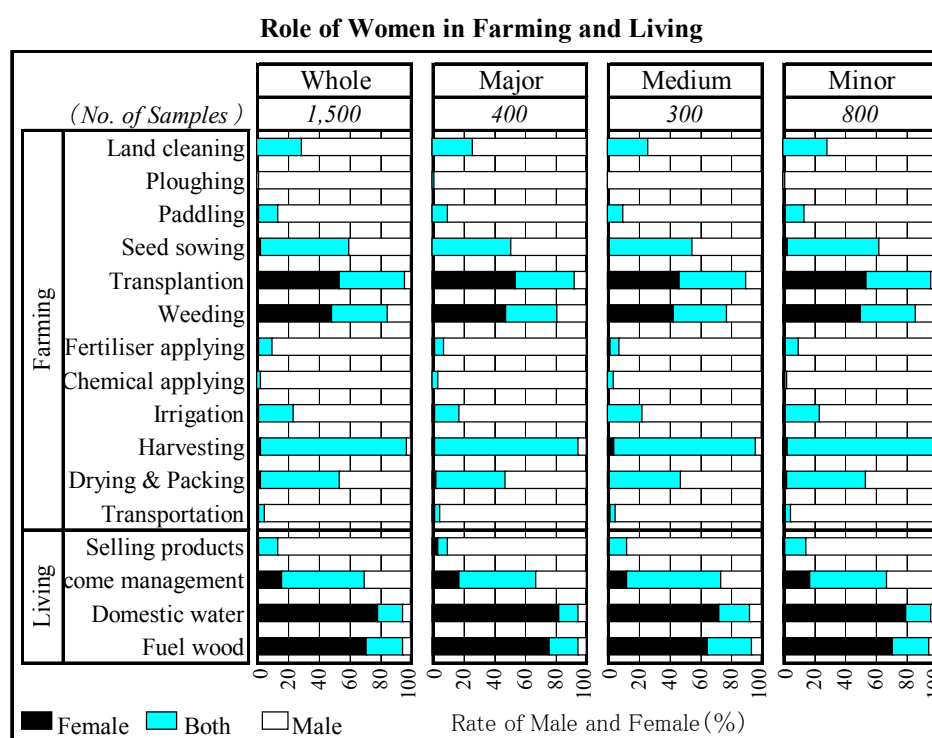
**Farm Economy by Landholding Size
Whole Irrigation Scheme (Rs./household)**

| | Irrigated Paddy Land Sizes | | |
|-------------------------|----------------------------|------------|------------------|
| | Average Whole | 0.4-0.8 ha | Less than 0.4 ha |
| (Sample No.) | (1,500) | (476) | (321) |
| (Distribution) | (100%) | (32%) | (21%) |
| I. Irrigated Paddy area | (0.75ha) | (0.47ha) | (0.21ha) |
| II. Gross Income | 96,800 | 81,200 | 66,900 |
| 1) Farm income | 33,600 | 24,000 | 11,800 |
| 2) Non-farm income | 60,500 | 55,200 | 53,900 |
| 3) Loan | 1,700 | 1,200 | 900 |
| 4) Other | 1,000 | 800 | 300 |
| III. Expenses | 77,500 | 65,400 | 63,600 |
| 1) Production cost | 17,900 | 12,000 | 6,200 |
| 2) Repayment | 700 | 600 | 500 |
| 3) Living expenses | 58,700 | 52,700 | 56,900 |
| 4) Other | 200 | 100 | - |
| IV. Net Income | 19,300 | 15,800 | 3,300 |
| (Bank deposit) | (1,900) | (1,300) | (1,400) |

Source: The Questionnaire Survey by the Study Team, 1999

5.2.8 Role of Women in Farming and Living

The figures below show role of women in farming and living. On farm works, land preparation, fertiliser/chemical application, irrigation and transportation are carried out by men and transplanting and weeding are by woman. Other farm works are shared by both men and women. On the living, transportation of domestic water and collecting of fuel wood are entrusted to 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 incomes are managed by both women and men and they have an equal status on the family finance.



5.2.9 The Poor in the Irrigation Schemes

In all irrigation schemes, the poor who are recognised by the leaders of FO account for 24% of total households in the typical village, as shown in the table to the right³. The minor irrigation

The poor recognised by FO Leaders

| | Major | Medium | Minor | All schemes |
|---|-------|--------|-------|-------------|
| Average Household per Village (Household) | 206 | 143 | 117 | 152 |
| Poor Family per Village (Household) | 32 | 41 | 34 | 36 |
| Percentage | 15% | 28% | 29% | 24% |

³ Poor in the community are defined as Samurudi recipients. However according to FO leaders, it is pointed out that there is difference between actual poor and the recipients. Here in the study, the poor is judged by

schemes have a share higher of the poor than the major schemes. For supporting the poor, the leaders of FOs have the opinions as in the table to the right. About 70% of the leaders have the opinion that basic requirement should be provided to the poor so they are self-supporting.

Opinion of FO Leaders to the Poor

| | Major | Medium | Minor | Total |
|--|-------|--------|-------|-------|
| Give enough money | - | 4% | 4% | 3% |
| Give help in kind | 12% | 9% | 12% | 11% |
| Give all the needs | 2% | - | 1% | 1% |
| Provide basic requirements to be self-supporting | 73% | 61% | 72% | 68% |
| Do nothing | - | - | - | - |
| Others | 13% | 25% | 11% | 17% |

Source: RRA by the Study Team, 1999.

5.2.10 Problem of Youth in the Community

It is important to maintain and foster young generation for the sustainable development of regional agriculture. The workshop with youth⁴ was held and the Study Team understood their idea on “Where do you want to work at?” and “Where do you want to live?” The participants of the workshop are shown in the table above.

Occupation of the participated youth by agriculture related sector and non-agriculture sector is shown in the table above. More than half of the youths in the major schemes are employed or self-employment in the agriculture related sector. On the other hand, more youths in the medium and minor schemes are working in non-agriculture sector.

Participants of Youth Workshop

| Scheme | Workshop Holding | Participant Total | | | Range of Ages |
|--------|------------------|-------------------|--------|-------|---------------|
| | | Male | Female | Total | |
| Major | 27 | 302 | 232 | 534 | 17-35 |
| Medium | 25 | 143 | 103 | 246 | 18-33 |
| Minor | 45 | 244 | 169 | 413 | 17-33 |
| Total | 97 | 689 | 504 | 1,193 | 17-35 |

Occupation of Youth in the Study Area

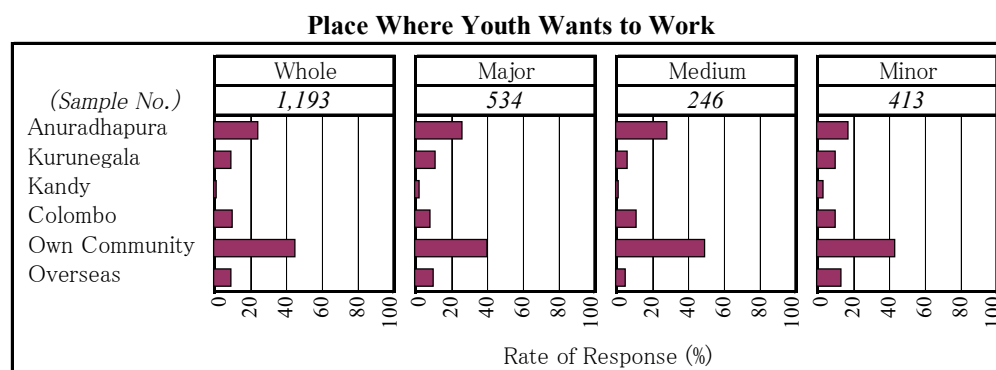
| Working Sector | Major | Medium | Minor | Whole |
|-----------------------|-------|--------|-------|-------|
| Employment | | | | |
| - Agriculture (%) | 64 | 30 | 35 | 42 |
| - Non-agriculture (%) | 36 | 70 | 65 | 58 |
| Self-employment | | | | |
| - Agriculture (%) | 57 | 44 | 42 | 47 |
| - Non-agriculture (%) | 43 | 56 | 58 | 53 |

Source: RRA by the Study Team, 1999

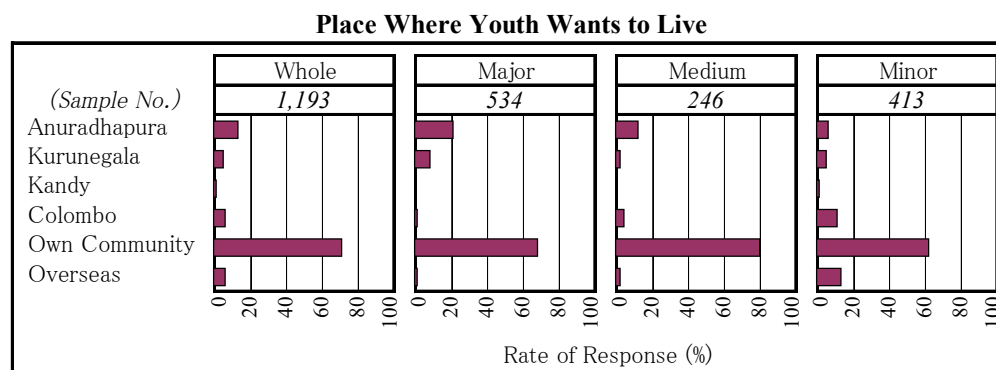
The results of the workshop are described below. Their own community is the place most wanted to work, followed by Anuradhapura which is the largest town in the northern irrigation area. The place they wanted to live is their own community (60%), so it can be expected that the majority will settle in their own community if employment is available there.

the FO leaders therefore the levels of poor among the schemes are varied.

⁴ Participated Youth is selected following to the qualification of the Youth Club, that is 16 to 35 years old.



Source: RRA survey by the Study Team, 1999



Source: RRA survey by the Study Team, 1999

5.3 The Summary of the Present Situation in the Irrigation Schemes

The present situations of each sector in the irrigation schemes are described in Section 5.2. This section is to consider the major feature and the problem and its causes of the irrigation scheme of the Study area based on the surveys.

(1) Paddy Land Holding

In the major schemes, less than 10% of irrigated paddy land is held by small-scale farmer. It is over 30% in minor scheme and it is in between for medium schemes. It averages 20% for all schemes. More traditional villages are in the minor schemes so farmland would be more fragmented in these areas. The development benefit by the rehabilitation and improvement programme is to reach more to the farmer holding larger land and less for small-scale farmer. In the view-point of the equitable distribution of the development benefit, special consideration, other than the rehabilitation and improvement programme, for the small-scale farmer is needed.

(2) Crop Yield

On the yield of irrigated paddy, the major scheme achieved relatively high level of 3.8ton to 4.1ton/ha, however, the medium and minor schemes are as low as 3.3ton to 3.6ton/ha. The yield distribution in the major scheme is centred in 3 to 5ton/ha and large variation is observed in 1 to 5ton/ha in the medium and minor

schemes. Major cause is considered to be the limitation of water resource discussed later. That is, the medium and minor schemes have unstable irrigation water supply and insufficient quantity comparing with the major schemes. It is considered to be the cause of low and unstable yield. On the fertiliser application, over 310kg/ha (total weight) of total fertiliser is applied in the major, medium, and minor schemes and it is definitely not a small amount compared with the DOA recommendation of 325kg/ha (total weight). It may be over application for the yield level being achieved. The excess dose of 458kg/ha on average is observed in the major schemes. The lower yield with high dose of fertiliser application is due to the lack of water as well as the application not being practised on time.

(3) Insufficient Irrigation Water and Cropping Intensity

For water reservation of tank in the irrigation schemes of the last five years (1994 to 1998), 80% of tank in the major schemes is filled every year but only 40% is filled in the medium and minor schemes. Average cropping intensities of paddy under irrigation in the last five years of the major, medium, and minor schemes are 156%, 133%, and 90%, respectively. Especially in Yala cultivation, only 20% of the tanks in minor schemes are filled. Serious water shortage of the minor scheme is observed and is the major cause of the low yield mentioned before. The existence of tanks without filled up in the minor scheme meant that the scheme is limit of the water resource.

(4) Operation and Maintenance of the Facility and Farmers' Organisation

In the answer of FO in the Inventory survey, the rehabilitation of irrigation facilities are needed by 88 schemes in tank and by 69 schemes in irrigation canal. In the questionnaire survey, over 90% of farmers has required the rehabilitation. Field investigation by the Study Team also has seen deteriorated facilities and judged the necessity of the rehabilitation. Lack of O&M as the cause of the deterioration is raised by 70% of FOs. The result of survey on system and activity of O&M is summarised below.

| | |
|-------------------------------------|--|
| Decision making organisation on O&M | Kanna meeting is established in all the scheme |
| Existence of FO for O&M | FO is established in almost all the scheme |
| Entry rate to FO | 57% of the entry rate in whole |
| O&M activity by farmer | Most farmers participate to weeding canal, desilting canal, earth works of canal bund. |
| Involvement of FO in O&M | Insufficient but 60% of FO maintained d-canal and F-canal, and 50% of FO maintained main canal |
| Organising Sramadana | 90% of FO is practised |
| Collecting irrigation service fee | Less than 10% of FO collecting. Subsidy by ID & IMD but insufficient |
| Maintenance cost for emergency | 80% of FO spend own money for emergency |
| Farmer training on O&M | 60% of FO trained but unsatisfactory |

It could say that O&M system by farmer/FO is existing in the scheme and carrying on O&M, though it is inactive. The cause of deterioration is not the problem of no system and no maintenance but the degree of the activity. There is a system but it is not functioning enough.

(5) Water Management

Farmers are conditionally satisfied on the present irrigation water supply. That is considering the limitation of water supply under the present deteriorated facilities. Farmers are expecting the irrigation water supply to increase by over 70% in the major schemes and by over 80% in the medium and minor schemes. Some farmers complain that water is not distributed according to decision made in the Kanna meeting and the following reasons are considered.

- a) Shortage of water source
- b) Shortage of the gate operator, problem of the Government administration
- d) Delayed planting by shortage of labour
- e) Lack of communication between officers and farmers
- f) Unclear resolution of the dispute

(6) Farm Economy

Non-farm income shares more than 50% of the gross income per household on average for all schemes. The share of non-farm income is relatively larger the minor schemes compared to the major schemes. Unstable rainfall in the Dry and Intermediate zones causes agricultural production to vary largely and thus income from agriculture is very unstable. Therefore, farmers require stable income from non-farm sector. The small-scale farmer (less than 0.4ha of irrigated paddy land holding), sharing 21% in the entire scheme, has a low agricultural income as well as non-farm income and is poor.