Chapter 3 PRESENT CONDITIONS OF STUDY AREA

3.1 Introduction

At the initial stage of the Study, in the 1st Field Work, data and information were collected from relevant agencies and 13 district offices in the study area. Although the Study focus on the wetland rice sub-sector development through sustainable irrigation development, data and information were collected covering a wide range of sub-sectors including livestock and other crops with the intention of formulating the D/P in a comprehensive manner based on a clear understanding of the whole agriculture sector in the study area.

Nevertheless, documented data for agricultural planning were lacking in the study area, even in the respective district offices. The Study Team has thus organised a series of workshops at district and sub-county levels in order to grasp the present conditions of agriculture and rural communities, including those relating to problems and constraints and potential for agriculture development. The present status of irrigation and wetland rice development performed by smallholders was also clarified in the workshops. Participants of the workshops were local government technical officers responsible for agriculture, rural development and environmental conservation, and representative farmers.

The description in this chapter is thus made, in a comprehensive manner, based on the results of assessment made on the data and information collected through these workshops.

3.2 Natural Conditions

3.2.1 General

The study area covers a gross area of about 37,020 km^2, of which about 9,390 km^2 is open water (water surface). The total land component of the study area is about 27,630 km^2 including some 2,500 km^2 of the low-lying wetland.

The study area is extending to an altitude ranging from 914 m to 1,800 m above mean sea level (a.s.l.). The land area can be divided into four physiographical zones, *i.e*. "*Mountain Slope* (middle part of Mt. Elgon; above 1,250 m a.s.l.)", "*Higher Plateau* (foothills portion of Mt. Elgon; 1,150 – 1,250 m a.s.l.)", "*Middle Plateau* (1,000 – 1,150 m a.s.l.)", and "*Lower Plateau* (914 – 1,000 m a.s.l.)". The land of each zone has been dissected into many small tracts (remnant terraces) through erosive action and valley formation. Accordingly, all the tracts are formed as eroded plateaux (or dissected terraces) and have gently undulating relief complexes. The bottom of the valleys then forms the "*seasonal swamp*" in the upper and middle-reach sections, while the "*permanent swamp*" is in the lower-reach sections.

3.2.2 Meteorology

(1) Climate

The rainfall and meteorological data on a daily and monthly basis for the last 11 years from 1993 to 2003 have been collected from the Department of Meteorology, MW&E.

1) Rainfall

Consecutive observations to collect the rainfall data have not been properly done for the Eastern region. However, the recent 11 years, 1993 to 2003, daily and monthly data for 13 stations have been collected, although the records are intermittent. The long-term observation record could be obtained only for Tororo, Soroti and Jinja in the Eastern region.

The monthly rainfall patterns are shown in Figure 3.2.1. The average annual rainfalls at Jinja, Soroti and Tororo are 1,358 mm, 1,379 mm and 1,507 mm, respectively. The annual rainfall at Tororo varies from 1,048 mm in 1993 to 1,840 mm in 1998, while the annual rainfall at Soroti varies from 1,770 mm in 1996 to 1,172 mm in 2002. The monthly rainfall pattern shows that there are two wet seasons in a year from March to May and September to November. The first dry season starts from December to February and the second one starts from July to August. According to the past records, however, the second dry spell fluctuates, sometimes prolonging from November to March such as in 1996/1997 at Soroti. On the other hand, the Tororo rainfall pattern shows that the second dry spell shifted between June and September for about two more months' duration. The number of times from 1993 to 2003 that less than 10 mm fell between December and February was only 3 at Tororo but it occurred 8 times at Soroti.

2) Meteorology

Temperature, wind velocity and relative humidity data have been collected. These data will be necessary to estimate the evapo-transpiration, using the modified Penman method for a water balance study assessing the sustainable use of water in the wetlands. However, the observation stations are quite limited at Tororo, Soroti and Jinja. The monthly temperature at Tororo varies 15.0 degrees centigrade in February to 35.1 centigrade in the same month. In Jinja (according to the 1995-2003 record), mean minimum temperature is 16.5 centigrade in July and the mean maximum temperature is 30.1 centigrade in February. The monthly average humidity varies from 28% in February to 80% in August at Tororo station and from 24% in February to 83% in August at Soroti.

3.2.3 Hydrology and Water Resources

(1) River Discharge

The river discharge record on a daily and monthly basis have been collected. River discharge data for Manafwa River, Namatara River, Sipi and Simu Rivers, Mopologoma River, Malaba River and Kapri River have been collected for the period from 1997 to 2003 considering the availability of the recent daily data.

Manafa River discharge records have missing data. A correlation analysis of the discharge data between Namatara River and Manafa River was made to complement the data. The coefficient of correlation was more than 80% and a regression equation was derived from the analysis.

The monthly discharge pattern for the above 7 rivers are shown in Figure 3.2.2. According to the collected data, monthly average data have been derived from the daily records. The monthly minimum and maximum data in the period 1997 to 2003 are shown in the following table. Comparing the monthly specific minimum discharge data among the rivers shows that the Mopologoma data are too small, and a measuring method would be necessary to check the data. Major parts of the catchment areas of the Sipi and Simu rivers are on Mt. Elgon. The catchment areas of Manafwa, Namatara and Malaba rivers also flow from Mt. Elgon, but the major catchment areas are lower flat areas. The minimum discharge at the Sipi River is rather small compared with the similar size of the catchment of Simu and Namatara rivers. As seen from the minimum specific discharge, the figures show that the bigger catchment rivers have smaller figures.

On the basis of the monthly minimum discharge data plotted on a logarithmic paper, the available monthly minimum discharge is estimated at about $0.7m^3/sec/100km^2$, which can be utilized for the availability of water resource for irrigation.

Monthly Minimum and Maximum Discharges for the Rivers (1997-2003)

Name of River	Sipi	Nama-Tara	Simu	Manafa	Malaba	Mopolo-goma	Kapiri
Catchment (km^2)	92.0	123.6	165.0	494.2	1,603.8	3,614.0	14,122.9
Minimum Discharge (m^3/sec)	0.150	0.771	0.368	1.396	1.228	0.134	2.270
Min. Specific Discharge ($m^3/sec/100km^2$)	0.1626	0.624	0.223	0.2825	0.0766	0.00371	0.0161
Maximum Discharge (m^3/sec)	11.869	10.466	9.463	25.370	53.026	58.187	16.683
Max Specific Discharge ($m^3/sec/100km^2$)	12.901	8.468	5.735	5.134	3.306	1.610	0.118

Source: The Department of Meteorology of the Ministry of Water, Land and Environment

3.2.4 Soils

The semi-detailed soil map on a scale of 1/250,000, which had been compiled and published by the Department of Agriculture in 1970/71, is available covering almost all of the study area. In this map, the soils are classified into 11 soil series according to the base rocks and/or geneses. The soils are further sub-classified into 26 soil phases (mapping units) putting emphasis on soil texture quality.

According to the soil classification system defined by FAO/UNESCO that is being called the "*Soil Maps of the World*", the soils classified in the above soil map are

broadly identified in 5 great soil groups, *i.e.* "*Cambisols*", "*Latosols*", "*Gleysols*", "*Vertisols*", and "*Peat*".

Amongst the soil groups, the *Cambisols* and *Latosols* are predominantly developed on the "dissected plateaus (or remnant terraces)" and widely used for agricultural production, at present. These soils are respectively occupying 78% and 13% of the study area. Both of the soils are mostly coarse in texture (loamy to sand) and have a poor physical nature, i.e. friable consistence when dry and loose consistence when wet (highly vulnerable to erosion), extremely low moisture holding capacity, and high permeability (or having a rapid basic intake rate). Accordingly, the soils are not so suitable for sustainable and economical irrigation development as crop production would be under risky conditions against "drought problems". As for the chemical properties, almost all of these soils are poor in fertility and/or have a deficit of nutritional elements, especially "*nitrogen*", for crop production. This is due to the fact that the soils are formed under oxidation-cum-laterisation weathering and leaching processes that have been strongly driven by the tropical wet climate. The application of chemical fertilizers alone is highly risky in soil fertilisation since the soils lack in clayey elements and hence have a very small cation-exchange-capacity (or elemental nutrition holding capacity). To cope with these infertile soils and maintain sustainable crop production at an economically reasonable level, application of organic manure and then supplemented with the chemical fertilisers is essential and crucial for success.

The *Gleysols* and *Vertisols* (so called black cotton soils) are the wetland soils extended along the upper and middle reaches of the present valley systems. The extent of the area of these soils is estimated almost 5% of the total land area. These soils have been developed with the *hydromorphic gleysation* weathering process under seasonally submerged and/or highly moistened conditions. These are mostly clayey to loamy in texture, relatively friable consistence when wet while very firm consistence when dry. These soils are all highly useful for cereal crop production, particularly paddy.

The *Tropical Peat* is a sedimentary deposit composed of wetland herbaceous plants such as papyrus, bulrush, reed and cyperaceous weeds, which have developed in the lower reaches of the present river system. The peat has mostly developed under permanent swampy conditions in the lower reaches of valleys, and occupies some 4% of the total land area. These soils are practically not arable or have very limited potential for agricultural development under the current socio-economic situations.

3.2.5 Natural Vegetation and Land Use

The Forestry Department, Ministry of Natural Resources compiled the "Land Cover (land use) Stratification Map" in 1996 as the final product of the "National Biomass Study" (NBS). The Maps on a scale of 1/50,000 cover the entire Ugandan territory. Other than the NBS, the National Environment Management Authority (NEMA) /Wetland Inspection Division (WID) under MW&E also conducted an inventory

survey of wetland in the entire country for conservation and management of the wetland. Through this inventory survey, NEMA/WID identified the distribution of the wetlands hydrology section by section, and clarified the present conditions of wetland including agricultural land use.

According to the above two survey and study results, the greatest part of the land (65.8% or 1,817,450 ha) in the study area has been reclaimed and intensively used for crop production. The pastureland occupied 18.6%. The remaining land is categorized into permanent wetland covered with papyrus, reeds, etc., bush and woodland, and forest. Each of the land categories occupies 6.2%, 7.3% and 1.7% of the total land area, respectively. Out of the total forestland, forestry tree plantations (reforestation) have so far only been established on 4.38% of the total forestland, while 73.25% of the forestland is being degraded to a serious level.

In the present land use/biomass maps, the agricultural land is categorized into two land units, i.e. "Subsistence Farm" and "Uniform Farm (larger unit of farming)". Each of the land units is further classified into "Upland Field" and "Paddy Field" as broken down and summarized in the table below:

Agricultural Land Use

Districts	Study Area (km^2)	Cultivated Land				Village Yard and Homestead (ha)
		Subsistence Farm		Uniform Farm		
		Upland Field (ha)	Paddy field (ha)	Upland Field (ha)	Paddy field (ha)	
Namutumba (Iganga)	2,479.6	203,370	15,380	90	0	550
Mayuge	1,082.5	67,150	670	660	0	170
Bugiri	1,569.2	105,620	2,570	0	1,060	320
Busia	730.9	52,540	290	160	0	330
Butaleja (Tororo)	1,849.2	127,660	22,250	270	2,220	1,010
Manafwa (Mbale)	1,372.6	98,270	2,470	0	0	1,220
Budaka (Pallisa)	1,925.4	130,760	15,190	0	0	270
Kaliro (Kamuli)	3,652.3	247,750	4,740	240	0	590
Sironko	1,093.9	52,120	20	230	0	180
Kumi	2,732.4	163,770	3,040	370	0	380
Soroti	2,874.0	180,770	150	320	0	1,350
Amuria (Katakwi)	4,915.3	225,410	10	0	0	470
Kaberamaido	1,354.7	89,860	0	0	0	50
Total	27,631.8	1,745,050	66,780	2,340	3,280	6,890
		1,811,830		5,620		

Source: Statistical Abstract, 2003; Uganda Bureau of Statistics
National Biomass Study (Land Cover (land use) Stratification Map), Department of Forestry, Ministry of Natural Resources and Inventory Survey on Wetland (Wetland Inventory Map), NEMA/WID, MW&E

3.2.6 Wet land Utilisation

The wetlands in the Eastern region are highly exploited for cultivation. The total wetland area in the 13 districts is 8,352 km^2, which is about 30% of the total district dry land area. The wetland has been categorized into two types that are permanent and seasonal wetlands. The area of the permanent wetlands is 2,590 km^2, which is about 31% of the total wetland. The area of the seasonal wetlands is 5,762 km^2, which is about 69% of the total wetland area.

The seasonal wetlands have been utilized for cultivation in the Southern districts. In

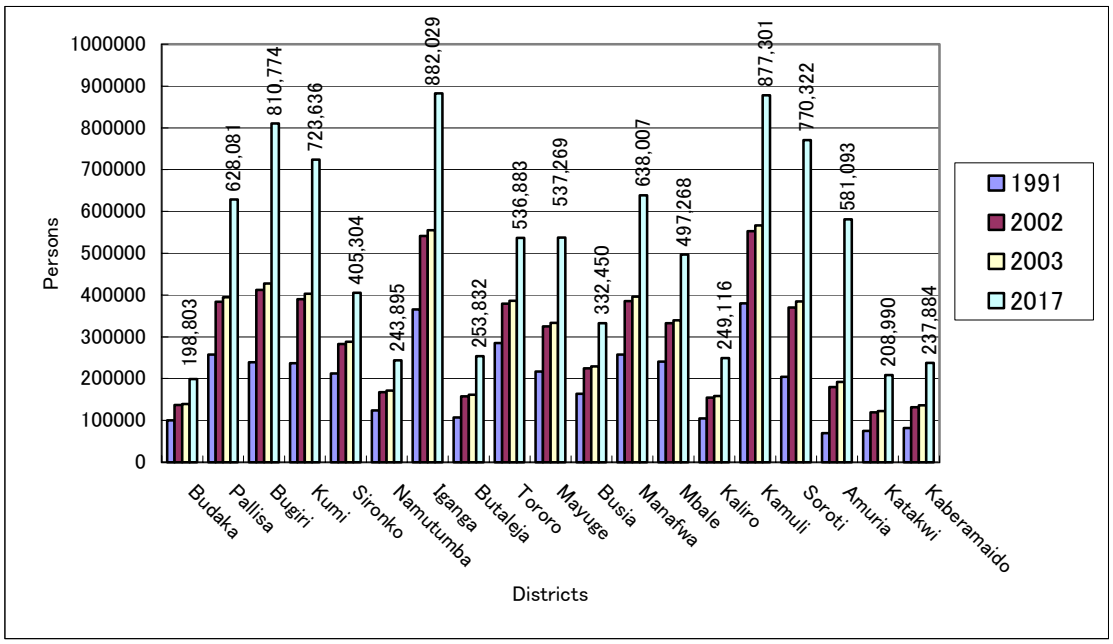
these wetlands, the total small-scale areas modified for agricultural use are 28% of the potential seasonal wetland area. According to the regulations on wetland utilisation, up to 25% of a seasonal wetland area can be allowed for use. In the permanent wetlands, two distinct large-scale modifications in Bugiri and Tororo districts can be seen, where the Kibimba and Doho Rice Schemes are located.

3.3 Socio-economy

3.3.1 Demography

The study area, which occupies most of the Eastern region, is known as the most populous area in the country, accounting for 23% (6,418,600 persons) of the Ugandan population (27,480,000 persons) in 2006[1]. According to the data from UBOS, the total population in the study area will be 9.6 million in 2017 which is nearly 1.5 times higher than that in 2006, although the growth rate differs in each district as shown in the following figure.

Population in Study Area



Source: Statistical Abstract 2006, UBOS

The growth rate of the region is higher than the national average. The national average population growth rate between 1991 and 2002 was estimated to be 3.2%, while the average of the study area was 3.8% during the same period. The highest population growth within the study area was reported to be in Amuria (9.1%), Soroti (5.5%) and Bugiri (5.1%), while the least grown area is Tororo (2.6%)[2].

The rural–urban population ratio in Uganda is estimated to be 87%. Applying this

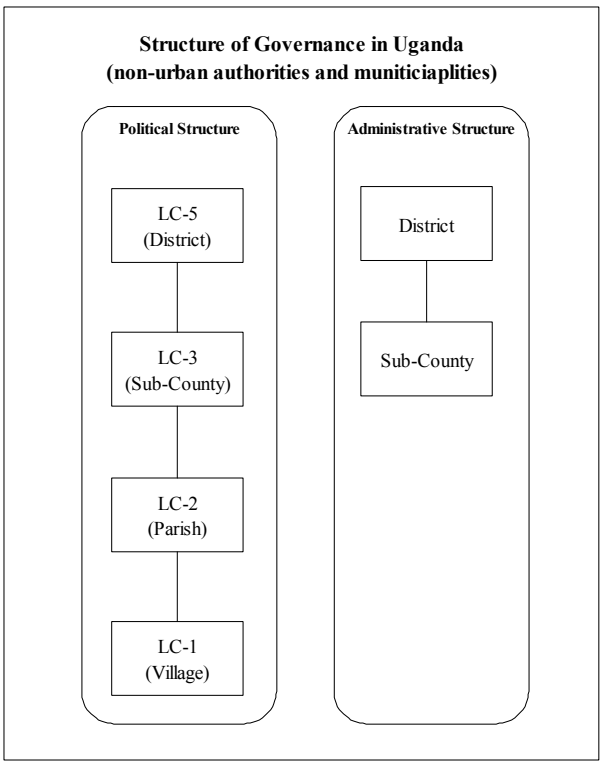
[1] 2006 figures are estimated based on Statistical Abstract 2006, UBOS.

[2] UBOS has adjusted the population figure based on the 2002 national household survey and republished in Statistical Abstract 2006.

figure, 5,584,200[3] persons live in the rural area within the study area. With an average family size estimated to be 5.06 persons per household (though it ranged between 4.76 and 6.00 persons/household among districts[4]), the number of rural households in the study area can be estimated as 1,268,500 (2006 projection). However, in the Eastern region, the size of the household could vary as polygamy is still practiced.

In the Eastern region, the most dominant ethnic group was Basoga (28.1%) followed by Iteso (25.5%) and Bagisu (14%)[5]. Some detailed observations of major ethnic groups in the districts were obtained in our farm survey: Basoga in Iganga, Mayuge and Bugiri; Basamia in Busia; Japadhola in Tororo; Iteso in Kumi, Soroti, and Katakwi; Bagisu in Mbale and Sironko; Kumam in Kaberamaido; and Bagwe, Bagwere and Iteso in Pallisa. The ethnicity tends to have implications on land ownership systems and farm practices. For instance, societies of Basoga, Basamia, Bagwe, Bagisu, and Kumam are commonly organised around clan and the land is owned by each clan[6]. Kumam are originally known as pastoralists, in which society women and children did not own land. It is also known that the Iteso use animal traction.

3.3.2 Administration of Local Government

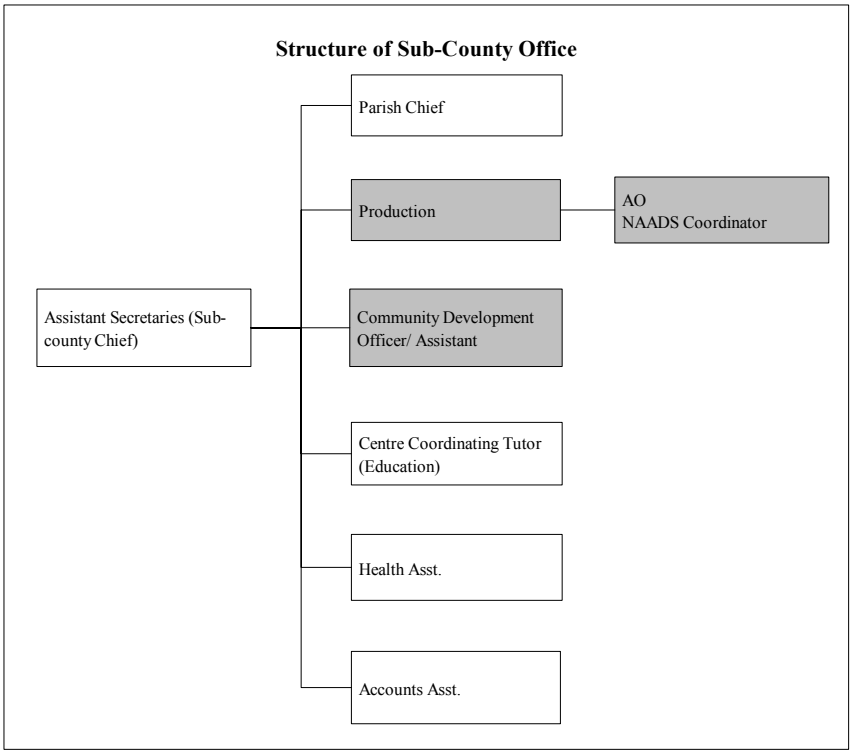


The local governance is structured in two ways. One is the political and the other administrative. These two structures work hand in hand. The political administration is structured in 4 levels of LC-5 (district level), LC-3 (sub-county level), LC-2 (parish level) and LC-1 (village level). The members of each council are either directly elected by the constituencies or appointed by the council members.

Since the early 1990s, the government of Uganda has particularly focused on decentralisation by transferring the financial resources to the local governments. Each district and

[3] The population data used for estimation is the 2006 projection in Statistical Abstract 2006, UBOS.
[4] Statistical Abstract 2003, UBOS.
[5] Uganda National Household Survey 2002/2003: Socio Economic Survey, UBOS.
[6] Nzita, Richard and Mbaga-Niwampa (1997), Peoples and Cultures of Uganda, Kampala; Fountain Publishers.

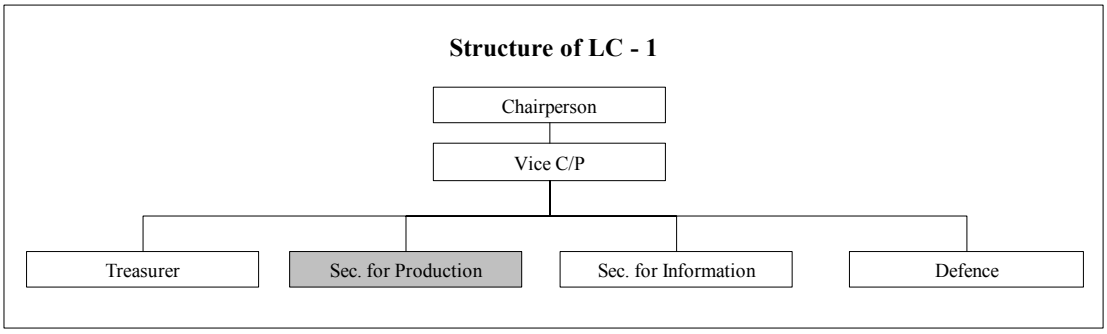
sub-county formulates its own development and financial plan. These plans are to be carried out by the district and sub-county offices in partnership with the local council. In the district administration, 9 departments were organised to carry out the public services under the leadership of a Chief Administrative Officer (CAO). In particular, the sustainable irrigation development concerns lay with the Production, Natural Resources and Community Based Services Departments at the district level. Under each department, officers in charge are assigned. As the district officers' recruitment often depends on the financial availability, there may be vacant positions. Further, concerning irrigation and paddy cultivation development, there are no fully qualified technical staff who can lead the development process. Though there is a water engineer to cater for both domestic and productive water supply, it is not technically feasible for him/her to do so as each sector requires different expertise.



The local level implementation of plans and policies is supervised by the sub-county offices. The sub-county office is often composed of a lesser number of officers. Those are officers of production, community development, health teacher centre coordinator, accounts and parish chiefs. The office is headed by an assistant secretary or sub-county chief who reports to the CAO at the district level. Agriculture and community development officers or assistants are concerned with sustainable irrigation development in the sub-county. There are no technical staff members assigned for wetlands and environment in the sub-county offices.

At parish and village level, there is no office for public administration. However, the local councils at the parish and village levels support the government with the delivery of public services to the communities while they also feed back the voices of

the locality to higher authorities LC-3, LC-2[7], and LC-1 are structured similar to the government office. Under each level of council, there are secretaries in charge of production, health and education, works, etc. Among them, the secretary for production at each level is in a position to support implementation of the projects concerning sustainable irrigation development through sensitising and mobilising community members. Below is the structure of the LC-1.



3.3.3 Poverty in Eastern Region

Under the "decentralisation policy" pursued by the GoU, the respective district governments are restructuring their staffing and functioning so as to achieve administrative and financial self-reliance and hence to better provide public services to induce socio-economic development successfully. Since 1997, the government of Uganda's major development goal has been to reduce absolute poverty to a level below 10% of the population living under US$ 1.0 a day by 2017.

The Eastern region has the second largest population after the Northern region, whose living condition is bellow poverty line[8] in Uganda. The poverty head count[9] in the rural Eastern region was as high as 48.3% in 2002/03 which is the second highest after the rural Northern region (65% in 2002/03) which has been affected by prolonged insurgency. Having nearly half the population, the contribution to eradicating poverty in the region will significantly improve the national level poverty indicators as well as help Uganda achieve the Millennium Development Goal by 2015.

[7] The members of LC-2 are selected from the council members of LC-1s. LC-3 and LC-1 council members are directly voted for by their constituencies.

[8] The poverty line was cross-examined by UBOS. The result indicated that "US$ 1.0 a day" was applicable to Uganda.

[9] Poverty headcount is defined as "the percentage of individuals estimated to be living in households with real private consumption per adult equivalent below the poverty line for their region. (UBOS, 2003, page 46). Uganda National Household Survey 2002/2003. Report on the Socio-economic survey, Nov. 2003.

Poverty Trend by Region by Poverty Headcount

(% of population)

	1992	1997	1999/00	2002/03
East	58.8	54.3	35.0	46.0
East Rural	60.6	56.8	36.7	48.3
East Urban	40.4	25.2	17.1	17.9
Central	45.6	27.9	19.7	22.3
Central Rural	54.3	34.5	25.2	27.6
Central Urban	20.8	11.8	6.1	7.8
West	53.1	42.8	26.2	32.9
West Rural	54.3	44.0	27.4	34.3
West Urban	28.9	19.7	5.7	18.6
North	72.2	59.8	63.7	63.0
North Rural	73.0	61.8	65.4	65.0
North Urban	55.2	34.0	28.6	38.9
National	55.7	44.4	33.8	38.8
Rural	59.7	48.7	37.4	42.7
Urban	27.8	16.7	9.6	14.4

Source: Uganda National Household Survey 2002/03, Report on the Socio-economic Survey

3.4 Crop Production

Blessed with a mild climate in the study area, farmers have recently realized crop diversification, and now grow varieties of crops such as maize, sorghum, millet, upland rice, beans, cowpeas, soybean, groundnut, cassava, sweet potatoes, sunflowers, cotton, etc. in the upland fields, and paddy in the wetland fields. Amongst the diversified crops, plantain bananas, cereals, pulses and tuber crops are the essential staple food of the local farmers. Cotton and coffee have been grown as the main cash crops since long years ago. However, these crops have recently lost their economic appeal, and in fact, their planting has been at standstill according to the comments of crop growers. Plantations of vanilla, aloes, lemon-grass, etc, have been introduced and promoted by some NGOs and donors as one of the challenges for rural poverty alleviation. Performance of these crops is still limited to slow progress, so far.

In contrast to the above, plantations of oil-seed crops, i.e., sunflowers, soybean and groundnut have been extensively familiarised/popularised with the local farmers, and accordingly, those productions are progressing well, and contributing to the household economy of the growers.

Major Crops Grown in the Study Area

	Food Crops	Cash Crops
Cereals	Maize, Millets, Sorghum,	Upland Rice, Paddy
Pulses	Beans, Cowpea, Pigeon-pea	Soybean, Groundnut
Tubers	Cassava, Sweet-potatoes, Coco- yam,	Irish-potatoes,
Oil Seeds	Sesame	Sunflower
Fibre		Cotton, Sisal
Trees	Plantain Bananas	Coffee, Cacao, Fruits (Mango, Banana, Orange)
Vegetables	Egg-plants,	Cabbage, Onion, Tomatoes, Carrot
Others	Chewing-cane,	Vanilla, Aloes, Lemon-grass, Sugar-cane

Due to the soil and rainfall conditions, plantain bananas and coffee are limited to growing on the mountain slope of Mt. Elgon (Mbale district), higher plateaux (Mbale

and Sironko districts), and middle plateaux (Mayuge, Southern part of Bugiri districts, Iganga, and the Western half of Kamuli districts).

Recently, paddy has been appreciated as one of the cash crops, and its plantation area is being extended to more than 70,000 ha. However, due to a lack of appropriate knowledge on paddy cultivation, extensive farming methods prevail in the entire study area, and accordingly, paddy yield is still low at 1.91 tons/ha as summarised in the following table. Upland rice is the newest crop in the study area. It has been introduced in 2000 by following two separate programmes, namely the USAID rural income generation programme and the rural poverty eradication programme conducted by Sasakawa Global 2000.

Present Paddy Production in the Study Area

District	Paddy Fields (ha)	Yield (ton/ha)	Crop. Intensity	Production (ton)
Pallisa	15,190	1.50	1.00	22,780
Bugiri*2)	2,570	1.75	1.50	6,750
Kumi*2)	3,040	1.75	1.50	7,980
Sironko	20	2.50	1.00	50
Iganga*2)	15,380	2.00	1.50	46,170
Tororo*2)	22,250	2.00	1.50	66,720
Mayuge*1)	670	2.00	2.00	2,680
Busia	290	1.50	0.99	430
Mbale*1)	2,470	2.00	2.00	9,880
Kamuli	4,740	1.50	1.00	7,110
Soroti	150	1.50	1.02	230
Katakwi	10	2.50	0.80	20
Kaberamaido	0	-	-	-
Sub-total or average	66,780	1.83	1.40	170,800
Doho R.S. *3)	2,220	2.85	1.70	10,760
Total or Average	69,000	2.63	1.41	181,560

Source: JICA Study Team; April 2005

Note: *1) Farmers grow paddy twice a year under full irrigated conditions.
*2) Farmers grow paddy 1.3 to 1.5 times a year on average due to imperfect irrigation function.
*3) Farmers grow paddy 1.7 times a year on average due to inadequate field conditions.
Paddy yield and production are presented in terms of the dry and un-husked rice.
In Bugiri district, the extent of paddy fields of Kibimba Rice Farm (1,060 ha x 4 tons/ha = 4,240 tons) is not included in the table.

Modernisation of agriculture is one of the main interests of the GoU. Although, improvement of farming technology and increase of production are in progress, traditional extensive farming methods are yet to become common in the study area. In reality, the farmers have no resource of farming funds. Therefore, the farmers cannot react to the government plan. Together with poor soil condition in the upland fields, food crop production is very low at subsistence level. Thus, surplus crops that can be sold in the markets are limited to local consumption throughout the study area.

As for post harvest activities, there are a limited number of supporting facilities in the study area as shown in the following table.

Inventory of Agricultural Processing Factories

Particulars	Location at Respective Districts
Oil-mill for cotton seeds	Busia, Soroti, Tororo
Oil-mill for sunflower	Kumi
Washing Soap Factory	Tororo
Cotton Ginning Factory	Busia, Kamuli, Sironko, Kumi, Kaberamaido, Soroti, Katakwi, and Mbale
Coffee Factory	Bugiri, Iganga, Mayuge, Mbale and Tororo
Sugar Factory	Bugiri
Milk Plant	Mbale
Skin/leather Factory	Mbale
Feed Processing Factory	Sironko
Cereal-cum-Cassava Flour-mill	Small flour-mills at all concerned local marketing/trading centres for household consumption
Rice Mill	All concerned districts except Amuria, Kaberamido and Sironko. Soroti has only 3 small rice mills.

Remarks: The washing soap factory, Tororo operates in close linkage with the cotton oil-mill in Tororo.

The land tenure system in Uganda can be categorised into seven (7), namely, “customary”, “leasehold”, “freehold”, “Mailo”, “occupancy”, “renting (tenancy)” and “borrowing” as summarising in the table below. Among these tenures, *customary* is the traditional, most common system in Uganda.

Land Tenure Systems

Tenure	Key Features	Geographical Incidence
Customary	"Traditional" land tenure, varying in different areas. More individualised in South and West, more communal in North and East.	Country wide
Leasehold	49 or 99 year leases, with development conditions. Ground rent and premium payable Leasehold title issued.	Country wide, especially in urban areas
Freehold	Registered ownership in perpetuity. Freehold title issued.	Predominantly in South and West
Mailo	Limited for freehold, which recognises tenants' rights. Mailo title issued.	Central region
Occupancy	Right to occupy land under specific conditions based on occupation prior to 1983.	Country wide on any registered land
Renting	Use rights to land for a defined period subject to payment of rent.	Varies country wide
Borrowing	Use rights to land for a defined period subject to payment of part of harvest	Various country wide

Source: Land Sector Strategic Plan 2001 - 2011: Utilising Uganda's Land Resources for Sustainable Development

According to the total numbers of farm households and the upland fields so far reclaimed in each district area, an average holding size of farmland per farm family is estimated to be 1.71 ha/farm household. Practically, however, the average land holding size varies rather widely, district by district, e.g., the smallest size at 0.81 ha in the case of Mbale district and the largest size at 3.59 ha in the case of Kaberamaido district. The farm household survey of this study revealed that the land fragmentation has proceeded to critical ranges in the Southern districts, while there is still a certain amount of room for land sharing in the Northern districts.

3.5 Irrigation

3.5.1 General

In order to obtain reliable information on paddy cultivation areas in the study area, "Wetland Cover Stratification Data" from the NBS have been collected and compiled as shown in Table 3.5.1. In the table, wetlands have been divided into two groups, i.e., seasonal and permanent with the respective ratios of 70% and 30% of the total wetland area. The cultivated areas for agricultural use are shown as "Modified" and categorized as small-scale and large-scale for seasonal and permanent wetlands. The irrigated paddy cultivation areas are included in the Modified area. Small-scale paddy cultivation is included in the seasonal modified wetland. In the permanent wetland, modified large-scale in Bugiri and Tororo districts are the Kibimba and Doho irrigation schemes, respectively.

3.5.2 Existing Irrigation Schemes

In the Eastern region, there are several irrigation schemes as listed in the following table:

Existing Irrigation Schemes in Eastern Region

Name of Scheme	District	Water Source	Main Crop	Irrigation Area (ha)	Remarks
Doho	Tororo	Manafa River	Paddy	966	Fully Implemented
Kibimba	Bugiri	Kibimba River	Paddy	1,060	Cultivated by Tilda Company
Kiige	Kamuli	Originally Lake Kyoga	Citrus	60	Water level completely retreated/receded
Odina	Soroti Kalaki	Lake Kyoga	Citrus	-	Did not take-off.
Labori	Soroti Kasilo	-do-	Banana Citrus		Collapsed a long time ago
Kakira	Jinja	Lake Victoria	Sugarcane	1,500	Selected areas out of the 10,000 ha.
Ngenge	Kapchorwa	Ngenge River	Paddy		Implemented by NGO. Intake is too high to get water.
Atrai	Kapchorwa	Ngenge River	Paddy		Implemented by NGO.

Source: MAAIF

Among the above schemes, Doho, Kibimba and Kiige are the functioning schemes in the study area, although Kiige has a comparatively small area. The Kibimba Rice Scheme has been leased to a private company for the long-term. This Scheme is therefore not considered in the Study.

According to the field investigation, the irrigated area of the original Doho Rice Scheme is estimated as follows:

Doho Rice Scheme Area by Block

Block Number	Area (ha)
Block 1	207.2
Block 2	225.8
Block 3	151.8
Block 4	116.1
Block 5	120.2
Block 6	144.9
Total	966.0

However, the surrounding areas have been expanded using the same water resources from Manafwa River and drainage water from the Doho Rice Scheme. The estimated areas attached to the scheme are shown in the following table.

Estimated Paddy Areas In and Around Doho Rice Scheme

Name of the Area		Area（ha）
Original Doho Rice Scheme		966.0
Outside Doho Rice Scheme	Upstream Privately Owned	459.8
	Upstream Area	209.0
	Downstream of Block 2	418.0
	Downstream of Block 2 & 6	167.2
	Sub-total	1,254.0
Total Area		2,220.0

In addition to the above area, farmers from the Doho Rice Scheme shifted to the surrounding wetland areas together with nearby farmers to expand the paddy fields to about 1,000 ha.

3.5.3 Small-scale Irrigation

(1) Estimation of the existing paddy field area

The cultivated areas for agricultural use are shown as “Modified” in the biomas data and are categorized into small-scale and large-scale for seasonal and permanent wetlands. The irrigated paddy cultivation areas are included in the Modified area. Small-scale paddy cultivation is included in the seasonal modified wetland. In the permanent wetland, modified large-scale areas in Bugiri and Tororo districts are Kibimba (approximately 1,060ha) and Doho Rice Schemes (approximately 2,220ha), respectively. On the basis of wetland coverage data prepared by the NBS, the field investigations, 1:50,000 topographical maps in which rice growing areas are partially indicated and Landsat data analysis performed in Japan, the ratios of the paddy field areas and other crops in the modified land in each district have been estimated as shown in Table 3.5.2 and Figure 3.5.1. Consequently, small-scale paddy field areas in the seasonal wetland in the study area are estimated at 70,059 ha which is about 8.4% of the total potential wetland area.

(2) Categorisation of the paddy field type

According to the field investigations in the paddy field areas, the paddy fields can be categorized into the following three types.

1) Type-I: A primitive stage of paddy field irrigation. Insufficient water harvesting

system due to lack of ridges or insufficient ridge height or width being prepared. Cropping pattern is wet season only by broadcasting or random transplanting.

2) Type-II: Proper Bunds Provided Type: Proper bunds have been provided and random transplanting is usually applied. It can be expected that there is water harvesting onto the farm plot from surrounding bunds. No irrigation canal is provided but water is taken through a notch in the upstream farm plot and distributed to the downstream farm plots. Water supply and distribution consensus will be inevitable among the farmers. It cannot be expected to have proper water management because the water should always come from the upstream paddy plot, so the plots located upstream are always at an advantage. Simultaneous irrigation system is usually adopted. A rotational irrigation system cannot be applied.

3) Type-III: Irrigation and Drainage Canal System Type: An irrigation canal with an intake system from the river or swamp is provided separate from the river course or drainage canal. The irrigation water is supplied through an irrigation canal and excess water is drained to the river/drainage canal or swamp. A water management system can be adopted to distribute water evenly. A rotational irrigation system can be applied when water is not sufficient to irrigate whole plots simultaneously.

Taking into consideration more improved types for better irrigation systems, Type-IV has been added as explained below.

4) Type-IV: Irrigation and Drainage with Farm Road Type: A farm road is inevitable for proper farming, especially during harvesting time, to bring the harvested paddy out to the market. The farm road should be 3 meters wide.

Each type of paddy field is illustrated in Figure 3.5.2.

According to the paddy cultivation zoning and field investigation of the potential paddy field areas, the district and field workshops results and the data on the existing paddy fields in the seasonal wetland in each district, the ratio of paddy field types has been estimated. The estimated acreage of each type of paddy field in each district is shown in Table 3.5.3.

3.6 Animal Husbandry

Cattle, sheep, goats and pigs are raised in the study area. Most of the livestock is consumed within the area. However, livestock is an important cash earning resource of the farm household. Other than the livestock, poultry is also available even though unit breeding is only for household consumption. It is notable that turkey breeding is being popularised as a cash earning source in the Northern districts, e.g., Pallisa,

Kumi, and Soroti.

It is notable that the use of ox-power is familiar with the local farmers, particularly on farm work, e.g. ploughing, harrowing, transportation, etc. Generally, the trained oxen are bred by cattle breeding farmers, and leased to farmers as required. The oxen rent that includes the wages of the coachman varies rather widely depending on the field and soil conditions, e.g., Ush 65,500/ha in the case of ploughing in the upland soils, while Ush 87,500 to 100,000/ha in the case of ploughing in paddy fields. Oxen ploughing is now popularly practised in Pallisa, Kumi and the lower plateau area of Kamuli districts.

3.7 Agricultural Support Services

3.7.1 Crop Research Activities

To promote the agricultural modernisation programme, MAAIF has organised 7 national agricultural research institutes into the National Agricultural Research Organisation (NARO), and launched the NARO programme.

To perform the agricultural research work, technical and financial support services are being extended by the international organisations, e.g., FAO and World Bank. Regarding "lowland rice (paddy)", the agricultural research institutes in Uganda so far do not conduct any research work due to non-availability of useful experimental farm plots (irrigated paddy fields) in the existing research stations. In a minor exception, the Doho Rice Scheme undertook crop experiments, e.g., "fertiliser application test", "plant spacing test" and "variety test" with assistance from the JICA Study Team, but the experimental performance has limited progress, covering only 4 crop seasons as of October 2006. As for upland rice, NCRI have recently started research work and they are undertaking multiplication of the extension seeds for propagation. This work is being much intensified with the assistance of a JICA expert since June 2004.

3.7.2 Extension Services

Under the current decentralisation policy, agricultural extension officers have been transferred from MAAIF to district governments for improvement and reinforcement of the extension service systems. In the respective district areas, the District Agricultural Officer (DAO) has an initiative for operation and management of the agricultural extension services.

Extension services are provided by agricultural officers who are assigned in the district office under the direct supervision of the DAO. The same working functions are being constituted in the sub-county office. The agricultural officers in sub-county offices in collaboration with the leading farmers then undertake practical operation of the agricultural extension services.

The on-farm working staff (extension officers and assistants) have been assigned in the respective technical sections under the supervision of the agricultural officer. At

present, extension officers are assigned in the section of "farmers association" or "agriculture (crop production)" as the main field, while a limited number of officers are attached to the section of "veterinary" or "fishery". Although, the fields of "entomology (apiculture and sericulture)" and "forestry" are assumed to be promising sections in the diversification of production, no technical officer is available at the moment. In Uganda, no specialist in paddy production technology is available so far.

In the Pilot Project activities, 13 extension officers have first developed as specialists for paddy production technology through the training workshop as well as practical engagement in the experimental work on paddy directly under the supervision of the JICA Study Team covering one crop season. They are now extending their services for transfer of paddy production technology to the other agricultural officers and extension staff at each district level.

3.7.3 Credit Services

To assist the smallholder farmers and peasants, an institutional credit system is essential. The GoU has been promoting micro-finance in 2003/04 and establishment of savings and credit societies (SACCOS) in 2005/06[10]. The Northern Uganda Social Action Fund (NUSAF) of the World Bank has supported communities' initiatives for development. This fund is also available in the Northern part of the study area of Katakwi, Amuria, Kaberamaido, and Soroti. Uganda Co-operative Alliance Bank (UCAB), United Nations Development Programme (UNDP), World Bank, etc. are jointly or independently supporting the initiative. Although such interventions are still available in limited areas in Uganda, it is expected to be expanded in the near future as it is a helpful tool for improving small-holder farmers and rural livelihoods.

3.7.4 NGO Activities

In the process of development in Uganda, NGOs have played a vital role. In the study area, a number of NGOs and CBOs are in operation in the sectors of health, agriculture, education, micro-finance and others. Most NGOs are engaged in multi-sector and social development activities. On the other hand, NGOs focusing on the agriculture sector are active in Kumi, Katakwi and Soroti districts. Those NGOs that are active in the study area include Africa 2000 Network, Action Aid, ADRA (Adventist Development and Relief Agency International), SOCADIDO (Soroti Catholic Diocese Development Organisation), and District Farmers Associations established in each district. There are also a number of informal groups that are not registered. These are easily organised without much consideration of their future and become dormant within the short-term.

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[10] Ministry of Finance, Planning and Economic Development (2005). Uganda Poverty Status Report 2005: Progress in Implementing the Poverty Eradication Action Plan, Kampala.

3.7.5 Farmer Organisations

The GoU promotes farmers being organised into groups to enable them to access agriculture supporting services and inputs as well as to the market. Therefore, there has been a range of initiatives to organise farmers into small groups. Uganda National Farmers Federation and Uganda Cooperative Alliances are major agriculture and marketing oriented associations of farmers' organisations. The following outlines the system or associations that intend to take advantage of collective action in advancing agricultural development.

National Agriculture Advisory Services: NAADS provides the national agriculture advisory services in Uganda and it plans to replace the public extension services with private service provider based technical assistance to the farmers. It is gradually expanding. The system requires village level farmers to organise small groups, which will then form an association at the sub-county level. The sub-county farmers' forum will select the priority crops for technical assistance and also service providers according to the needs of the farmers in the locality. For this system, the village level farmers' groups are organised as the unit of clients (see Section 3.7.7 for more details).

The Uganda National Farmers Federation (UNFFE): UNFFE was established in 1992 in each district. The members of UNFFE include the district and commodity based farmers' organisations, community based farmers' organisations, agro-related industries/services, and honorary members approved by the National Farmers Council. UNFFE has its organisation in each district with its own membership. UNFFE has a membership of 71 organisations with over 200,000 individual members. UNFFE has trained farmers who can act as "Extension Linkage Farmers" in their own community. The training programme was developed in cooperation with DANIDA.

Uganda Cooperative Alliances (UCA): Primary cooperatives are the grass roots groups, organised by the individuals in the locality, that are registered with the District Unions and overseen by the UCA. Currently, over 6,000 cooperatives are organised as the primary cooperatives. In the study area, 1,362 cooperatives are formed in the areas of consumers, savings and credits, micro-finance, poultry, transportation, vegetables, and hides and skins.

In addition to those associations of farmers' organisation, many NGOs have mobilised farmers to organise themselves to take part in their interventions. However, support to build management capacity in the groups and help them reach out to other services after the completion of the interventions was not sufficient.

3.7.6 Marketing of Farm Inputs

The farm inputs, such as chemical fertilizers, agro-chemicals, quality seeds/seedlings, farming tools/implements, etc. are all available in the district market, but the quantity and quality of those inputs are not always reliable. The "*Stockist*", so-called, is the

authorized/licensed farm inputs dealer, and in general certain numbers of stockists are located at the respective marketing/trading centres in each district. Since these stockists are not all educated enough in agricultural technology, appropriate advice on use of chemicals, farming equipment, etc. is hardly expected.

3.7.7 Activities of Other Supporters

(1) National Agricultural Advisory Services (NAADS)

NAADS is a government programme formulated with the overall aim to reform the delivery of agricultural advisory services (extension) to farmers. As a part of the PMA, NAADS strives to contribute to the transformation of subsistence farming to commercial agriculture. Many farming activities currently being undertaken by small-scale subsistence farmers are either unable to optimally exploit existing market opportunities or have very limited or no market opportunities.

NAADS must contribute to the PMA goal supporting farmers to access agricultural technologies, knowledge and advice that enhance agricultural productivity. Increasing productivity alone, however, is not enough. Farming must be made profitable. A combination of higher farm productivity and profitability is needed to increase incomes of rural farm households and fight poverty. Higher incomes will increase the ability of rural farm households to access food through the market and to invest in agricultural production. This approach to improve household incomes and food security is a departure from the traditional approach of self-food sufficiency.

NAADS was commenced in 2001/02 and, as of 2005/06, is being implemented in 341 sub-counties in 49 districts, which include Soroti, Tororo, Busia, Iganga, Mbale, Kamuli, Bugiri, Kumi and Kaberamaido within the study area. The programme has a 25 year vision and is expected to cover the whole country in 7 years.

According to 2003/04 information from NAADS, its participating districts and sub-counties in the study area are listed as follows:

District	Sub-county
Soroti	1.Gweri, 2.Bugondo, 3.Kyere, 4.Asuret, 5.Atiira, 6.Olio, 7.Arapai, 8.Katina, 9.Pingire, 10.Tubur, 11.Kamuda, 12.Kateta, 13.Kadungulu
Tororo	1.Kisoko, 2.Rubongi, 3.Butaleja, 4.Mukuju, 5.Merikit, 6.Busolwe, 7.Nawanjofu, 8.Petta, 9.Nagongera, 10.Mazimasa
Busia	1.Busitema, 2.Buhehe, 3.Dabani, 4.Buteba, 5.Bulumbi, 6.Lumino, 7.Luyo
Iganga	1.Bukooma, 2.Waibuga, 3.Nawandala, 4.Ivukula, 5.Buyanga, 6.Irongo, 7.Namable
Mbale	1.Bukyende, 2.Bwabogo, 3.Bufumbo, 4.Bududa
Kamuli	1.Bumanya, 2.Nkondo, 3.Kitayunjwa, 4.Mbulamuti

Source: NAAS secretariat

(2) FAO

In the study area, the most vigorous donor is FAO. FAO is carrying out the upland development scheme named “Small-scale irrigation, special programme for support of food security (SPFS)”. The details are as follows.

The programme is supported using FAO Partnership funding and GoU counterpart funding. The programme piloted affordable water harvesting and supplementary irrigation technologies countrywide. Its fundamental principle is national ownership, participation and quick action, with obligatory adoption by farmers and national institutions involving participation in all aspects of small-scale irrigation.

The main objective of SPFS is to help low-income deficit countries to improve national and household food security on an economically and environmentally sustainable basis while pursuing the goal of social equity with special regard for the livelihoods of women and poor rural households.

Phase I of the SPFS provided an opportunity for rural communities to demonstrate, refine and adapt promising technologies and approaches to increasing agricultural production, enhancing food security and raising incomes.

Phase II objective was to ensure the development of a macro-economic, institutional and policy framework that is favourable to agricultural production, processing, marketing and access to food, supportive of increased private and public investment in agricultural activities and services, and conducive to increasing rural incomes.

The specific objectives included:

- Establishing demonstration plots of various crops (vegetables, fruit trees, coffee, rice, green maize and clonal coffee),
- Intensification of awareness creation among policy makers, potential investors and the public of low cost irrigation technology options, increased and sustainable agricultural production,
- Provision of marketing skills and methods required for increased agricultural output,
- Development of farmer-buyer linkages, and
- Strengthening and popularisation of the existing farmers association/water users groups and agro-processors, providing an entry point for enhanced private sector participation in irrigation development.

3.8 Rural Infrastructures

3.8.1 Road and Domestic Water Supply

The conditions of the road networks in the Eastern region are rather good compared with the other regions. The most common water source in the study area is boreholes, which 60% of households in the study area rely on. Dug wells provide water for 23% of the households in the study area. Others include fetched water from swamp (6%), rivers (4%), and piped gravity systems (2%), which were only found among sampled households in Mbale and Kumi.

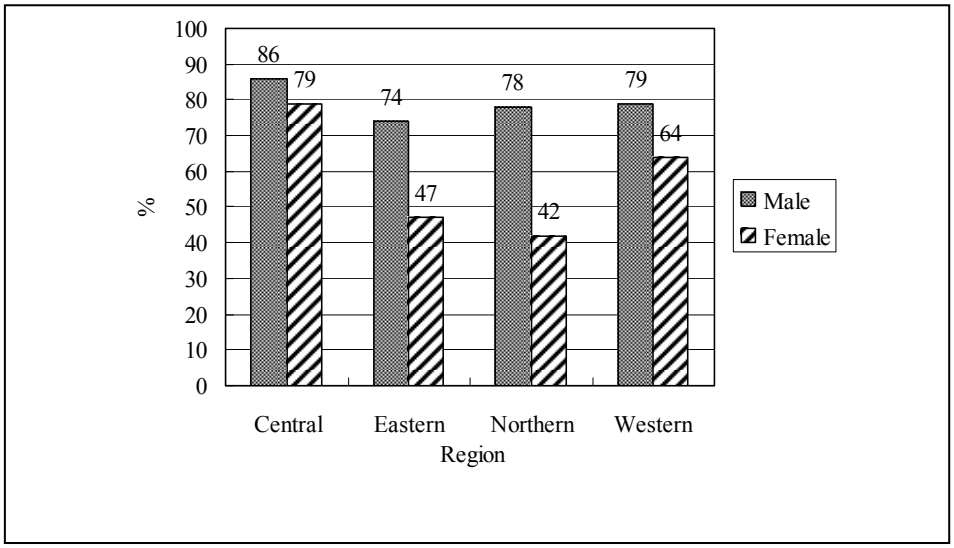
3.8.2 Health Care Services and Education

According to the Human Development Report 2002, the health indices show that people in the study area have a higher rate of population without access to safe water

and health facilities compared to the total average of Eastern and Northern regions. The population without access to health facilities in the Eastern region has been reported to be 26% while it is 29% in the study area. The farm household survey indicated that the 89% of the households had their own toilet facility at their homestead.

National male adult literacy in 2002/03 has been reported to be 79% and that of females 58%, which shows the wide gender gap. The average adult literacy in the Eastern region for the same year is 74% for male and 47% for female.

Literacy Rates for the Population Ages 18 and Above (2002/03)



After the launch of UPE, the GoU have encouraged each village to establish one primary school. As a result, 92% of the population has access to primary schools in the village or within the parish. On the other hand, secondary education institutions are less accessible by the majority of rural households.

3.9 Environment

3.9.1 Introduction

One of the strategies of the Ugandan PMA is to promote the fullest practical exploitation of agricultural potential with respect to available natural resources while at the same time conserving these resources for future generations. This strategy identifies the Eastern region, namely the districts of Iganga, Kumi, Pallisa, Bugiri and Tororo as areas of high activity and production in wetland rice cultivation. It is said that in this region paddy is grown by smallholder farmers under rain-fed conditions without any technical guidance. As a consequence yields of paddy are declining due to improper management of plant nutrients, soils and water. Therefore, there is a need to put across recommendations and mitigation measures to avert continuing reduction of yield and further wetland conversion and degradation.

The GoU has recently instituted the Wetlands Inspection Division (WID) in the MLWE, which also houses the National Wetlands Programme (NWP). WID is

mandated to sustain the ecological and socio-economic functions of wetlands for the present and future well being of the people of Uganda. The NWP recognises that many of the problems related to wetlands conversion for agriculture can be avoided if wetland agriculture is done at the right place and in the right manner. Hence, guidelines have been designed to promote the wise use of wetlands for agriculture and other income generating activities. These do not run against the cultivation of approved areas of selected wetlands but are designed to stop the present unplanned, disorganized and environmentally harmful conversion of wetlands. To hear and know more about wetland use policy and its implications, the Study Team has convened a workshop on preliminary environmental impact assessment of wetland uses.

3.9.2 Environmental Laws and Regulations

At the international level Uganda has ratified and implemented several international agreements on the environment between 1971 and 1996. These include the Convention on Biological Diversity (CBD), the United Nations Convention to Combat Desertification (UNCCD), the United Nations Framework Convention on Climate Change (UNFCCC), and the International Convention on Wetlands of International Importance, especially the waterfowl Habitat (Ramsar Convention). These conventions are important international legal instruments that address issues of sustainable development with particular emphasis on environmental concerns and can complement Uganda's efforts to protect the environment by providing benefits such as access to financial resources from donors and international financial institutions.

At home the commitment of Uganda to ensuring sustainable management of its environment and natural resources is clearly reflected in key government development policies and legal frameworks such as the Uganda Constitution (1995), the National Environmental Statute (1995), the Land Act (1998), the Poverty Eradication Action Plan (PEAP), and the Plan for the Modernisation of Agriculture (PMA). The Uganda Constitution (1995) has very clear provisions on wetlands. These provisions give wetlands a status similar to natural lakes and rivers, forest reserves and National Parks. Under the Constitution, therefore, the wetlands enjoy a very high level of protection.

Though there are many laws and regulations intended to ensure that wetlands in the country are managed and used more wisely, it is said that 3,000 – 5,000 ha of wetlands a year are being developed by individual smallholders without proper permits. In Igogero alone, located between Iganga and Bugiri districts, over 2,000 ha of swamps have already been developed by small farmers without control, and the developments are tending to spread over the whole swamp area. Furthermore, among the existing 3 large-scale rice irrigation schemes, Kibimba Rice Irrigation Project (over 500 ha developed in 1982 with potential extension to 3,900 ha), Doho Rice Scheme (development started in 1976 and now over 2,200 ha are cultivated) and Olweny Swamp Rice Irrigation Project (with a potential development of 800 ha, 1992), only the latter has completed an EIA study. Moreover, it is also said that some

private organisations and NGOs have directly helped farmers through, for example, implementation of projects without passing through the proper EIA procedures.

3.9.3 Environmental Impact Assessment (EIA) Procedures

(1) EIA in Uganda

It is the policy and legal requirement of the GoU that an Environmental Impact Assessment (EIA) be conducted for proposed activities that are likely to, or will have significant impacts on the environment. Following the enactment of the National Environment Statute, 1995, the National Environment Management Authority (NEMA) was created and charged with the responsibility to oversee, coordinate and supervise the operationalization of the EIA process in Uganda. The Statute provides that NEMA shall prepare and adopt guidelines for EIA on proposed actions that may affect the Country's natural and social environment. However, the actual implementation of the EIA process will be the function of the relevant line ministries and departments, the private sector, non-governmental organisations and the general public.

According to the "Environment Impact Assessment Guidelines" issued by NEMA, developers of projects are expected to submit their Project Brief, as shown in EIA Procedures Documents 1 attached, to NEMA that shall in turn forward these to the appropriate sectoral Lead Agencies with responsibility for management of a specific environmental resource or component, so that these can be screened to determine the level of EIA required, and the developer advised accordingly. The level of EIA required will vary on a project-by-project basis, depending on the nature, scale and possible effects of the project, and the characteristics of the site where the project is to be located. The costs for the assessment recommended shall be borne by the developer, and the assessment shall be conducted by experts approved by NEMA.

(2) Levels of EIA

The level of EIA required for a particular project will vary on a project-by-project basis, but in general such levels will include the following three major categories:

1) Small-scale projects whose easily identifiable potential adverse environmental impacts can be readily mitigated through measures that can be included in the design and/or implementation of the project. The environmental aspects of such small-scale projects would be normally approved on the basis of the mitigation measures so identified, without the need for a detailed Environmental Impact study requiring field investigations.
2) Projects suggesting some level of uncertainty on the nature and level of impacts, which would then require a more in-depth Environmental Impact Review (EIR) to determine if mitigation measures can be identified, or whether a more detailed Environmental Impact Study would be required. If adequate mitigation measures can be identified during the review and incorporated into the project design, the necessity for a detailed Environmental Impact Study may be eliminated and the

environmental aspects of the project may be approved.

3) Projects which clearly will have significant impacts whose mitigation measures cannot readily be prescribed unless a detailed Environmental Impact Study (EIStudy) of the project and its possible alternatives is conducted, with a view to determine if an alternative exists which has minimal or less adverse environmental impacts.

(3) Basic Components of the EIA Process in Uganda

The basic components of the EIA Process in Uganda consist of three interconnected phases: screening, environmental impact study, and decision-making. The basic components of the EIA process, including outputs and inputs and time frame of execution, are illustrated in Figure 3.9.1 and explained as follows.

After receiving the Project Brief from the developer, NEMA proceeds to the Screening process in order to determine whether the proposed project:

- clearly does not require an EIA, i.e.; exempt category,
- has significant environmental impacts for which mitigation measures can readily be identified either directly or through environmental impact review, or
- has significant environmental impacts whose mitigation measures cannot readily be identified, hence requiring a detailed Environmental Impact Study.

If a decision is made at the screening stage to exempt a project, or to approve its environmental aspects on the basis of the mitigation measures, such a decision shall be contained in a Certificate of Approval of the Environmental Impact Assessment issued by NEMA (Refer to EIA Procedures Documents 2)

If, however, after screening, it is determined that the project requires a detailed EIStudy, such a certificate shall only be issued after approval or disapproval of an Environmental Impact Statement (EIS).

The Environmental Impact Study starts with a scoping process involving the identification of potentially significant environmental impacts and/or elimination of insignificant impacts, and is applied to all activities that require a full Environmental Impact Study. Scoping would basically involve consulting with NEMA, the Lead Agency, and potentially affected communities, relevant government agencies, representatives of other interested parties including NGOs, the private sector, independent experts and all other stakeholders to obtain their comments on what should be in the study and what alternatives should be considered. After these consultations the developer shall prepare a scoping report summarizing the results of scoping, and which shall also constitute part of the Terms of Reference for the study (TORs). The TORs shall define the scope of the EIStudy and is to be submitted to NEMA, that shall in-turn forward them to the appropriate lead agency(ies) for comment. The TORs are to be reviewed by NEMA, in consultation with the responsible lead agencies before an Environmental Impact Study is conducted. Through the Environmental Impact Study an Environmental Impact Statement (EIS) will be prepared. The developer shall submit ten copies of the EIS to NEMA that

shall in-turn forward copies to the Lead Agency and to other stakeholders and interested parties for comment and review, before approval is considered. Any comments received shall be taken into account in making a decision on the EIS.

A decision shall be made to approve or disapprove the environmental aspects of a proposed project. If approved, the necessary action shall be taken by the developer. The basic steps in the approval process for the EIS include: 1) review of environmental findings where NEMA in consultation with the appropriate Lead Agency, shall review the contents of the EIS, putting particular emphasis on the identified environmental impacts along with their mitigation measures, as well as the level of consultation and involvement of the affected stakeholders in the EIStudy process; 2) approval or disapproval of the environmental aspects of the project by NEMA which will take due consideration of the comments of the Lead Agency, stakeholders and the public, and issue a Certificate of Approval of the Environmental Impact Assessment, and; 3) decision on the project and record of decision whereby NEMA, the Lead agency decision makers and licensing authorities will take appropriate action to approve or deny the project based on all of its merits (environmental, social, economic, political or other factors), and a Record of Decision (Refer to EIA procedures Documents 3) shall be prepared.

After reaching a decision on the proposed project, if it is approved, the developer will be licensed or permitted to implement the project in accordance with the mitigation measures stipulated in the EIS and any other terms and conditions attached to the approval. If it is denied, the developer may, if such denial is based on environmental considerations that can further be improved, be urged to revise the proposed action to eliminate adverse impacts.

REQUIREMENTS FOR AN ENVIRONMENT IMPACT ASSESSMENT PROJECT BRIEF

According to Regulation 5 of the Environment Impact Assessment, 1998, the Project Brief should state:

(i) the nature of the project in accordance with the categories identified in the Third Schedule of the Statute (refer to Attachments 3 and 4);

(ii) the projected area of land, air and water that may be affected;

(iii) the activities that shall be undertaken during and after the development;

(iv) the design of the project;

(v) the materials that the project shall use, including both construction materials and inputs;

(vi) the possible products and by-products, including waste generation of the project;

(vii) the number of people that the project will employ and the economic and social benefits to the local community and the nation at large;

(viii) the environmental effects of the materials, methods, products and by-products of the project, and how they will be eliminated or mitigated; and,

(ix) any other matter which may be required by NEMA.

According to the Guidelines for Environment Impact Assessment in Uganda of July 1997, the Project Brief should also contain the following information:

(a) Name and Title, Address of Developer.

(b) Name, Purpose, Objectives and Nature of project, including attributes such as size of the project, activities that shall be undertaken during and after the establishment of the project, products and inputs, sources of inputs, design, etc.;

(c) Description of the proposed project site and its surrounding, and alternative sites, if any, where the project is to be located.

(d) Description of how the proposed project site and its location conforms to existing laws, regulations and policies governing such project and use of site/area proposed for its location.

(e) Description of any other alternatives which are being considered (e.g., technology, construction and operation procedures, sources of materials, handling of wastes, etc.)

(f) Any likely environmental impacts that may arise due to implementing various phases/stages of the project and proposed mitigation measures thereto.

(g) Any other information that may be useful in determining the level of EIA required.

Source: NEMA

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY

CERTIFICATE OF APPROVAL OF THE ENVIRONMENTAL IMPACT ASSESSMENT

To be filled in Quadruplicate
Original to developer
Duplicate to Lead Agency
Triplicate to NEMA
Quadruplicate to any other relevant agency

TO: PROJECT DEVELOPER

NAME .....
Address ....
Tel: .....

Title of Project:

Project Location (specific and District/City):

Project Location (District/Sub County/Ward):

Project Description: Nature, Purpose:

.....

.....

.....

(Delete whichever is not applicable):

This is to advise that the **Project Brief...../Environment Impact Statement (EIS)**.....on the above project has been duly **screened...../reviewed**.....by.....(Lead Agency) and NEMA and the environment aspects of the project are **approved...../not approved**.....on the basis of the following:

Source: NEMA

Certification based on Project Brief:

1. The project is Categorically Exempted from any necessity for EIA
   Reasons why project is exempt (attach details as required):

2. The project was found not to have any likely significant environmental impacts and therefore requires no further EIA to be conducted.

3. The project was found to have significant environmental impact but adequate mitigation measures were identified and shall be a condition of approval and implementation of this project.

4. The project was found to have significant environmental impacts and further detailed environmental impact study is required.

Certification based on EIS:

This is to certify that the Final EIS with comments and responses and record of project approval is available to the general public at (street address or description):

.....

It is hereby certified that the Final EIS submitted in accordance with the National Environment Statute and the Guidelines and Regulations made thereto, has been reviewed and the Environmental aspects were found to be **satisfactory**...../**not satisfactory**....., and that after considering the comments made on the EIS during review, the environment aspects of the project are **approved**...../**not approved**.....because:

A. An Environment Impact Statement **was**..../**was not**.....prepared for this project pursuant to the provisions of the National Environment Statute.

B. Appropriate Mitigation measures **were**...../**were not**.....identified and were made a condition of the approval of the project.

Date: _____
Signature of Responsible Officer: _____ Title: _____

National Environment Management authority
P.O. Box 22255
Kampala
Tel: 236817/251064/5

Date received by Lead Agency _____

Name of Responsible Officer: _____

Title: ....

Signature of Responsible Officer: Date.....

....

Source: NEMA

EIA Procedures Documents 3 (1/1)

RECORD OF DECISION

TO: Name of Developer

.....

Project Title:

.....

Project Location (specific and District/City):

.....

This is to advise that the _____

_____ (Lead Agency) has approved the above described project on ____ (Date) and has made the following determinations regarding the project (check all that apply):

1. The project __will, ___ will not have a significant effect on the environment.

2._____Adequate mitigation measures were prepared for this project pursuant to the provisions of the National Environment Statute.

3._____An Environmental Impact Statement was prepared for this project pursuant to the provisions of the National Environment Statute.

4._____Mitigation measures_____were, __were not made a condition of the approval of the project.

Lead Agency Approving project:
Approving Official:

Name: _____ Title _____

Signature .....

Date Received for filing by the Authority: _____

Signature of responsible Officer: _____Title: _____

Source: NEMA

EIA Procedures Documents 4 (1/1)

LIST A

PROJECTS WHICH ARE LIKELY TO BE EXEMPTED FROM THE EIA PROCESS

The following list identifies those projects which are normally exempt from the EIA Process. The characteristics and anticipated physical effects of each project should be carefully considered when or if they are exempted from further steps of the EIA Process.

Clearing and farm construction for individual subsistence small farms.

Construction or repair of individual houses.

Minor land uses changes in areas with slopes less than 20% including housing construction.

Information collection (scientific or educational) except if it involves use of chemicals or endangered species or alien materials.

Transfer of ownership of land or related facilities so long as the general character of the area is not changed.

Environmental enforcement actions.

Emergency repairs to facilities within the character of its surroundings

Source: NEMA

LIST B

Projects to be considered for Environment Impact Assessment

The following projects are listed in the National Environmental Statute, 1995, Schedule 3, as those for which an EIA shall be conducted:

1. General
(a) an activity out of character with its surroundings;
(b) any structure of a scale not in keeping with its surroundings;
(c) major changes in land use.

2. Urban development including -
(a) designation of new townships;
(b) establishment of industrial estates;
(c) establishment or expansion of recreational townships in mountain areas, national parks and game reserves;
(d) shopping centers and complexes.

3. Transportation including -
(a) all major roads;
(b) all roads in scenic, wooded or mountainous areas;
(c) railways lines;
(d) airports and airfields;
(e) pipelines
(f) water transport

4. Dams, rivers and water resources including -
(a) storage dams, barrages and weirs;
(b) river diversions and water transfer between catchments;
(c) flood-control schemes;
(d) drilling for the purpose of utilizing ground water resources including geothermal

5. Aeral Spraying

6. Mining, including quarrying and open-cast extraction of -
(a) precious metals;
(b) diamond;
(c) metalliferous ores;
(d) coal;
(e) phosphates;
(f) limestone and dolomite;
(g) stone and slate;
(h) aggregates, sand and gravel;
(i) clay;
(j) exploration for the production of petroleum in any form.

7. Forestry related activities including -
(a) timber harvesting;
(b) clearance of forest areas;
(c) reforestation and afforestation.

8. Agriculture including -
(a) large scale agriculture;
(b) use of new pesticides;

(c) introduction of new crops and animals;
(d) use of fertilizers.

9. Processing and manufacturing industries including -
(a) mineral processing, reduction of ores and minerals;
(b) smelting and refining of ores and minerals;
(c) foundries;
(d) brick and earthenware manufacture;
(e) cement works and lime processing;
(f) glass works;
(g) fertilizer manufacture and processing;
(h) explosives plants;
(i) oil refineries and petro-chemical works;
(j) tanning and dressing of hides and skins;
(k) oil refineries and petro-chemical works;
(l) tanning and dressing of hides and skins;
(m) abattoirs and meat-processing plants;
(n) chemical works and process plants;
(o) brewing and malting;
(p) bulk grain processing plants
(q) fish processing plants
(r) pulp and paper mills
(s) food processing plants;
(t) plants for the manufacture or assembly of motor vehicles;
(u) plants for the construction or repair of aircraft or railway equipment;
(v) plants for the manufacture or processing of rubber;
(w) plants for the manufacture of tanks, reservoirs and sheet-metal containers;
(x) plants for the manufacture of coal briquettes.

10. Electrical infrastructure including -
(a) electricity generation stations;
(b) electrical transmission lines;
(c) electrical substations;
(d) pumped storage schemes.

11. Management of hydrocarbons including -
the storage of natural gas and combustible or explosive fuels.

12. Waste disposal including -
(a) sites for solid waste disposal;
(b) sites for hazardous waste disposal;
(c) sewage disposal works;
(d) major atmospheric emissions;
(e) offensive odours

13. Natural conservation areas including -
(a) creation of national parks, games reserves, and buffer zone;
(b) establishment of wilderness areas;
(c) formulation or modification of forest management policies;
(d) formulation or modification of water catchment management policies;
(e) policies for management of ecosystems, especially by use of fire;
(f) commercial exploitation of natural fauna and flora;
(g) introduction of alien species of fauna and flora ecosystems.

Source: NEMA

3.9.4 Need of Environmental Conservation

Wetlands in the study area are undergoing significant changes in their land use, from the original vegetation of grasslands and woodlands to agriculture lands. In recent years, farmers are encroaching on the wetlands with a significant speed. For paddy production purposes alone, it is said that 3,000 to 5,000 ha of wetlands are being converted annually in the study area. Major causes of such encroachment are; (i) lack of agriculture land, and (ii) unclear wetland conservation policy particularly at farmer level. Population pressure on the agriculture land and limited job opportunities available in other sectors accelerate the land fragmentation which further accelerate the encroachment on the wetlands.

The customary land tenure system and unclear user rights of the wetlands make the control of wetland use more complicated. In order to give clear guidance to the farmers in use of wetlands in a sustainable manner, the MW&E developed guidelines for Smallholder Paddy Cultivation in Seasonal Wetlands in 2001 and Wetland Edge Gardening in 2002 as educational materials for the officers in local government and staff of NGOs/CBOs. However, the aim of these guidelines has not been properly informed to the farmers, and many farmers have fears that the government might dispossess them of their paddy land because the officers in the local government emphasize that encroachment upon wetlands is illegal.

Although the situation is unclear and uncontrolled, there are about 70,000 ha of paddy land that have been converted from wetlands and produce some 150,000 tons of rice annually in the study area. The value of this volume of rice is estimated at Ush 75 billion at farmer level. In addition, paddy brings a considerable amount of benefit to rice millers, middlemen, traders, etc. It is therefore necessary to involve the environmental conservation components in the planning of sustainable irrigation projects for poverty eradication. The proposed programme is to be formulated in line with the above-mentioned guidelines for wise use of wetlands because these guidelines were developed within the framework of national policy of PEAP and PMA. In the D/P, smallholders should be aware of the importance of wetlands and be organized in wetland associations to produce paddy in a more sustainable manner.

Chapter 4 ASSESSMENT OF AGRICULTURAL DEVELOPMENT POTENTIAL AND CONSTRAINTS

4.1 Agricultural Development Potential

4.1.1 Potential for Land and Water Resources Development

High population growth will force an increase in food production. In particular, high production demands will increase rapidly, not only for the supply of staple food but also for cash crop production because upland crop production will not have so much potential. There will be higher potential in paddy cultivation in the wetland than other crops due to the availability of water resource. According to the environmental regulations regarding the use of the seasonal wetland area, less than 25% of the total wetland in the section can be allowed for cultivation. Therefore, in the area where the presently cultivated area has not reached the limitation, the grassland area in the seasonal wetland can be newly cultivated for rice production. The permanent wetland area would not be touched for agricultural use. The small-scale farmers who are cultivating in the permanent wetland need to stop for the sake of wetland conservation.

According to the above criteria, the potential paddy field cultivation area has been estimated as shown in Table 4.1.1 and Figure 4.1.1. The detailed estimations are shown in Table 4.1.2.

The result of estimation is summarized below:

1)	The diversification areas from other crops	31,110 ha
2)	New development areas from the existing grassland in the seasonal wetland	72,830 ha
3)	The total new development areas	103,940 ha

Accordingly, the total potential development area for paddy production is estimated at 172,940 ha including 69,000 ha[1] of existing paddy field areas.

4.1.2 Potential for Increase of Cropping Intensity

(1) Upland crops

The crop production has been diversified, not only in food crops but also in the cash crop sub-sectors. The local farmers grow a variety of crops in their farm plots by applying a rotational cropping system. Since the landholding size has become small with the process of the current land fragmentation through generation changes, the cropping intensity has been attaining over 1.35 (or 135% relative to the total farm land) on a total average. This means that the farmers cultivate their own farm plot, intensively and continuously. To this end, however, no farmers practise crop/soil fertilisation properly. Accordingly, such over-cropping causes degradation of soil

[1] The paddy area of 1,060 ha in the Kibimba Rice Scheme is excluded from the total paddy area of 70,060 ha, because this scheme is being operated by a private company.

fertility to a serious extent. No, or very marginal, possibility exists for further intensification of cropping in most parts of the Southern districts, even though it is likely that a regional and/or household demand for the food crop production will be increased in future. In contrast, the present cropping intensity of the Northern districts is still low at less than 1.0 (or less than 100% relative to the total farm land). Accordingly, such districts as Kaberamaido, Katakwi, a part of Pallisa, Kamuli etc. have a certain amount of room for further intensification of crop production, e.g., 50 - 60% increment to the present conditions. This means that the crop production could be increased by more than 50% even without development of new farm plots in these areas.

(2) Paddy

Paddy fields are being developed so far in about 70,000ha in the entire study area. Out of the total paddy fields, only about 6,400 ha (including Doho and Kibimba Rice Schemes) have been consolidated to advanced conditions, and used for paddy cultivation almost twice a year. The greater remaining area is still not properly developed yet, but used seasonally, once a year under rain-fed or flooding water-fed conditions.

4.1.3 Potential for Increase of Crop Yield

(1) Upland crops

With regard to yield of the upland crops, to refresh/restore the soil fertility to an economically reasonable level and then to continue crop production successfully, it is essential and crucial to apply organic manure and/or compost that is prepared by use of the by-products of crop production, wild pasture, etc. Without application of organic manure, it could not be expected to achieve a significant effect on soil/crop fertilisation practice, even when using a certain amount of chemical fertilisers, since the soils are coarse in texture, poor humus content, and therefore have small element holding/carrying capacity (cation-exchange capacity). Either way, it is foreseeable, in the case of food crops, that an increment of the upland crop production would be marginal since the farmers are not able to use so much fertilizer because of no, or limited, cash earning effect. However, in the case of cash crops a 35 to 50% increment could be expected from present production levels if soil/crop fertilisation is properly practised.

(2) Paddy

As for paddy production, except the commercialised large rice farm in Kibimba, the majority of farmers use few farm inputs for paddy cultivation at present. However, blessed with the natural supply of nutritional elements and a relatively good distribution of precipitation, the farmers obtain 1.5 to 2.3 tons/ha of paddy and 1.83 tons/ha on average. In the case of the Doho Rice scheme, some farmers who have been fairly advanced in utilisation of farm inputs obtained 2.8 to 3.0 tons/ha of paddy with a dosage of 40 to 60 kg/ha of urea and 50 kg/ha of DAP, giving 2.85 tons/ha on

average in the entire Doho area.

In the P/P activities, it is through the crop experimental work that it has been appreciated that paddy is responding well to the soil/crop fertilisation practice, and hence, the yield has been recorded as high as 8 to 12 tons/ha of paddy. It is also observed that farmers have, even under the rain-fed conditions, achieved a paddy yield from 3.75 to 5 tons/ha and 4.3 tons/ha on average by applying the advanced cultivation technology. Under fully irrigated conditions, farmers have recorded 6 to 8 tons/ha and 6.3 tons/ha on average, even in commercial operation of paddy production in the individual farm plots. The total average of the paddy yield coming from the entire Pilot Project activities (the 3rd cropping) has then been estimated to be 5.8 tons/ha as of the end of September 2006. This means that farmers could obtain 4 to 5 tons/ha of paddy yield on average if the paddy field is consolidated for facilitating water control/management and by applying appropriate farming practices. Besides, it could also be foreseeable to obtain 6 to 7 tons/ha of paddy whenever farmers are skilled enough for irrigated farming operations as well as irrigation management. To the above end, some five of the recommended paddy varieties (i.e., NM-1, NM-2, NM-3, NM-5 and NERICA-4) that have a high-yielding ability, resistibility to pest and diseases and are tolerant to grain-shuttering, are being made available through the P/P activities, and those extension seeds are being multiplied in the Doho Rice Scheme for propagation to the entire study area.

4.1.4 Potential for Livestock Development

In the study area, the pasture/grassland understood to be suitable for livestock grazing has been recently reduced to a low level, particularly in the Southern districts. Of course, the possibility of livestock development still remains as small-scale grazing using the pasture combined with the by-products from crop production. To utilise the natural pasture resources and promote development of animal production for contributing to farm-households as well as the regional economy, the local administration should make a particular effort to enable cattle to graze more freely in the pastureland.

As explained in Section 3.2.4, the soils of the study area are so poor and/or infertile for crop production that the application of organic manure, e.g., compost, cow-dung, etc. is indispensable so as to maintain soil fertility and secure crop production, particularly for annual crops. To materialize soil/crop fertilisation efficiently, it is strongly suggested that every farmer should breed a few cattle in the house yard using the pasture combined with by-products of the crop production, e.g., paddy/maize bran, paddy/millet straw, runners of sweet potatoes, husks of soybean, etc. Some of the cattle should then be trained as draft cows for ploughing, and other traction works. Cow-dung and urine are very useful for processing good compost. Precisely those by-products should be piling up in the compost-piling-yard together with such crop residues as paddy/millet straw, husks of beans, maize stems, etc. as well as weeds/wild grasses for processing compost.

Other than the livestock grazing, poultry, e.g., chickens, turkeys, quail, etc. would provide a promising marketable production in the house-yard if using the by-products of crop production, effectively and satisfactorily.

4.1.5 Potential for Agro-based Industry Development

In the study area, there are many flour mills for household consumption. In addition, as for agro-processing factories, there are many small rice mills as well as 4 oil mills for cotton seeds, 1 oil mill for sunflower, 8 cotton ginning factories, 5 coffee factories, 1 sugar factory, 1 milk plant, 1 skin/leather factory, and 1 feed processing factory in the entire study area. Amongst those factories, the cotton ginning factories and coffee factories are, through the local production depots, receiving all of the products harvested within their respective districts. However, the working capacity of other factories, except rice mills, is extremely small if compared with the total crop production in the study area. Accordingly, the greater part of the production is carried outside the study area as ingredients or raw materials in bulk without adding any value. In practice, this is a great loss of not only useful and valuable resources but also of the best chance for creating employment opportunity as against the large population. If agro-processing facilities are established in the respective district areas to process the total production as a whole, this could surely create employment opportunities for 30,000 to 40,000 able persons in the rural area. The processing activity would accordingly contribute to the regional socio-economy and also provide a stable marketing route for producers. The by-products to be obtainable through the processing work would be highly useful resources for developing new production business, e.g., pig farming, fish farming, mushroom farming, etc., and then generating an additional income to be helpful for the farm-household economy.

4.2 Constraints to Agriculture Development

4.2.1 Natural Environment

(1) Land Constraints

The study area has no physiographical constraints in agricultural production activities, except the mountain slope of Mt. Elgon where the land has been dissected deeply, and accordingly, the agricultural land use is limited to only narrow terraces. The soils in the most part, however, are subject to precise fertilisation using organic manures (composts).

(2) Irregular Precipitation and Drought Hazard

The rain distribution is so irregular, including certain dry spells frequently during the month period from March to mid-April as well as August to December. The soils in the study area, except the wetland soils, are entirely lacking in humus (organic substance) and have a coarse texture that ranges from “sandy loam” to “sandy” and accordingly have an extremely low moisture holding capacity. Subsequently, droughts coupled with such inadequate soil physical features directly cause poor crop

growing or low crop yield, and sometimes, serious damage to crop production.

In contrast, a heavy precipitation brings about a seasonal flood especially in the month from mid-April to mid-May. Many paddy growers who cultivate paddy, especially in valleys and/or fan-formations at the foot of mountains, get serious damage to nursery work very frequently, at present. To minimise this flood damage and then grow paddy successfully, it is crucial that the present cropping pattern should be amended by excluding such a critical flood month and shifting the nursery work to the period mid-May and after.

In the case of the upland fields, the same precipitation leads to soil erosion to a serious extent in those fields, season by season and year by year, as explained in more detail hereunder.

(3) Soil Erosion and Degradation of Fertility

The upland soils are mostly coarse in texture (loamy to sand) and are easily eroded by surface rainwater run-off, even though the land has a gentle slope at less than 1%, which causes not only structural degradation of the arable soils but also brings about a great deal of harm to the ecological system of swamps. The lack of essential nutritious elements such as calcium, magnesium, potash, phosphate, nitrogen, etc. and moreover, the micro-elements, e.g., boron, zinc, copper, etc., humus and clayey elements, and continuous cultivation on these poor/infertile soils without careful maintenance and/or fertilisation for many long years causes degradation of soil fertility/productivity to a more critical extent.

4.2.2 Socio-economic Conditions

(1) Population Pressure on Land

The population pressure on the land is very high in the study area with the population density of 227 persons/km^2 in 2002 which is about 1.8 times higher than that of the national average of 127 persons/km^2. The density is particularly high in the Southern and Eastern districts of Iganga, Mayuge, Bugiri, Busia, Tororo, Mbale, Pallisa and Sironko, where it is 341 persons/km^2 on average, which is about 2.7 times higher than that of the national average.

The current fragmentation of farmland due to heavy population pressure appears as one of the most critical constraints in the study area. The landholding size per farm household has already dropped to less than 1.2 ha (or 3 acres) per household on average in the case of the Southern districts. The small landholding size coupled with the existence of infertile soils causes much difficulty for maintaining farmer livelihood from both viewpoints of household economy and food security. Consequently, due to over-cropping without careful fertilisation, the soil fertility is further degraded to an extent that it has become marginal. In the case of the Northern districts, i.e. Kaberamaido, Katakwi and Kumi, however, this constraint is so far not serious, though a negative impact is latent in the present constitution of farm families.

(2) Land Tenure System

In the study area, customary land tenure is still prevalent. In the 2002/03 National household survey, 73%[2] of the plots were under customary ownership. This means, as the population pressure increases, the plot will be divided among the male members of the family, land title remains informal, and often the ownership is not well documented and thus the boundaries may be blurred. This has caused a sense of insecurity towards land ownership when outside developers approach the farmers. Further, an incident in which the government forced farmers to leave the land for large-scale irrigation development in the 1970s is still vivid in the farmers' memories which lead to their hesitation to join the project.

The ownership of wetland has become a sensitive issue after the issuance of an Environment Statute in 1995 which stipulates that wetland is a common property of Ugandan citizens and therefore individuals cannot claim ownership. Now paddy growers who often cultivate in wetland areas are sometimes regarded as encroachers on public land. Although paddy production is a prominent agricultural enterprise to eradicate poverty, some of the farmers find it difficult to participate in such projects due to the fear of being regarded as such.

(3) Demographic Change Due to HIV/AIDS

Demographic change due to HIV/AIDS may negatively affect farm labour. The loss of population of the most productive age group, which accounts for a large number of household heads, means that the capacity for production, such as financial capital, land and knowledge, is reduced significantly.

(4) Prevalence of Water-born-Diseases

Though not rampant, water-born-diseases such as "Bilharzias" and "Amoebic Dysentery" have been reported in the study area. Where there is no adequate information and treatment accessible by the farmers, the paddy growers in wetlands raised concerns of contracting such diseases. In the course of the irrigation development for paddy cultivation in wetlands, this issue should be dealt with. In addition, paddy growers seriously complain about leeches attacking during their on-field working. However, proper management of irrigation and drainage systems could reduce the population of leeches from the paddy plots, and hence, make safe conditions for fieldwork.

(5) High Adult Illiteracy Rate

The high adult illiteracy rate in the region may also hinder many of the farmers from access and understanding to agricultural technologies and related information. In other words, this will require a training programme to be designed appropriately and the farmers require a longer time to be assisted by the specialists.

[2] Uganda National Household Survey 2002/03, Socio-Economic Survey, UBOS.

(6) Insecure Northern Districts

The security condition of the area may have an implication on agricultural development. As mentioned earlier, the Northern districts indicated the highest number of people whose living condition is below the absolute poverty line. In the study area, Soroti, Amuria, Katakwi and Kaberamaido districts were among those areas affected by security. As of 2006, the condition of the districts improved. The farmers are settled and began their enterprise development. However, there is no guarantee that the condition will remain stable. As we have seen in the past, stability is the key to the development and therefore must be maintained.

4.2.3 Agricultural Production

(1) Low Crop Productivity Due to Poor Farming Technology

The majority of farmers in the study area are still keeping to the traditional farming system, though crop diversification and intensification have recently progressed extensively in the entire area. The present over-cropping without soil/crop fertilisation practices directly leads to degradation of soil fertility, and hence, brings about low productivity of crops. Practically, however, due to a lack of working capital coupled with a low educational level, and then a narrow understanding, or lack, of technical knowledge, the majority of farmers have not been able to take the opportunity so far to change/improve their own farming system.

(2) Improper Post-harvest Technology

So far, the greater part of the agricultural production in the study area is being consumed domestically in the farm household. Only a limited number of products are being commercialised.

To the above end, therefore, no particular post-harvest technology has been developed in the study area. Use of traditional farming implements leads to field losses to a significant extent during harvesting and threshing work. In fact, during the field inspection, it was observed that the field loss of grain products exceeded 10 to 15 % in the case of paddy harvesting. A poor quality of crop products is also brought about due to careless management of field practices, e.g., non-picking up/elimination of foreign varieties, harvesting under submerged conditions, drying directly on earth bed, etc. As for processing the crop production, the milling machines that are being used in the study area are mostly very old and/or old types. For refreshment of these mills, however, the local fabricators and/or dealers did not research better machines in the current market, and bought and sold the same old type, continuously. This present situation with milling machines is also one of the outstanding problems for improvement of the quality of marketing product.

Other than the above, no farmers use by-products efficiently and satisfactorily. The majority of those by-products after threshing and milling are all burnt or spoiled on the field so they become useless.

To maintain quality as well as quantity of the products and to materialise smooth and

efficient marketing of the crop production, propagation of an adequate post-harvesting technology, including tools and implements/equipment, is indispensable. Moreover, it is essential to motivate farmers and teach them how to manage the quality and quantity of the agricultural products for commercialisation purposes. It is also crucial to educate farmers how to use by-products as valuable resources for generating secondary income.

(3) Deficit of Agricultural Processing Facility

The agricultural processing facilities available in the study area are mostly flourmills having a milling efficiency at less than 100 to 250 kg/hr for meeting the household demand. The rice mills having a milling efficiency at 350 to 500 kg/hr are also available mainly in the respective local market/trading centres at the sub-county bases. These milling machines are all so old type, so-called "*single-pass mills*", that it is hard to expect a reasonable quality of milled rice.

In the study area, crop diversification and intensification has recently progressed, and accordingly, the local farmers grow a variety of industrial crops as the essential cash crop. However, since no processing facilities have been provided yet near the plantation area, the greater part of the production is carried outside the study area as ingredients or raw materials in bulk without adding any value. In practice this is a great loss of not only the valuable resources but also the best chance for creating employment opportunities as a remedy to the large population unemployment.

(4) Lack of Capital

The small landholders/peasants have no working fund. Therefore, they use their own seeds and continue their farming with application of less farm inputs. Accordingly, the crop yield is so low that it is at subsistence level. To get out from such meager circumstances, farmers need an initiation fund for procurement of an appropriate farming technology and then to tackle the most urgent problems for increasing crop production. Addressing the above concern, the Central Government has pursued the "Micro-credit" service system that is being organised as one of the essential programmes for promotion and then realisation of the PMA. The micro-credit service programme is now being implemented in collaboration with the supporting programme provided by UNDP, World Bank, Uganda Co-operative Alliance, etc. Practically, however, this micro-credit is effectively not helpful for small landholders/peasants because they have nothing to meet the terms of loan-security specified in the borrowing agreement. To successfully extend the micro-credit, especially for application to poor small landholders/peasants, it needs to be re-organised and scheduled as a credit institution that in principle uses a beneficiary participatory approach with particular emphasis on such terms and conditions as "group based loan-security", "in-kind based borrowing", and "in-cash based repayment" immediately after harvesting of crops and establishment of a "revolving fund" within the farmers' group or primary cooperative society.

(5) Lack of Information for Farming System Improvement

During the workshops held at the selected sub-counties in each respective district, the local farmers identified, and seriously complained about "*Lack of Information for Farming System Improvement*". In fact, the district agricultural office does not have sufficient data and relevant information on the "*crop science*", "*modern technology on crop cultivation*", and "*post-harvest technology*". In addition, no information from agricultural research institutes is available at all in the respective districts. Recently, under NARO and NAADS programmes, some helpful posters where displayed, in which recommended farming practices were represented using photographs for visual effect. These were distributed and set on the wall in the sub-county offices. However, the majority of the local farmers, especially the peasants, have almost no accessibility to those effective functions, or even access to knowledge about the said functions, as they are unable to understand the demonstrated technical suggestions appropriately and satisfactorily due to a lack of basic knowledge.

The most effective way to improve farmer accessibility to information is the provision of proper explanations and field guidance by the extension staff in the local language of the subjected society. Currently, the number of extension officers is limited in each district at an intensity of services of 3,000 to 4,000 households per officer. Moreover, the districts do not have sufficient budget and transportation means for the agriculture extension services.

(6) Poor Farm Input Supply System

The farm inputs, e.g., chemical fertilizers, agro-chemicals, farming tools/equipment, etc. are sold by the authorized dealers, so-called "*stockists*" in each district. The stockists are located at the district centre or major trading (marketing) centres within the district. The long distance from farmer to stockist inhibits most farmers from utilising farm inputs. Besides, each stockist does not always stock varieties as well as the quantity of inputs to meet the demand. In addition, the stockist's package of inputs is in most cases larger than that of the farmer demand. Since the farmers have a limited working capital, they hesitate to purchase chemical fertilizers.

To fulfil agricultural modernization, and hence stabilisation of the agricultural production, successfully under promotion of the PMA, it is essential and crucial to reinforce/improve the present farm input supply system in parallel with the reinforcement programme in the agricultural extension service system. All of the stockists should be subject to being re-educated in agricultural technology through provision of capacity building courses, and preferably, specialising them in dealing with the chemical commodities, machinery and equipment, separately. Promotion of dealing with service systems in collaboration with the farmers' co-operative activities is also recommended in addressing the above concerns.

4.2.4 Agricultural Infrastructure

(1) Insufficient Irrigation Facilities

The agricultural land in the study area is mainly cultivated under rain-fed conditions, and in a small part, fed by a primitive irrigation system. Almost no consolidated/ advanced irrigation facilities exist in the study area, except in the Doho and Kibimba Rice Schemes. Although there are some schemes utilizing spring water for paddy fields, those with irrigation canals are quite rare cases. The present paddy fields that are either irrigated or dependent upon floodwater or rain-fed are estimated to be about 70,060 ha, being only approximately 4 % of the total agricultural land. Upland crop irrigation has been developed in quite a limited way and corresponds to small-scale pumping irrigation systems.

(2) Difficulty in Water Control in Paddy Fields

The paddy fields are mainly located in the seasonal wetland. Availability of irrigation water to paddy fields totally relies on discharge from the catchment area. Normally, very few paddy fields are provided with irrigation and/or drainage canals. In most paddy fields, the cropping schedule of paddy is set for the wet season mostly from mid-March to July. However, the production is low due to floods, which are difficult to control by the local farmers themselves. Most of the paddy fields in the study area are put under difficulties in controlling the floodwater in the wet season and maintaining the water in the dry season.

(3) Poor Management Capacities of Large-scale Irrigation Schemes

The only large-scale irrigation schemes are the Doho and Kibimba Rice Schemes. The irrigation facilities have deteriorated due to sedimentation and lack of proper maintenance and management. Without increasing the management capacity and maintenance capabilities of the farmers' organisations, the Doho Rice Scheme will not recover its original functions.

(4) Poor Rural Road Networks and Transportation Means

The paddy fields are located in the wetland area offering limited provision of farm roads from fields to the trunk road for marketing. As a result, farmers are at present obliged to provide transportation of the crop products by means of bicycles.

4.2.5 Agricultural Institutions

(1) Weak agricultural extension services

The number of agricultural officers and extension staff in the Study is far short of desirable if directly compared with the total numbers of farm households. In addition, in order to carry out extension services in the field, the district and/or sub-county offices do not have sufficient working funds or tools/equipment and transportation facilities.

(2) Lack of research outputs to both extension staff and farmers

There is a lack of information for the extension staff and farmers on research activities in the specific field of agricultural production technology. As far as the

paddy production technology is concerned, the research work has not taken off yet despite the fact that the only the research being done in NAARI at present is that related to upland rice. The extension staff have not learned the production technologies and hence are failing to spread them among the farmers up country.

(3) Lack of irrigation engineers

Irrigation is very important in supporting and securing food production. Irrigation engineering requires very extensive knowledge in climate, meteorology and hydrology in order to accommodate field conditions in the social requirements for infrastructure development and hydraulics. Structural design along with biological knowledge for crop cultivation, and sometimes economic knowledge, become very important factors in finding the best design from an economical point of view. In particular, water resource development knowledge is very important to secure food production, and flood mitigation ability to protect social losses. However, almost no irrigation engineers are available at the district level and even at the central office in MAAIF and DWD in MWLE. Very few irrigation engineers are working for the government. This situation constrains greatly the promotion of irrigation development projects in the country, meaning that the security of food production will not be guaranteed. It is urgent to train irrigation engineers as soon as possible.

(4) Weakness of farmers' organisations

The current policy does provide the incentives for the farmers to be organised. NAADS is one example. It required farmers to be organised into small groups so that they could effectively appraise their needs and improve access to agricultural extension services. Therefore, farmers can do so fairly well. However, in many cases, little technical assistance is available for them to develop their organisational capacity to reach out for various services and assistance. For instance, they often lack practical skills in organisational management such as record keeping, action planning, and financial management and do not have information on marketing and funding sources. Furthermore, concerning paddy growers using wetlands and irrigation users, they have limited exposure to the roles and functions of organisation in using wetlands and managing irrigation facilities to enhance their livelihoods.

(5) Unclear policy of the local government for agricultural development

All of the district administrations have prepared their "*Rolling Plan"* (three-year plan covering 2003/04 to 2005/06) covering the various programmes proposed by the respective departments. The plan in agricultural development is unclear in terms of practical target figures on specific products, specific areas, implementation schedules, etc. in general.

Up to the present, the agricultural production has been diversified through introduction of the varieties of crops. However, the majority of such diversification programmes are at a standstill with respect to stepping up to an advanced stage or bearing the effect of development. The local administration should first pay careful

attention to the individual situations, and then focus on the best way for future development.

Furthermore, as the proposed developments in this Study promote sustainable irrigation using water in the wetlands, acquiring water rights will be important for farmer groups as that guarantees sustainable use of water by legally stopping further encroachment on the wetlands. This is because those who have the water rights can stop the actions of those who don't. However, the *Water Act* says that any group using motorized water abstraction of up to 400 m^3/day or any impounding should pay for water rights up to Ush 450,000 as processing fees plus yearly water costs of Ush 1,000,000 for uptakes in the 400 m^3/day to 1000 m^3/day range where most smallholders organized in groups would stand. Though the law says these costs are waived for individual subsistence farmers, it is not clear whether it can be applied to subsistence farmers organized in groups as promoted by the PMA and this Study. It is evident that for poor small-scale farmers to pay such high costs will be nearly impossible as the scales of development considered here are so small and the farmers involved are not commercial farmers but subsistence ones. Something has to be done to clarify this issue.

Chapter 5 DEVELOPMENT PLAN

5.1 Introduction

At first for the D/P formulation, the potential and constraints for sustainable irrigation development are assessed based on those made for the whole agriculture sector in the study area presented in Chapter 3.

As evaluated in section 4.1, the potential for irrigation development is quite large in terms of availability of both land and water resources. At present, there are approximately 69,000 ha (excluding the Kibimba irrigation scheme) of paddy fields in the study area. Adding 104,000ha of estimated paddy development potential area to the above, the total potential area for sustainable irrigation development will be 172,940 ha, which is about 2.5 times the area of existing paddy fields. The new area for paddy development has been estimated making reference to the wetland conservation guideline, in which agricultural development is limited to a maximum of 25% in each wetland section. Availability of water resources is also taken into account as one of the critical factors for proceeding with the irrigation development in a sustainable manner. Regarding paddy production, its cropping intensity can be increased using available water resources wisely, and its unit yield can also be increased up to a level of 5 - 6 tons/ha with proper technical services provided to smallholders.

Nevertheless, there are several hurdles that should be overcome for the development. Among the constraints on agricultural development explained in section 4.2, the constraints of the lowland paddy sub-sector can be summarized as follows:

1) Unorganised Development of Wetlands: Agricultural development in the wetlands has been proceeding at a rate of 3,000 - 5,000 ha/year under the aforementioned customary practice. The regulations and guidelines of the government are not functioning effectively on the ground.
2) Weak Institutional System of Agricultural Support Services: Although, NAADS has been supporting the modernisation of agricultural activities under the PMA, the assistance to paddy farming has hardly been commenced so far. NARO has limited information on paddy production technology. Almost no extension staff specialized in paddy production technology are available in either the central or district governments. No technical support can be provided to the farmers, even in small-scale irrigation development.
3) Traditional Land Tenure System: There is a big gap between customary practice in traditional land tenure in rural areas and government's Land Act. Big landowners own most of the wetland and hence the existing paddy fields. The tenant farmers are engaging in wetland reclamation, thereafter getting land use permission from the landlord. The reclaimed paddy fields are not all continuously used every year for paddy cultivation or other purposes. In parts, paddy fields are being carelessly left fallow for certain periods, and accordingly, it causes

devastation of the wetland.

4) Lack of Production Technology: Due to the weakness of the existing institutional support service system, paddy production and irrigation development have been implemented by the local farmers themselves using traditional cultural practices. These developments have consequently brought low unit yields and unstable production.
5) Weak Farmer Organisations: Only a limited number of farmer organisations have been established at present. Their management is poor and is at subsistence level.

5.2 Basic Concept

The government policy applied to PEAP and PMA should be the basic reference to this development planning. In the D/P, "sustainable development" is the most essential and basic concept. "Sustainability" herein means that the subjected development should be (i) "environmentally sustainable", involving ways of designing and implementing projects that are not harmful to the natural environment, and then, (ii) "development" that could be managed in the long-term by organisations of smallholder farmers who participate in the Project. Besides, it is also expected that the D/P should, as one of the elemental schemes in the integrated rural development, contribute to the regional socio-economy of the study area.

5.3 Approaches to Sustainable Irrigation Development

The D/P is designed with the following four approaches to attaining sustainable irrigation development.

i) Common and Area-Specific Approaches: The former considers the institutional problems while the latter is to deal with area-specific problems and potential, which are given by district categorisation.
ii) Step-by-step Approach: The project implementation is scheduled on three step-by-step bases of short, medium and long-term. "Pilot Schemes[1]" shall first be implemented as models for development serving the function of technical demonstration for the subsequent implementation of the proposed schemes. Implementation of these Pilot Schemes should be monitored and assessed regularly. Based on the results of the said monitoring and assessment, technical guidelines should be prepared as an essential reference to implementing the development programmes. In cases where the district has a wide area, several Pilot Schemes (or Small-Scale Irrigation Schemes to be developed in mid and long-term plans) could conjointly be implemented as required for demonstrating the development impacts more extensively to the local farmers.
iii) Environmentally Sustainable Approach: Development in compliance with environmental regulations to harmonise itself with the natural environment.

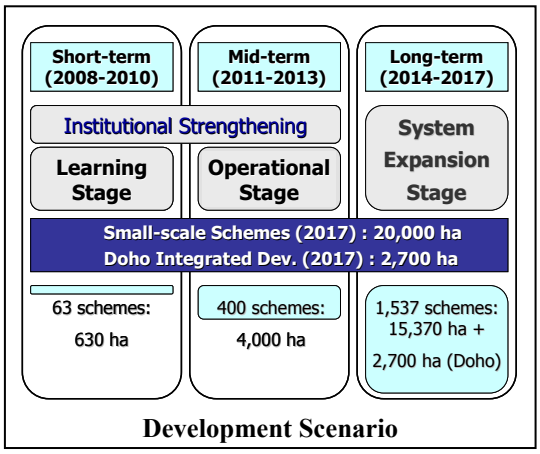
[1] "Pilot Scheme" is a project to be implemented by the Ugandan Government after the Study within the A/P period.

iv) Participatory Approach: The D/P aims at community based small-scale development through a participatory approach.

5.4 Sustainable Irrigation Development Plan

5.4.1 Target of Development

The target year of the D/P is 2017. The target production is estimated by establishing the following development scenario.



Development Scenario

1) In the short-term plan (2008-2010), the institutions necessary for the small-scale irrigation development as well as lowland paddy sub-sector development will be built up through practical implementation of the Pilot Schemes in each district. District Irrigation Officers (DIOs), extension service staff and farmers would be trained up intensively during this period. The number of Pilot Schemes implemented during this period would be three in each district. Assuming that each scheme is 10 ha, then the total development area would be 630 ha in three years. In order to secure irrigation water supply, especially during the dry season, small impounding reservoirs will be necessary to be constructed during the following mid and long-term periods. Investigations and studies for dam sites should be commenced in the short-term plan. The number of small impounding dams has been estimated at 22 sites and each dam will supply water for approximately 500 ha of irrigation area in which about 50 Pilot Schemes or Small-Scale Irrigation Schemes will be included. Regarding the Doho Rice Scheme, a feasibility study (F/S) for the Doho Integrated Development Project will be carried out covering existing paddy fields in and around the scheme.
2) In the mid-term plan (2011-2013), the trained DIOs would continuously support farmers for their small-scale irrigation development. The trained extension service staff would also extend their technical services to farmers for modernisation of paddy cultivation technology. The number of Small-Scale Irrigation Schemes annually developed would be about 6 in the priority sections of wetlands in each district. The total development area would be about 4,000 ha during this period. In parallel with the small-scale irrigation scheme development, the construction of small impounding dams will be undertaken for 10 sites in the mid-term plan period. Based on the result of the F/S, construction work for the Doho Integrated Development Project will be implemented after clarification or settlement of water rights among stakeholders in the watershed.
3) In the long-term plan (2014-2017), the small-scale irrigation scheme development would continuously be implemented with intensive technical

support from the DIOs and extension service staff. In each district, on average, about 18 schemes would be developed annually. Thus the total development area would be 15,370 ha during the 4-year period. In parallel with the said schedule, integration of Small-Scale Irrigation Schemes would also be carried out by implementing small impounding development. The Doho Integrated Development Project construction work will be completed in the long-term plan period.

With the above scenario, the total development area would be 20,000 ha in the small-scale irrigation scheme development and 2,700 ha in the Doho Integrated Irrigation Development Project by 2017, and these areas can be set as the target. The target rice production is then set assuming that 10,000 ha are rehabilitated or improved, and another 10,000 ha are newly developed following the government regulations and guidelines. It is foreseeable that about 40,000 ha of wetland would be newly encroached on by smallholders until 2017 without any control by the government. The Project thus aims to involve such smallholders in 10,000 ha of new development so as to lead them to wise use of wetland.

As shown in Table 5.4.1, under the project conditions, paddy production from the 20,000 ha would be about 180,000 tons with the target unit yield of 5 tons/ha (or 3.4 tons/ha of rice) and cropping intensity of 1.8. In addition, about 32,400 tons of paddy would be produced in the Doho Rice Scheme with the target unit yield of 6 tons/ha (or 4.08 tons/ha of rice) and cropping intensity of 2.0 after the rehabilitation. Moreover, about 220,300 tons would be produced in the existing paddy areas and/or newly encroached areas outside the Project area. The total paddy production is thus estimated at about 432,700 tons (or 294,300 tons of rice) in the future with the Project conditions of which about 51% would be produced outside the Project. The incremental production, which is the balance of production under "with" and "without Project", is estimated to be 101,600 tons. This amount is expected to correspond to about 24% of the estimated annual consumption of rice in Uganda in 2017.

5.4.2 Plan Period

The target year of the Development Plan is set for 2017, which is the same period stated for PEAP. Periods of the Development Plan have been separated into three terms as short-term (2008-2010), mid-term (2011-2013) and long-term (2014-2017). Therefore the total period becomes 10 years.

5.4.3 Outline of D/P

To ensure sustainable development, the following achievements will be essential, namely, (i) land and water resource development with a steady supply of irrigation water, (ii) technical advancement in paddy production practices, (iii) organisation and activation of farmer organisations as well as institutional capacity building in co-operative activities along with institutional improvement and reinforcement of the project executing authority/agency, and (iv) environmental conservation.

The essential components for the D/P are listed as follows:

Land and Water Resource Development Programme:

- Rehabilitation of the existing paddy fields;
- Improvement of the existing paddy fields;
- Diversification of production through conversion of other existing crops in the seasonal wetland to paddy;
- New paddy fields development;
- Wetland peripheral area development;
- Small impounding dams' F/S with EIA and implementation;
- Training of Irrigation engineers and DIOs.

Production Technology Development Programme:

- Research work on paddy cultivation technology inclusive of crop experiment and seed multiplication;
- Farming practice improvement, through establishment of technical demonstration farm plots, introduction/propagation of adequate farming tools, and introduction/propagation of resource-cycle utilisation agriculture;
- Extension service system improvement through technical training of the extension service staff as well as key farmers in each Pilot Scheme/ Small-Scale Irrigation Scheme.

Organisational and Institutional Development Programme:

- Organisation and activation of farmer associations.

Environmental Conservation Programme:

- Reinforcement of community based wetland management system;
- Establishment of environmental monitoring system particularly for water and soils.

(1) Land and Water Resources Development Programme

1) Rehabilitation Programme

Rehabilitation is mainly referred to as reinforcing the existing bunds and canals in order to ensure proper function. However, the type of paddy field, for which a definition is explained in Chapter 3, does not change with the rehabilitation and remains as it stands.

2) Improvement Programme

The improvement means lifting the existing conditions to better conditions. The categorised type of paddy field is lifted to the following higher type. Incidentally, there are several notes to be referred to when implementing the rehabilitation and improvement programmes, which are as follows.

a. Some portion of the existing Type-I area would not be suitable for sustainable use of the wetland due to flooding, which should be naturally returned to the buffer zone in the future. 50% of the Type-I area would be left as it is without rehabilitation but the remaining 50% would be improved

to Type-II.

b. 50% of the Type II and III areas would be rehabilitated and the remaining areas would be improved to a higher level Type.
c. The Large-scale schemes in the Kibimba area would not be considered for the Development Plan because the area has been leased to a private company.
d. The Large-scale schemes in the Doho area are scheduled to be transferred to farmer organisations after completion of the rehabilitation. Accordingly, a rehabilitation and improvement plan for the Doho Rice Scheme has been included in the Development Plan.

3) Diversification Programme

This programme is to convert, at least a part of potential paddy areas that are currently producing other crops, such as millet and sorghum, to paddy fields, taking into account the availability of water (i.e., the catchment area should be more than 20 times the paddy field area). It is also aiming at an increase of the cropping intensity of paddy in the wet season and upland crops in the dry season. Given the estimation that rice is more profitable than the "current crops", it would help to raise the income of farmers and diversify their income sources. The diversification area would be developed for Type II, III and IV to introduce advanced irrigation technology.

4) New Development Programme

The new development will be implemented for Type II, III and IV to introduce advanced irrigation technology and to conserve the wetland. In this development, farmers will be trained for the wise use of the wetland in future and for using sustainable irrigation technology. The location of the implementation area would be carefully selected to secure enough catchment areas for paddy cultivation (as a criterion, the catchment area should be 20 times the size of the paddy field area).

5) Wetland Peripheral Area Development Programme

This programme is to introduce high-profit crops such as upland rice and vegetables into wetland peripheral areas. Water availability can be ensured by harvesting surface run-off through collector drains, which are also useful in mitigating the damage of soil erosion and supplying water to paddy fields in the downstream area.

6) Small Impounding Dams' F/S with EIA and Implementation

In order to reduce the required wetland acreage for production and to secure a steady and constant flow for the conservation and sustainable supply of irrigation water to the paddy fields in the wetland, a small impoundment will be necessary in the upstream stretches of the wetland in the long-term development plan. Small impounding dams have been planned for

approximately 500 ha of paddy field area as one unit of watershed development. Accordingly, on the basis of the D/P areas in districts basis, 40 units of watershed areas have been considered for development. Among them, 22 dam sites have been proposed and selected on the basis of possible dam sites in lower flat watershed units, for which water resources are required to be supplemented by small impounding dams due to low water resource availability.

The said impoundments will play very important roles due to the following multi functions:

a. Flood mitigation by storing peak floodwater into the storage reservoir.
b. Constant water supply to the wetland for environmental conservation.
c. Constant water supply to the paddy fields in the wetland especially during the dry season for annual double cropping. Normally, about 30% to 40% of the irrigation water for paddy fields will be returned to downstream areas through drainage canals, which will contribute to wetland environmental conservation.
d. Constant water supply for rural water supplies to nearby residence areas.
e. Mini-hydraulic power generation utilizing the constant water supply for the above purposes.
f. Protection against farmer intrusion of the upstream stretches of the wetland area due to deep water and seasonal water level fluctuation.
g. Inland fishery development in the storage areas that will supply protein to farmers.

This programme includes the following investigation and studies, namely:

a. A F/S for small impounding dam construction by a dam engineer, hydrologist/irrigation engineer, geologist and economist. The study period will be about one year including the following survey and investigations.
b. Topographical survey of dam sites and other necessary appurtenant structures.
c. Geological investigation by borehole drilling at dam axis.
d. Soil mechanical test for dam body materials.
e. EIA for impounding reservoir areas.

The F/S for the small impounding dam sites will be commenced during the short-term period.

During mid and long-term D/P periods proposed small impounding dams will be constructed. The construction of these dams can be done by local contractor under the supervision of trained DIOs.

7) Human Resources Development for Irrigation Engineering

a. DIO training for district offices

At the moment, there are very few DIOs in the district offices. In order to promote and supervise implementation of small-scale irrigation development

for A/Ps and D/Ps, DIOs or NAADS service providers or NGOs should be trained. The trained DIOs will engage for the planning of irrigation and drainage systems, agreement consensus obtained from farmers to promote participatory implementation and management of irrigation schemes and supervision and training of farmers involved in the Pilot Schemes.

The required number of DIOs to implement the Small-Scale Irrigation Schemes of 20,000 ha can be estimated at about 100 engineers who can organise and manage about 200 ha of irrigation schemes per engineer. According to the study of potential paddy field development in each district, the potential for paddy field acreage varies depending upon the location and the availability of seasonal wetland acreage. As a result, the required number of DIOs will depend upon the potential for paddy field acreage.

b. MAAIF irrigation engineer training abroad

MAAIF engineers who have potential as qualified irrigation engineers will be trained in higher institutional organisations in irrigation technology abroad, such as in the Philippines, Tanzania, Kenya and even in Japan. The necessary number of staff will be 6 engineers. These 6 irrigation engineers will be first trained in a one-year course, sending two simultaneously per course and completing their training in 3 years time.

(2) Production Technology Development Programme

The production technology development programme consists of four major sub-programmes. The sub-programmes further include a number of essential activities for fulfilling the programme targets as presented hereunder:

1) Crop research and seeds multiplication

This sub-programme includes the following two major activities, namely:

i) Crop experiment in paddy production technology

The crop experimental work is scheduled to conduct the following three tests as a minimum requirement:

- Varieties adaptability test for selecting the most recommended varieties which should be highly adaptable to the study area and productive as well as resistible to both diseases and shattering hazard;
- Seasonal cropping test for identification of the best suitable and productive cropping season in the subjected local area; and
- Fertilizer dosage test for identification of the most economical dosage of organic manures (compost)/fertilisers, including the azolla effect for soil and crop fertilisation, respectively.

The crop experimental farm plots (CEFP), which might share about 0.4 ha (1 acre), will be established using the existing experimental and demonstration farm plots in the Doho Rice Scheme. In line with the “Participatory Approach”

that is advocated as a research policy of NARO, the subjected crop experiment will be conducted by the extension service staff as one of the field practices in paddy production technology in the course of the technical training workshop programme. The paddy varieties to be used for the varieties adaptability test will be selected amongst the most prevailing varieties in the advanced rice producing countries, and seeds of those varieties will be obtainable through the service of the IRRI, Philippines and WARDA. The most important objective of this crop research work is to find out the most adaptable paddy varieties for the study area. The preferred varieties shall be resistant to pests and diseases, especially leaf-blast and yellow-mottled diseases, as well as tolerant to the grain-shuttering hazard.

ii) Multiplication of quality seeds of recommended paddy varieties

This activity will include "preservation of the basic/foundation seeds of recommended varieties" and "multiplication of extension seeds" and then commercial seeds for propagation of the recommended varieties. To this, it has first trained 5 candidate seed growers and established a total of 0.5 ha of the seed farm plots (each seeds grower operates 0.1 ha or 1/4 acre seed-farm plots) in the Doho Rice Scheme during the working period of the P/P implementation (December 2004 up to October 2006).

For operation of the Pilot Schemes that is scheduled during the short-term development period, the present 0.5 ha of seed farm plots in the Doho Rice Scheme is enough for meeting the demand for quality seeds of the recommended varieties for the cropping operation of the scheduled 63 schemes (or total 630 ha of paddy fields). Accordingly, 5 seed growers who have trained in the P/P activities will undertake the initial seed multiplication work.

The seed farms should be, in the mid-term as well as long-term development stages, extended to the Small-Scale Irrigation Schemes in each district area according to the seed demand that will be increased through the performance progress of project implementation. Accordingly, technical training of the candidate seed growers shall be continued year by year to develop reliable seed growers according to the seed demand in the mid-term and long-term development stages.

Establishment Schedule of Seed Farms and Training of Seed Growers in Each Development Stage

Development Stages	Schemes to be Developed (ha)	Demand for Seeds (kg)	Seed Farm Plots to be required (ha)	Nos. of Seed Growers to be trained (persons)
Short-term	630	6,300	0.5	5
Mid-term	4000	40,000	3 to 5 ha	45
Long-term	15,370	153,700	15 ha around	75

To the above end, NCRI with the administrative supervision of NARO should have a responsibility to preserve the foundation seeds of each recommended variety, and also to multiply/supply the extension seeds to the seed growers for

multiplication of commercial seeds. The seed preservation farm plots and extension seed multiplication farm plots respectively having a size of 0.1 ha and 0.2 ha will be set up in a part of the CEFPs that has been scheduled to be established in the Doho Rice Scheme as presented above.

2) Farming practice improvement sub-programme

The sub-programme includes three essential counter activities as presented below:

i) Execution of technical demonstration farm plots

In implementation of the small-scale irrigation scheme development, it is scheduled to establish the technical demonstration farm plots (TDFP) in each scheme area. Each TDFP will be a minimum size of 0.4 ha (1 acre) as a package unit for demonstrating the advanced paddy cultivation practices as well as undertaking the transfer of advanced paddy production technology to the member farmers. Each TDFP shall also have a seed multiplication and supply function for smooth propagation of the recommended paddy varieties.

The key farmers who would be selected from amongst the members of farmer organisations shall be trained in the training workshop to be organised at the TDFP in each core irrigation development scheme, e.g. Budaka (Pallisa), Bugiri, Kumi and Sironko. The key farmers shall, immediately after coming-back to their own scheme, take the initiative to establish a TDFP and repeat the training workshop to practise the learned farming technology. In this field exercise, the key farmers shall demonstrate advanced paddy plantation practices such as the most adequate nursery work, the regular transplanting method using the transplantation-ruler, weeding by use of a rotary weeder, crop fertilisation using cow-dung and/or paddy straw compost, and harvesting and threshing practices using the pedal thresher, winnower, etc. Demonstration of the recommended varieties is also an essential effect in the above activities.

ii) Propagation of adequate farming tools and implements

At present, the majority of farmers own only one or two hand hoes and panga for farming practices. Accordingly, it is hardly expected that a reasonably effective farming operation would result. Thus, herein TDFP it is proposed to introduce the following farming tools and equipment, which have a simple structure and are able to be operated by manpower and/or animal-power, as one of the counter-solutions for improving working efficiency and hence reducing the labour intensity.

To widely propagate the above tools and equipment, it is scheduled to implement a manufacturing scheme for preparing all of the required tools and equipment using local materials available in Uganda. The proposed manufacturing scheme will be effective for maintaining those prices at a reasonable level, and moreover, to contribute to the creation of a labour

employment opportunity in the rural area.

Major Farming Tools and Equipment

Farming Tools & Equipment	Particular Work or Function
Oxen disc-plough	For initial ploughing of soils
Oxen disc-harrow	For harrowing of ploughed soils
Oxen disc-soil-puddler	For soil puddling and levelling
Transplantation ruler	Support for regular transplantation practice
Rotary weeder	For weeding and tilling azolla into soils
Saw-edged sickle	For harvesting paddy
Pedal thresher	For threshing of harvested paddy
Winnower	For winnowing/cleaning of threshed grains
Bull-cart	For transportation of products & farm inputs, etc.
Rear-cart (bicycle-trailer)	For transportation of products & farm inputs, etc.

In the P/P activities, it has become a challenge to make such farming tools and equipment as the rotary-weeder, transplantation-ruler and pedal-thresher using local facilities, and it could be successfully confirmed that the local carpenters and welders are technically skilled enough for manufacturing these farming tools and equipment using the locally available materials, though provision for the short-term training and supervisory services in the practical job is required.

To train up the technical staff, it is also scheduled to organise particular courses using an effective function of the Nakawa Vocational Training Institute, Kampala. The proposed training course will be organised at an early stage of the short-term development programme. The training course will take three (3) months for completion. To this course, 15 persons such as blacksmiths, carpenters, and welders will be invited as the trainees. For practical manufacturing of the required tools and equipment in the rural area, a technical and financial assistance programme will be scheduled at an early stage of the mid-term development programme.

iii) Promotion of a cycle of resource utilisation farming

In the current rice production system, there has been no use of the by-products of paddy such as straw, husks, and bran as well as fine broken rice. Those are all uselessly burnt in the field.

Utilizing such resources has a high contribution, not only to achieve crop/soil fertilisation in paddy cultivation, but also to increase upland crop production, livestock, poultry and fishery development, e.g., by returning straw and husks to the uplands as organic manure and/or mulching materials, and by feeding livestock, poultry and fish with bran and fine broken rice. In addition, mushroom production that uses straw for cultivation beds (compost) would be introduced as a new source of income generation. Thus, with this sub-programme, the D/P is expected to contribute not only to irrigated paddy development but also to generate related development on an integrated basis.

To promote and materialise the above integrated farming, it is first necessary to schedule to train paddy growers on how to use paddy straw as an organic

manure for crop/soil fertilisation in both paddy fields and upland fields. For this, the training workshop, including field practice, will be organised as one of the essential counter activities for fulfilling the sub-programme, and implemented within the short-term development period. The related development to paddy production, e.g., livestock, poultry and fishery work, etc. will be executed during the mid-term and long-term periods, step by step, in accordance with the wishes of the farmer groups.

3） Training of extension staff sub-programme

To realise an improvement in the traditional wetland farming and then to modernise paddy producing farming, the extension service staff specialised on paddy production technology should train up prior to commencing practical implementation of the proposed D/P. The requirements for the extension service staff at each development stage are as estimated below:

Extension Service Staff Required

Particular	Short-term	Mid-term	Long-term	Total
No. of Schemes to be developed	63	400	1,537	2,000
- NAADS Service Providers	-	21	21	42
- Extension Service Staff	21	21	21	63
- NGO Staff	10	20	65	95
Total Service Staff	31	62	107	200
Responsibility in service to schemes	2 schemes/person	7 schemes/person	12 schemes/person	10 schemes/ person

To train up the technical staff, the Project should provide a training programme for technical staff such as the district extension service staff, agricultural staff of NGOs, the service providers of NAADS, etc. To the above end, it has been scheduled to organise a “4-month training course” using the technical function of crop experimental farm plots that will be established in the Doho Rice Scheme. The required staff training will be conducted once a year during the main crop season from mid-March to mid-July. The size of classroom will be for 25 trainees as the maximum. The training programme will be composed of a total of seven sessions covering the full growing stage of paddy from nursery stage to yellow-ripening/maturation stage.

The extension staff shall, immediately after returning back to the home district, establish a TDFP in the respective Small-Scale Irrigation Schemes, and provide technical demonstration as well as technical training of the key farmers from the scheduled development schemes.

4) Extension service improvement sub-programme

Reinforcement of the existing extension system will be made through practical implementation of the proposed D/P. Technical training and capacity building of the extension staff that are scheduled on the preceding Section 3) will be the essential basis for fulfilling this sub-programme. In a course for the technical training of extension staff, it is also scheduled to organise an extension service

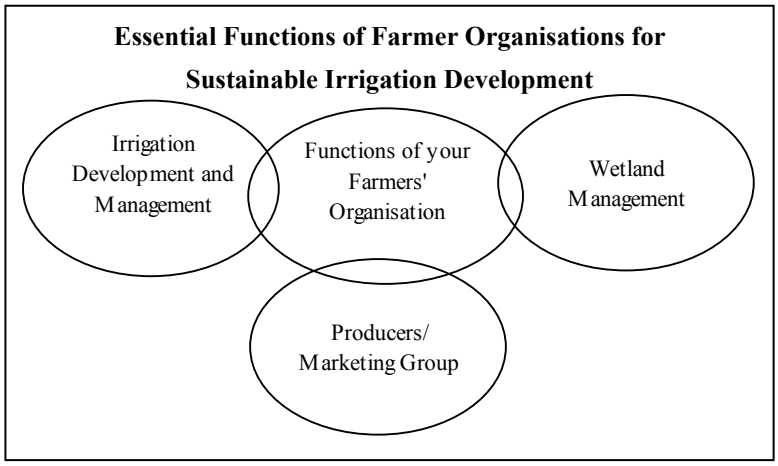
network covering the entire 21 districts, and to have functioning the technical service system to be applicable to the NAADS programme. The basic formation of this extension service network will be made within the short-term development period.

In addition to the above, the institutional support service for the paddy production sector shall also be reinforced through newly establishing an "*In-kind-based Micro-credit with a Joint Guarantee Scheme*" amongst the members of farmer organisations, a "*Seed Banking Scheme*" with involvement of the seed growers association, interested seed company(ies), the Seed Certificate Authority in MAAIF, etc. The proposed service system will be functioning, step by step, through practical implementation of the small-scale irrigation scheme development within the medium-term development period.

(3) Organisational and Institutional Development Programme

1) Building Capacity for Farmer Organisations for Sustainable Irrigation Development

The appropriate organisation for sustainable irrigation development shall play three main roles to achieve its objectives. One is the irrigation development and management. Irrespective of the scale of the irrigation facilities, it is essential for the irrigation users to be organised to coordinate and regulate the activities within the scheme. The organisation to achieve such a goal is called a Water Users Association (WUA). Secondly, if the farmers are using seasonal wetlands, management of the wetland resources would be critical to sustain their livelihoods. The organisation with such an objective is called a Wetland Association (WA). Thirdly, the organisation to enable its members to access agricultural support services and market can be cooperative or any other type of group including a NAADS group.



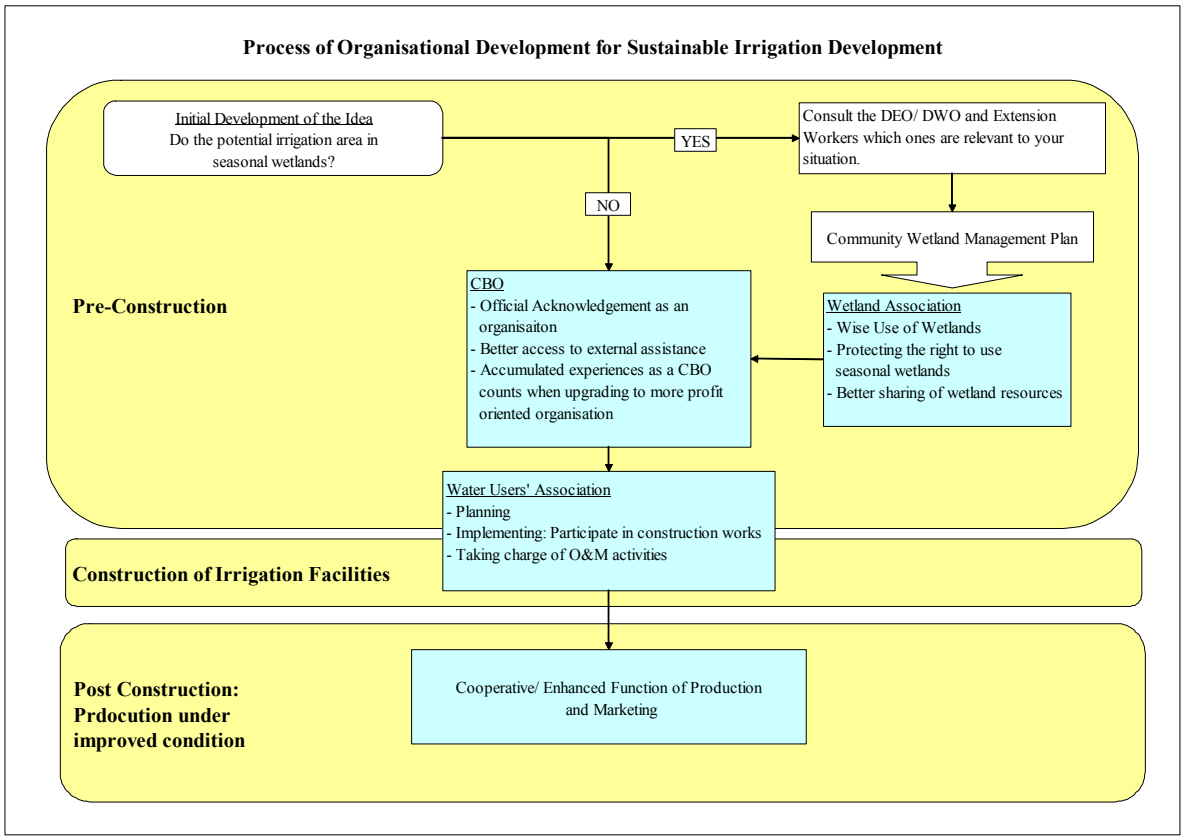
From the above, one can see that the issue of organisational development is multi-sectoral between production and natural resource management. This means that the participating farmers in sustainable irrigation development require assistance from technical staff of agriculture, environment, wetland and cooperative. In particular, the community development officer can also play a vital role in linking the technical staff and the farmers. (Registration as a Community Based Organisation (CBO) will certainly provide the members

with the authority to effectively carry out development interventions.)

Type of Farmer Organisations Relevant to Sustainable Irrigation and Paddy Growers

Function of Farmer Organisation	Office in Charge
Wetland Association	MW&E (Required of Community Wetland Management Plan upon obtaining a permit to use the wetlands.)
Community Based Organisation	District Community Based Services Office
Water Users Association	No registration required, but it is recommended that it be registered as a CBO.
Cooperative	MTTI through District Cooperative Officer

The process of organisational formation depends on the participating farmers' access to wetlands and stages in irrigation development. The following figure indicates the procedure for registration. If they use wetlands, it is advised to start organising a WA at as early a stage as possible since it takes a long time to mobilise wetland users other than paddy growers and to develop a community wetland management plan. A WUA shall be organised just before construction and a cooperative after construction.



To enable the above organisational development among paddy growers, the support shall be comprehensive and multi-sectoral. Further, such support needs to be coordinated among various sectors. It is also critical to place more emphasis on practical skills and essential knowledge in managing a paddy growers' organisation to ensure its sustainability. In order to cope with the

above constraints, two components will be implemented between 2008 and 2017.

2) Capacity Building for Farmer Organisations for Sustainable Irrigation Development

The programme is composed of officer guidance aided by national consultants and actual farmer training. Preceding the farmer training, district technical staff and NAADS service providers will be introduced to how to conduct the training, spending 2 days on technical guidance. The trained officers will conduct the community level training. The farmer capacity building has 7 sessions of 20 days in total covering the topics of wetland management, functions and management of different types of organisations, financial management and sustainable irrigation development. The methods of training are highly participatory and interactive to create a conducive learning environment for the adult learners. The outline of the training programmes is indicated in the table below. The details of the training process can be found in Section 2.3 in the Pilot Project Report (Volume II of the Final Report).

Outline of the Capacity Building Programme for Farmer Organisations for Sustainable Irrigation Development

Title of Sessions	No of Days	Outline
Session I: Nurturing Farmer Organisations for Paddy Cultivation in Wetlands (Officers Only)	2	Introduction of the organisation and paddy cultivation in wetlands / participatory irrigation development / necessary permits to be acquired
Session II: Wetland Management and Livelihood	2	Introducing farmers to the sustainable uses of wetlands / analyzing linkage between livelihoods and wetland management
Session III: Organisation for Paddy Growers in Wetlands	3	Different types of organisations to help paddy growers / wetland users and irrigation users
Session IV: Registration of a Community Based Organisation (CBO)	2	Procedure of CBO registration
Session V: Organisational Capacity Building	3	Problem tree analysis / action planning / record keeping
Session VI: Financial Management for Farmer Organisations	3	Financial record keeping / different types of funding sources
Session VII: Accessing Agriculture Support Services	3	How to access various agriculture support services
Session VIII: Participatory Irrigation Development / Wrap Up	4	Process of participatory irrigation development / agreement exchange / O&M record keeping / WUA

3) Institutional Development

Institutional development provides the backbone to the sustainable irrigation development. In order to achieve the long-term development goal, four critical areas must be developed. One is the human resource for irrigation and paddy

cultivation. Second is the establishment of the irrigation department within MAAIF to lead the process. Thirdly, the system to enable dissemination of the appropriate paddy cultivation technology shall be established. These three issues will be addressed in the land and water resource development and production technology development programmes.

Lastly, the coordination mechanism for sustainable wetland development at the national and district level shall be established and implement a capacity building programme for farmer organisations. The establishment of such a mechanism will create synergy between stakeholders and therefore enable cohesive policy implementation. MAAIF will establish and facilitate the activities of national and district level task forces. The national level task force (Project Coordinating Committee) is to facilitate the policy dialogue to develop a coherent sustainable wetland development plan and formulate the TOR for the district level task forces (DTF: District Task Force). The DTF will be the arena for the technical staff concerned to share tasks and coordinate implementation activities.

(4) Environment Conservation Programme

1) Community-based Wetland Environment Conservation Reinforcement Programme

Through the implementation of Small-scale Irrigation Schemes, the institutional arrangement and procedures for promoting community based wetland development and utilisation, including the irrigation development, as a wetland friendly project will be verified among the central and local government officers as well as the relevant farmers.

2) Wetland Environment Monitoring System Establishment Programme

A system is to be established for continuous monitoring of the impact of irrigation development on the wetland environment. The monitoring system includes MAAIF, which oversees the irrigation development, NEMA and WID which control wetland environmental conservation, the relevant district offices, DWD (Directorate of Water Development, MW&E), Makerere University and the Ministry of Health.

5.4.4 Implementation Plan for D/P

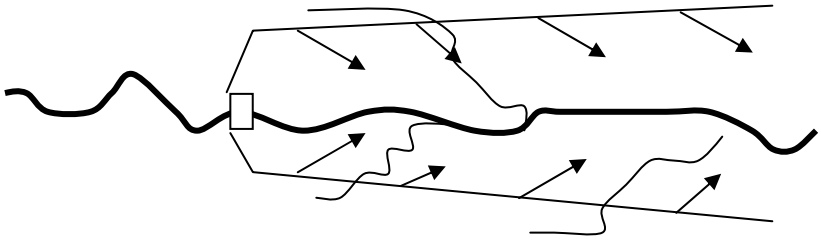
(1) Land and Water Resources Development Programme

1) Small-scale irrigation scheme development

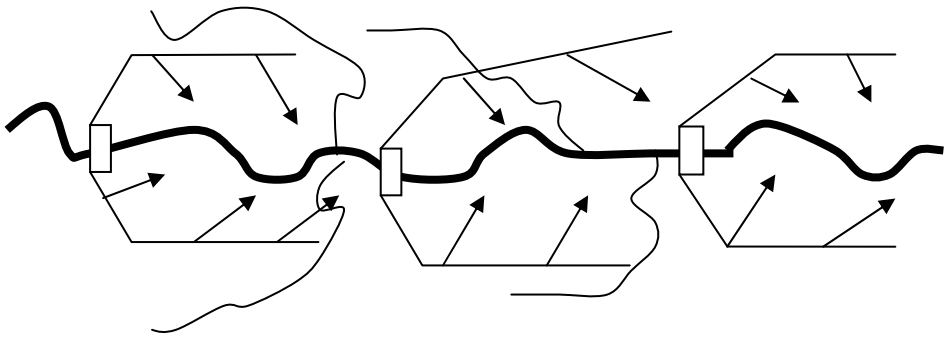
Because of the geographical features dominant in the Eastern region, fluvial and alluvial plains are not so wide. Generally the wetlands are not widely spread and their narrow footprints are surrounded by hilly areas with sloping contours.

When one intake structure is to irrigate a whole narrow area, the irrigation canal

will be very long on both sides of the wetland. As a result, the canal length to the command area unit will be rather long. Accordingly, the irrigation losses will increase, and irrigation water distribution time will also increase. Furthermore, the irrigation system becomes large in scale, which complicates the farmer organisation and operation and maintenance. Providing only one intake site located upstream will therefore limit the catchment area as well as the available water.



In order to avoid development of such a problem, it is possible to divide the wetland into a few blocks and provide irrigation facilities for each block on a small-scale basis. The water users association (or PRGA) will be a small group, and operation and maintenance of the facilities will be simplified and easier to manage. Providing a few intake sites in the catchment area can make water utilisation more effective, and the return flow from the intake located upstream can be repeatedly utilized in the downstream irrigation schemes.

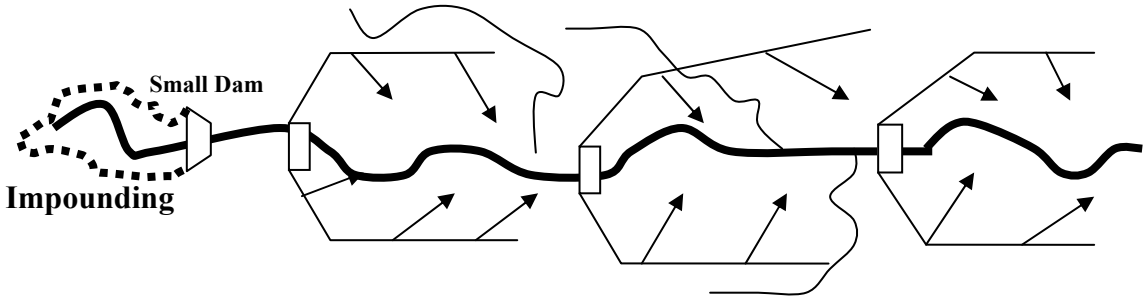


2) Small impoundment development

According to the characteristics of the catchment area, which is the source of water resources for irrigation, availability and reliability of water resources can be categorised into the following 2 types. One of the catchment areas originates from the Mt. Elgon area from which water resources are quite reliable due to high precipitation in the mountain area. On the contrary, catchment areas located in the lower flat areas will not have enough water resources compared with the Mt. Elgon catchment area. Accordingly, small impounding areas have been proposed in the districts located in the lower flat areas. There are 15 districts, out of the 21 districts, located in the lower flat area. Considering the potential of each district, 22 small impounding structures have been proposed

for implementation. A F/S together with survey work and EIA for designing dams and appurtenant structures for all the 22 sites will be conducted during the short-term implementation period.

Without any storage of water, its availability will be quite limited and a sufficient amount cannot be supplied to the wetland, especially during the dry season. It will be impossible to introduce double cropping of paddy. This means that one would need to increase acreage of paddy cultivation in order to increase production. This would accelerate farmer intrusion into the wetland. However, if double cropping can be introduced, the required wetland area will be half that of single cropping. This is a significant point justifying the necessity of water storage facilities.



In order to reduce the required wetland acreage for production and to secure a steady and constant flow for the conservation and sustainable supply of irrigation water to the paddy field in the wetland, a small impoundment will be necessary in the upstream stretches of the wetland in the long-term development plan. These impoundments will play very important roles due to the following functions:

- Flood mitigation by storing peak floodwater in the storage reservoir.
- Constant water supply to the paddy fields in the wetland, especially during the dry season for annual double cropping.
- Protection against farmer intrusion of the upstream stretches of the wetland area due to the depth of water and seasonal water level fluctuation.
- Inland fishery development in the storage area that will supply protein to farmers.

It will not be necessary to provide new irrigation canals for the impoundment in order to cover the whole irrigation area because the proposed Action Plan will develop enough Small-scale Irrigation Schemes in the sections of the wetland so as to provide sufficient intakes and farm ditches. Water released from the small impoundment will reach the paddy field area through the provided intakes and farm ditches and will be evenly distributed. Accordingly, the unit construction cost can be sensibly reduced.

As for the operation of the intake gates of the small impoundment, broad knowledge of hydrology, water resource management and irrigation etc., will be

required for the operator. This makes it necessary for this operator to be a staff member of the district office.

3) Categorisation of 13 districts

Based on district categorisation, the 13 districts for the land and water resource development component are divided into the following four groups:

- Group-1: Rehabilitation of the existing paddy fields (Rehabilitation)
- Group-2: Improvement of the existing paddy fields (Improvement)
- Group-3: Diversification of production through conversion of other existing crops in the seasonal wetland to paddy (Diversification)
- Group-4: New paddy field development.

The result of categorisation of the 13 districts is shown in Figure 5.4.1, Figure 5.4.2 and Table 5.4.2.

Short-term Development Plan

The districts categorized in Group-1 and Group-2 are prioritized in the rehabilitation and improvement of existing paddy fields. In these districts, the development of wetland to agricultural land has already exceeded NEMA's criteria. Hence, it is necessary to increase the unit yield by maintaining the irrigation facilities and improving the production technology. By doing so, it is possible to prevent farmers from further encroachment upon the wetland. Moreover, the rehabilitation and improvement of existing paddy fields are economically favourable as compared with new development.

On the other hand, in the districts categorized in Group-2 and Group-3, the paddy fields have been rapidly developed without any control by the government. There is a big gap between the farmers who develop and cultivate paddy in the wetland and the relative regulations and guidelines, which have an understanding that the wetland belongs to the people of Uganda. Therefore, it is a key factor to promote the wise use of wetland, which the government encourages with farmer participation. In the short-term plan, several Pilot Schemes will be implemented involving the government officers at central and local levels as well as farmers, including the fishermen and animal breeding farmers who utilize the wetland. From that process, an adequate way for wetland development will be established.

The irrigation development will be designed in the unit of watersheds to ensure the availability of water sources. In the short-term irrigation development, all the schemes should be organised with the community based small-scale approach including the participation of farmers so that the farmer association will learn the operation and maintenance of the irrigation facilities. In this short-term period, a F/S for all of the 22 small impounding dam sites will be commenced.

For the Doho Rice Scheme, a F/S will be undertaken covering both the original Doho scheme and surrounding areas, because the water from the Manafwa River is taken not only for the original Doho scheme but also for the surrounding out-growers' areas.

In this comprehensive study, tentatively called the "Doho Integrated Development Project", which includes establishment of an Irrigation and Drainage Training Centre and re-organisation and unification of WUAs in Doho and with out-growers, proper water distribution plans with the limited water source and sustainability of irrigation facilities after rehabilitation will be the main themes.

Mid and Long-term Development Plans

In mid and long-term development plans, the rehabilitation and improvement of existing paddy fields as well as the new developments will be carried out, and the number of Small-scale Irrigation Schemes which are implemented in the short-term development plan will be increased for the expansion of irrigation areas.

The construction of small impoundments/tanks is scheduled in the mid-term for 10 sites and 12 sites during the long-term plan.

At the beginning of the mid-term, it will be necessary to find funds for implementation of the construction of the "Doho Integrated Development Project", on the basis of the results of the F/S during the short-term period. First, it will be necessary to implement the Irrigation and Drainage Centre to provide training facilities for irrigation officers and farmers. Then, construction of facilities for rehabilitation and improvement of Doho and the surrounding out-growers areas unification should be implemented in the long-term period.

The implementation plan for the land and water resource development programme is indicated in the following two tables. One is for a small-scale irrigation scheme development and the other is for the Doho Integrated Development Project.

Implementation Plan for Land and Water Resources Development Programme

Items of Development Plan	Present	Short-term			Mid-term			Long-term			
	Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Implementation of Pilot Schemes											
1) Number of Implementations in a Year		21	21	21	100	150	150	300	350	400	487
Accumulated Number of Schemes in each Term		21	42	63	100	250	400	300	650	1050	1537
Accumulated Number of Schemes		21	42	63	163	313	463	763	1113	1513	2000
2) Planning and OJT Period											
Overall implementation Plan in districts											
Selection of Potential Site											
OJT Training in the P/P area											
Irrigation & Drainage Plan for Short-term dev.											
Human Resouces Dev. for Irrigation Engineering											
1) District Irrigation Officerrs Training at Doho	1	2	2	1							
Accumulated numbers per district	1	3	5	6							
2) Overall Irrigation Officers (DIOs) Training	13	42	42	21							
Accumulated numbers in 21 districts	13	55	97	118							
3) MAAIF Irrigation Engineers Training in Abroad	1	2	2	2							
Accumulated Number		2	4	6							
Small Impounding											
1. Short-term Period											
1) Inventory of Potential Dam sites and Find 2 Sites											
2) F/S and Implementation Plan by Local Consultants for 22 Dam Sites		5	7	10							
Agreement of Land Compensation for Reservoir area											
3) EIA and Approval From NEMA											
4) Selection of Contractor for Dam Construction											
2. Mid- and Long-term Period											
Dam Construction					3	3	4	3	3	3	3
Accumulated Number of Schemes					3	6	10	13	16	19	22
Operation and Maintenance of Pilot Schemes											
1) Training of WUA Farmers at Doho											
2) OJT Training at each Pilot Scheme Area											
3) Establishment of Regulation for WUA											
4) Registration of WUA											

Implementation Plan for Doho Integrated Development Project

Items of Development Plan	Present	Short-Term			Mid-term			Long-Term			
	Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
1. Short-Term Period											
1) Feasibility Study											
2) Re-organaization and Unification of WUA											
3) Establishment of CWMP and WA											
4) EIA and Obtain Approval of Construction from NEMA											
5) Water Right Registration											
2. Preparation of Implementation Fund											
3. Implementation of Construction works											
1) Irrigation and Drainage Training Center											
(with demonstration farm and reserch facilities)											
2) Re-construction of Doho and Surrounding Area											

(2) Production Technology Development Programme

1) Short-term Development Plans

i) Crop experimental work

In the P/P activities, the Study Team has conducted a crop experiment on paddy, covering the varieties adaptability test, fertiliser dosage test and plant spacing test, and got useful information though it is still limited to only a four-crop season operation. To promote settlement of modern irrigated paddy farming, the basic crop experiment should be continued in the short-term development stage. The crop research function shall be established in a part of the existing

experiment-cum-demonstration farm plots in the Doho Rice Scheme. To execute crop experimental work, the technical training and capacity building of experimental staff shall be scheduled as soon as implementation of the Project is commenced. The trained staff will play a role in paddy production research in line with the "beneficiaries' participatory approach to the research work", which NARO is promoting. Extension staff and NAADS service providers from each respective district, and agricultural staff of NGOs will be targeted for this technical training and capacity building programme.

ii) Quality seed production and distribution

In the Doho Rice Scheme, the foundation seeds of the promising paddy varieties are preserved well, and in part, the extension seeds of the recommended paddy varieties have also been multiplied sufficiently for commercial seed production. Besides, the potential paddy seed growers were trained through the training workshop and also experienced the fourth set of practical exercises in the field. Thus, it is now appropriate to start paddy seed production, even for commercial operation.

In the short-term plan, therefore, it is scheduled that a seed multiplication and seed supply system is established using the above seed multiplication function, e.g., 5 seed growers and 0.5 ha seed farm plots, which has been created by the JICA Study Team in the Doho Rice Scheme during the P/P operation period. Quality control in terms of mixture of immature (green) grains, drying conditions, separation of foreign materials, etc. shall also be specified in this short-term period. NARO should assist this system, particularly in control of the seed quality. NAADS shall then assist commercialisation of the seed business.

iii) Activation of technical extension services

In a farming practice improvement programme, the extension staff and NAADS service providers will be trained to gain knowledge on paddy farming. Since there are no extension staff specialised in paddy production in any of the districts at present, it is urgently necessary to train up the technical staff first in the short-term development stage. Basically, extension service staff and agricultural staff of NGOs shall be educated to improve their ability on paddy production using the function of crop experimental farm plots in the Doho Rice Scheme.

Extension Service Staff to be required in Short-term Implementation Stage

Particular	Short-term
No. of Schemes to be Developed	63
NAADS Service Providers	-
Extension Service Staff	21
Agricultural Staff of NGOs	10
Total Service Staff	31

The technical training of the respective staff and rice growers shall be

conducted using crop research-cum-technical demonstration functions of RRTDFP to be established in the Doho Rice Scheme. “Learning by doing” through direct participation in the crop research and/or operation of the demonstration farm plots should be the essential basis for capacity building, and achieving technical skilfulness. The technology should be transferred from the trained staff to the beneficiary farmers through establishment of a TDFP in each respective scheme area.

The staff training will be conducted once a year during the main crop season from mid-March to mid-July. The size of classroom will be 35 trainees as the maximum. The training programme will be composed of a total of seven sessions covering the full growing stages of paddy from nursery stage to yellow-ripening/maturation stage. The extension staff shall, immediately after returning back to their home district, establish a TDFP in the respective Pilot Schemes, and extend technical demonstrations as well as technical training of the key farmers from the scheduled development schemes.

iv) Improvement of farming practice

In implementation of the development scheme, the key farmers and extension service staff who trained at Doho and were attached to the scheme shall have a responsibility to demonstrate the advanced paddy cultivation technology as well as transfer the technology to the member farmers through TDFP activities. The member farmers shall also participate in the TDFP operation and directly exercise the transferred technology repeatedly to achieve satisfactory technical skill.

To modernise the existing paddy cultivation practices and improve the productivity to a reasonable level, introduction and propagation of adequate farming tools and equipment is essential and crucial. However, it is rather troubling that manufacture of the proposed farming tools and equipment has been closed down in most rice producing countries since paddy farming is being mechanized in those countries, and accordingly, it is becoming difficult to purchase a number of the set units. To cope with these situations in the international farming tool market, it is proposed to manufacture all necessary farming tools and equipment within the Project area for propagation widely in all development schemes. This manufacturing of farming tools and equipment should be highly acceptable as it will be effective and helpful for generating labour employment opportunities in the rural area.

In Uganda, the Nakawa Vocational Training Institute, Kampala, which has been established, and is now being operated with financial and technical assistance from JICA in collaboration with NGOs/CBOs, is available as a useful function for training technical staff for manufacturing the farming tools and equipment. In Mbale district, an NGO also owns the mechanical workshop having a function of manufacturing farming tools and equipment. This function is also

useful for training of the technicians and/or practical exercises for the manufacturing work, thereafter getting a training course. Besides, many blacksmiths, carpenters, welders, etc. have been working in the respective villages in the Project area. If those local technicians are trained up in the manufacturing technology for farming implements, it could be easy to realise commercialisation of those farming tools and equipment. Thus, to train up the local technicians for manufacturing of farming tools and equipment, it is hereby scheduled to organise particular training courses using an effective function of the Nakawa Vocational Training Institute. The proposed training course will be organised as one of the important components and commenced at an early stage of the short-term development programme, namely advertisement of interested technicians in the early half of 2008, and execution of the course using the later half of 2008 and early half of 2009. The training course will take three months for completion. To this course, 15 blacksmiths, carpenters, and welders will be invited as the trainees.

v) Promotion of the resource-cycle-utilisation farming

In the current rice production system, there has customarily been no use of the by-products of paddy production, such as straw, husks, and bran. These are highly useful as organic fertiliser resources and effective for increasing paddy production as it has been technically demonstrated in the fertiliser dosage test at RRTDFP. Utilisation of these resources can also contribute a lot to upland farming as well as livestock, aquaculture development, and mushroom cultivation. All of these uses are promising as new sources for both creation of labour employment opportunities and income generation in the rural area.

Up to the present, no farmers have accepted the idea to process this organic manure (compost using by-products of paddy production). The high labour component and absence of means of transport are the main causes identified so far. However, the greater part of labour cost will be offset from the reduction in the main work of paddy cultivation when paddy farming is improved by adoption of new technology. Such surplus labour force should be used for proper and effective utilisation of the by-products of paddy production.

To promote and settle resource-cycle-utilisation farming, it is first scheduled to train paddy growers how to use paddy straw as organic manure for crop/soil fertilisation in both paddy fields and upland fields. Mulching support by use of the paddy straw for the young seedlings of cotton, vegetables, etc. is also an essential subject for the training practice. This training programme shall be included as one of the crucial activities in the farmer training that has been scheduling on each TDFP in the respective Pilot Schemes in the districts. The related development from paddy production, e.g., livestock, poultry and fishery work, etc. will be executed during the mid-term and long-term periods, step by step, in accordance with the wishes of the farmer groups.

2) Mid and Long-term Development Plans

i) Crop research work

The crop research work shall be continued even in the mid and long-term development stages so as to cope with the technical matters, smoothly and efficiently. All of the field work shall be practiced by the participants in the technical training courses, from time to time, as per the research policy of NARO.

ii) Seed multiplication and distribution services

The seed farms should be, in the mid-term as well as long-term development stages, extended to the respective Small-scale Irrigation Schemes in each district area according to the seed demand that will be increased through the performance progress of Project implementation. Accordingly, technical training of the candidate seed growers shall be continued year by year in order to develop reliable seed growers to meet the annual seed demand in each development stage. The training programme shall be implemented in the main rainy season, year by year, adapting the same training sessions to the extension staff at RRTDFP, Doho Rice Scheme, in order to train 4 to 5 candidate seed growers annually. The candidate seed growers shall participate in field exercises for at least four crop seasons, using parts of their own paddy fields (0.1 ha or 1/4 acre size) before getting a certificate. Technical follow-up and field guidance will be provided by the trained extension staff, from time to time, at each essential growing stage of paddy.

To smoothly and effectively supply quality seeds to the paddy growers, it is proposed to establish a "*Seed Banking Scheme*", preferably in the later part of the mid-term development stage, through realisation of an adequate partnership amongst NARO, NAADS, the interested seed companies and the seed growers as well as with the primary paddy growers' cooperatives. The paddy seeds produced by the seed growers shall be gathered into the seed depots, which are managed by the respective paddy growers' groups, and then, distributed to each scheme or to satisfy other demands, either by a direct route or through other reliable distribution channels that might be maintained by the seed companies. The specific conditions for seed quality control, which would primarily be prepared within the short-term development stage, shall be reviewed and amended as required. NARO shall assist the Seed Banking Scheme, particularly in control of the seed quality, and NAADS is requested to assist commercialisation of the seed business.

iii) Activation of technical extension services

The mid and long-term plans for the production technology development component are to improve the technical extension service system to a self-reliant level and to expand it to the subsequent areas. Hence, the crop

research for improvement of farming practices will be carried out continuously to assist the staff training and practical field activities of the extension service system.

Subsequent to the initial extension staff training programme performed in the short-term development stage, it is also scheduled to up-skill these extension service staff. The staff training will be conducted once a year during the main crop season from mid-March to mid-July at RRTDFP, in the Doho Rice Scheme. The size of classroom will be 35 trainees as the maximum. The training programme will be composed of a total of seven sessions covering the full growing stages of paddy from the nursery stage to the yellow-ripening/maturation stage.

The extension service staff trained under this Project will be graded into the NAADS service providers and/or graded having a quality of technology according to the authorisation of the NAADS programme. The constitution of the extension service staff and number of staff required have been preliminarily estimated as follows:

Extension Service Staff to be required in Mid & Long-term Implementation Stages

Particular	Mid-term	Long-term
No. of Schemes to be developed	400	1537
NAADS Service Providers	21	21
Extension Service Staff	21	21
Agricultural staff of NGOs	20	65
Total Service Staff	62	107

After completion of the training programme, preferably at the mid-term development stage, the trained staff will then be organised into the extension service network. This network is, in practice, the coordinating linkage amongst the NAADS service providers, extension service staff, agricultural staff of NGOs and paddy growers in the development schemes. When the above service network is functioning, the Project will gain authorisation within the NAADS programme as one of the promising development programmes for commercialisation of paddy production.

iv) Improvement of farming practices

In succession to the training programme for the local technicians, the Project will extend technical and financial support to the local manufacturers to enable them to start the manufacturing of farm tools and equipment, smoothly and successfully.

As for the technical matters, the Project will dispatch an expert and will periodically extend follow-up guidance and supervision for the practical job. As for the financial assistance to the manufacturers, the Project will first exchange a contract agreement and then issue an advance payment (almost 30% of the contract amount) as an expedient for smooth procurement of the materials in the domestic market. The advance payment hereby issued is a part of the

services of micro-credit for the Project beneficiaries that is scheduled to apply to this Project implementation. Refund of the advance payment shall be partly made "in kind" (manufacturing products), from time to time, and the balance of the payment shall be made in cash on the basis of the performance progress of manufacturing work and delivery of the products.

v) Promotion of the resource-cycle-utilisation farming

As has been explained in the previous section, a large quantity of by-products such as paddy straw, husks, bran and fine broken rice are also being produced from paddy farming. Practically, these are quite useful potential resources for activating the following production activities: e.g., livestock, poultry and fishery as well as mushroom production. This is sure to be effective for generating additional income for the economy of farm households. Thus, to promote and materialise the "paddy production based resource-cycle-utilisation farming", it is proposed first to implement farm-household based schemes, such as increasing number of livestock and poultry in the yard, grazing using the paddy straw, fresh rice bran and fine-broken rice. Mushroom cultivation using paddy straw compost is also possible to implement on an individual basis. As for fishery development, it will be necessary to organise group work if the irrigation water is to be used efficiently and satisfactorily. To implement these schemes, the Project shall provide the technical guidance as well as the training workshop as required. The tentative schedule of training workshops will be as follows:

Tentative Schedule of Training Workshops for Utilisation of Paddy By-products

Targeted Farming Type	Sessions	Days of Session	Classroom	Scheduled Time
Livestock grazing	3, periodical	3 days each	25 persons/class	Early half of 2012
Poultry grazing	2, periodical	3 days each	25 persons/class	Early half of 2012
Aquaculture	2, periodical	3 days each	25 persons/class	Latter half of 2013
Mushroom cultivation	3, periodical	3 days each	25 persons/class	Latter half of 2013

(3) Organisational and Institutional Development Programme

The plan mentioned in Section 5.4.3 (3) for the organisational and institutional development will be implemented in 10 years consisting of three terms being short, mid and long-term. Corresponding to the physical infrastructure development for sustainable irrigation, farmer capacity building shall be conducted. The implementation plan is indicated below.

Short-term Development Plan

During this stage, procedures of the A/P outlined in Section 6.3.2 shall be closely followed. The programme is twofold. One is for officer guidance and the other is for farmer training. The officer guidance will be conducted for 2 days every year. During the short-term period, the participants will be the district officers (DAO or NAADS coordinator, DEO, DWO, DCO and DCBO). This also gives them an opportunity to get exposed to the issues concerning wetland management, paddy cultivation and irrigation development.

The farmer training will be conducted by the trained officers at the sub-county level. During the training, one sub-county officer will also join so that she/he can closely follow up on progress. The detailed training programme is listed in Section 6.3.2.

No. of Participants for Farmer Group Development/ Capacity Building Training in 21 Districts (Short-term)

Year	Short-term		
	Year 1	Year 2	Year 3
No of Schemes to be developed / district	1	1	1
Officers / NAADS Coordinator	42	42	42
	2 persons x 21 districts	2 persons x 21 districts	2 persons x 21 districts
Sub-County Officer	21	21	21
	1 person x 21 s/c	1 person x 21 s/c	1 person x 21 s/c
Farmer Representative	42	42	42
	2 persons / scheme x 21 districts	2 persons / scheme x 21 districts	2 persons / scheme x 21 districts

Mid and Long-term Development Plans

During the mid-term, the officer's guidance continues for three years. The participants will include 2 officers of district or sub-county level and NAADS service providers from Kumi, Bukedea, Soroti, Iganga, Namutumba, Butaleja, Toro, Pallisa, and Budaka. These districts have a large number of schemes to be developed in the long-term plan and expect a shortage of facilitators.

In both mid and long-term plans, the farmer training will be conducted in the sub-county by the trained officers and NAADS service providers. During the mid-term, 10 farmers' scheme representatives will be trained at one series of training and 15 during the long-term. Sub-county technical staff will also participate in the sessions for further follow up of the farmers' organisational capacity development.

During these stages, the organisations which started their operations during the short-term shall be encouraged to transform their organisations into cooperatives or any other type of profit oriented organisations with assistance from a district Cooperative Officer, Uganda Cooperative Alliance and South-eastern Private Sector Promotion Enterprise Ltd. This is to reinforce the function of paddy production and marketing of the farmers' organisations and enable them to register as a cooperative. In the long run, it is recommended that these primary societies should be organised into federations at sub-county and district level, which would increase the efficiency of organisational performance.

No. of Participants for Farmer Group Development/ Capacity Building Training in 21 Districts (Mid and Long-term)

	Mid-term	Long-term
No. of Schemes to be developed	400	1,537
No. of Officer Guidance programmes to be conducted	3	0
Officer Guidance (Participants will be from 2 officers of district/ sub-county level and NAADS service providers from Kumi, Bukedea, Soroti, Iganga, Namutumba, Butaleja, Tororo, Pallisa, Budaka.)	54	0
	2 persons x 9 districts x 3 years	0
No. of Farmer Training sessions to be conducted	40 (10 schemes per training)	103 (15 schemes per training)
S/C Officers	40	103
	1 officer / s/c x 40 scheme areas	1 officer / x/c x 103 scheme areas
Farmer Representatives	800 2 farmers/ site x 400 Schemes	3074 2 farmers/ site x 400 Schemes

(4) Environment Conservation Programme

Short-term Development Plan

The total development of 20,000 ha targeted by the D/P in a 10 year period (2008-2017) will involve 2,000 Small-scale Irrigation Schemes of 10 ha each. It would be unthinkable to formulate 2,000 Project Briefs, 2,000 wetland management plans and 2,000 monitoring systems considering the cost and manpower that can be involved. It is proposed to regroup several Small-scale Irrigation Schemes in one 500 ha-watershed unit and formulate one Project Brief, one wetland management plan and one monitoring system for that watershed unit. The table below shows that instead of 2,000 Project Briefs that could have been written when Small-scale Irrigation Schemes are considered individually, only 50 would be formulated at the end of the plan saving considerable cost and manpower. A similar observation can be drawn concerning the wetland management plans (CWMP), as only 50 would be formulated from a possible 2,000. Based on such an assumption, the number of environmental activities necessary in each district of the D/P is shown in Table 5.4.3.

Summary of Environmental Activities for 21 Districts of D/P

Items	Short-term	Mid-term	Long-term	Total
Project Brief	21	20	9	50
CWMP*	17	11	0	28
EIA**	0	11	11	22
Water Sampling	189	321	519	1,029
Soil Sampling	84	106	182	372

**EIA will include 1 CWMP not counted in the CWMP* above

In the short-term plan, which is considered as a learning stage, only one Project Brief is written for each district as the development will only concentrate in one watershed per district. The Project Brief will be written by a local environmental specialist hired by the Project to work together with the DAO.

The community based wetland environmental conservation enhancement programme is organised for the appropriate use of the wetland in rural society. The NEMA's guidelines, which are aimed at the wise use of wetlands, have not yet been understood at the village level where farmers have continuously encroached upon the wetlands. Therefore, to enhance conservation, valid use and to minimise potential conflicts among the different interest groups, a wetland management plan is necessary. One will be developed in the short-term in each district for one watershed unit to address the interest of the different stakeholders and also to put in place management measures that will enhance the conservation and hydrological value of the area. The approach to be taken is adopted from the concept of collaborative management, which emphasizes local communities participation in decision making and management of wetland resources. This management tool has been introduced in some wetlands of Uganda and has significantly reduced conflicts between resource users and managers and has also greatly improved the management of these resources. This approach is likely to be more acceptable to the local communities, will greatly minimise law enforcement, and enhance sustainable management of the Project.

A wetland environment monitoring system will also be established in the short-term plan. The impact on water and soil quality by the lowland paddy farming will be continuously monitored. The collected data is useful for the planning of wise use of wetland in the future. In the first year of monitoring, each DAO accompanied by 1 staff member from the district, 1 staff member from sub-counties where the watershed is located and key farmers will guide the Senior Water Analyst and Senior Agronomist contracted by the Project to decide on the sampling sites and receive a lecture on the items to sample, why, when and how. On the second sampling, the DAO and the selected staff will go themselves to the sites decided in the watershed to collect water and soil samples. The DAO will give proper instruction for future sample collection to key farmers or to the sub-county agricultural officer to collect water and soil samples. The location of samples for water will be at the inlet and outlet of a watershed. The location of samples for soil will be at upstream, midstream and downstream stretches on both sides of river flow. The people instructed to take samples by the DAO will not be paid by the D/P but by the district.

Mid and Long-term Development Plans

The outputs to be used for making the Project Brief by the local environmental specialist with the DAO and the people from the community based wetland environment conservation strengthening programme will be spread and applied to the new irrigation development in the mid and long-term plans. The wetland environment will be constantly monitored using the system that is established in the short-term plan. An EIA is to be undertaken in every watershed where a dam construction is planned.

5.5 Cost Estimate for D/P

The cost for implementation of the D/P is presented in Table 5.5.1 and summarized in the following table.

Cost for Development Plan

(Unit: '000 Ush)

Development Components	Cost of D/P
Small-scale Irrigation Scheme Development	
- Land and Water Resources Development	113,071,080
- Production Technology Development	7,985,825
- Organisational and Institutional Development	806,296
- Environmental Conservation	2,049,136
- Management Consultants	12,391,234
Sub-total	136,303,571
Doho Integrated Development Project	
- Feasibility Study	2,865,650
- Construction and others	27,750,000
Sub-total	30,615,650
Total	166,919,221

5.6 Implementation Schedule of D/P

The implementation schedule for the D/P has been prepared based on the above-mentioned implementation plan in Section 5.4.4 and is presented in Table 5.6.1.

5.7 Evaluation of D/P

5.7.1 General

Project evaluation is made through thorough assessment of the project feasibility in view of economic and financial aspects. For the economic evaluation, three methods are used, i.e., the Economic Internal Rate of Return (EIRR), the Benefit Cost Ratio (B/C) and the Net Present Value (NPV). The agricultural benefit will accrue from incremental paddy production under improved conditions through land and water management development, small impoundment development, production technology development, environmental conservation, organisational/institutional strengthening, rehabilitation of large-scale irrigation schemes, etc.

The indices for economic evaluation are computed for 2,000 Small-scale Irrigation Schemes and the Doho Integrated Development Project.

The project evaluation is based on the following basic conditions:

- The useful life of the Project is taken as 30 years from project implementation;
- The small-scale irrigation scheme development will start in 2008, and investments will be completed by 2017;
- The Doho Integrated Development Project will be studied before its implementation and is due to start in 2013;

- For the calculations of economic indices, only direct benefits are counted, but indirect benefits, such as environmental benefit from wise use of wetlands and stopping encroachments, are not;
- The exchange rate of the Ugandan Shilling to US$ is taken to be USh. 1,850 equivalent to US$ 1.00 (of as August, 2006);
- Tradable prices refer to World Bank Commodity Price Projection for 2015;
- The target yield for small-scale irrigation scheme development is 5.0 tons/ha of paddy with husks. The one for Doho Integrated Development Project is to gradually increase during the works period, reaching 6.0 tons/ha after the completion of the rehabilitation of the irrigation facilities.

Financial evaluations of typical farm household economies are made to examine the capacity to pay for the water charge at the farm level.

5.7.2 Economic Evaluation

(1) Conversion Factor

In order to evaluate project costs and benefits with respect to world market prices, a Standard Conversion Factor (SCF) of 80.5% is applied to the prices of non-traded goods and services. This figure is calculated on the basis of export and import statistics for the fiscal years 2000/01 - 2004/05 as shown in Table 5.7.1. The Construction Conversion Factor (CCF) applied is 80%. Economic prices of trading commodities and farm input are presented also in Table 5.7.1.

(2) Shadow Wage Rate

The unskilled labour wage was computed at USh.1,500 per day for economic costs.

(3) Project Cost

The project costs for economic evaluation consist of irrigation facility construction cost, annual O&M cost, production technology development cost, environmental conservation cost, organisational and institutional development cost, management consultant cost and others. The annual O&M cost for the irrigation facilities are estimated as 3% of initial construction costs.

The life of concrete structures is set at 30 years. Therefore the cost for replacement will be saved annually for 30 years.

(4) Project Benefit

The project benefit is expressed as the difference of annual net income between the conditions “with project” and “without project”. The calculated crop budgets based on the economic prices are shown in Table 5.7.2. The incremental net income per hectare for each Small-scale Irrigation Scheme and the Doho Scheme is estimated as shown in the table below.

Summary of the Benefit

(Unit: USh. '000/ha)

Type of Small-scale Irrigation Scheme Development and Progress of Doho Integrated Development Project		Incremental Benefit per ha
Small-Scale Irrigation Scheme Development	Rehabilitation type	2,276
	Improvement type	2,276
	Diversification type	2,540
	New development type	2,713
Doho Integrated Development Project	Yield 4 tons/ha in progress	877
	Yielding 5 tons/ha in progress	1,741
	Yielding 6 tons/ha: final target	2,599

It is assumed that profits under the future without project condition would remain at the present level. The present low yields are due mainly to uncontrollable water and low technologies. These problems would not be solved under the without project condition.

(5) Economic Evaluation

In order to compute the EIRR, B/C and NPV, the annual economic cost and benefit flows were firstly prepared as shown in Tables 5.7.3 and 5.7.4. From the tables, the result of economic evaluation is summarised as follows.

Summary of Project Evaluation

P/P Site	EIRR (%)	B/C (12%)	NPV (12%)
Small-scale Irrigation Development	22.3 %	1.61	USh. 61 billion
Doho Integrated Dev. Project	29.7 %	1.87	USh.19 billion

(6) Sensitivity Analysis

Project sensitivity in terms of EIRR was analysed based on changes applied on project costs and benefits. The results of the analysis are summarised below.

Summary of Sensitivity Analysis for Small-Scale Irrigation Development and Doho Integrated Development Project

(Unit: %)

	Small-Scale Irrigation Development			Doho Integrated Dev. Project		
Construction Cost Increased	Yield Decreased *			Yield Decreased *		
	0%	0%	-5%	-10%	-5%	-10%
0%	22.3	20.4	18.3	29.7	27.5	25.2
+5%	21.3	19.3	17.3	27.9	25.7	23.4
+10%	20.3	18.4	16.4	26.2	24.1	21.9

As seen in the above table, the project is economically viable even if the construction costs increase 10% and the yield decreases 10% with EIRR amounting to 16.4% in the small-scale irrigation scheme development and 21.9% in the Doho Integrated Development Project.

These analyses showed that these two types of projects are justified economically.

5.7.3 Financial Evaluation

(1) General

Financial viability of the projects is evaluated from the viewpoints of the farmers' economy. Farm budget analysis is conducted to access whether the project will generate enough income for the farmers.

After completion of the construction, the cost of O&M for the irrigation facilities will be covered by fees collected from each member of the farmers' organisations. The annual O&M costs for these facilities are estimated as 3% of the initial construction cost of the work. In order to grasp the financial feasibility of the D/P, financial analysis is carried out by preparing farm budget statements on the basis of the annual O&M cost and the intake replacement cost.

(2) O&M Cost

The estimation of these O&M costs was made under the following conditions:

a) After the implementation of the construction work, the WUA members participated in the maintenance work of the irrigation systems and farm roads without payment. The WUAs have to manage such communal work. The labour cost is therefore not included in the O&M cost.
b) The WUAs do not employ full-time staff and all of their activities are carried out on a voluntary basis by members.
c) The annual O&M costs for these facilities are estimated as 3% of the initial construction cost of the work.

(3) Replacement Cost

The project life is taken as 30 years until the replacement of the concrete intake gates and small impounding dams.

(4) Water Charge by WUA

The annual member fees of WUAs, which are called water charges, are analyzed under the following conditions:

a) All of the O&M and replacement costs are covered by the member fees, and no subsidy is provided from outside.
b) The deposit interest rate is set at 9.3%, which is the average rate of commercial time deposit interest rate in Ugandan Shillings from February 2005 to July 2006 as announced by the Bank of Uganda.
c) Membership fees are collected for the miscellaneous expenses of WUAs. Generally entrance fees and annual membership fees are charged to the members. However, the levels of fees differ with WUAs. In these analyses, USh.5,000 is used for every WUA as an annual fee.

The estimated water charges for each development type are presented in the following table.

Annual Water Charge

Type	(ha)	Annual O&M cost		Annual replacement cost		Total of Average (Ush./ha)	Membership fee (Ush./house-hold/year)
		Total (Ush.)	Average (Ush./ha)	Total (Ush.)	Average (Ush./ha)		
Small-Scale Irrigation Scheme Development Without Small Impounding							
Rehabilitation	10.0	519,920	51,992	53,420	5,342	57,334	-
Improvement	10.0	587,000	58,700	72,430	7,243	65,943	-
Diversification	10.0	1,608,950	160,895	60,630	6,063	166,958	-
New Development	10.0	1,895,110	189,511	41,450	4,145	193,656	-
Annual member fee							5,000
Small-Scale Irrigation Scheme Development With Small Impounding							
Rehabilitation	10.0	1,352,420	135,242	245,900	24,590	159,832	-
Improvement	10.0	1,419,500	141,950	264,910	26,491	168,441	-
Diversification	10.0	2,441,450	244,145	253,110	25,311	269,456	-
New Development	10.0	2,727,610	272,761	233,930	23,393	296,154	-
Annual member fee							5,000

The WUAs will collect these costs from members, and the annual amount per hectare is estimated at USh 57,300 to 193,700 in the schemes without small impounding construction. In the cases of schemes with small impounding dams, the annual amount per hectare is estimated at USh 159,800 to 296,200. In addition to this amount, a membership fee, USh 5,000 per member household, is charged.

(5) Farm Budget Analysis and Capacity to Pay by WUA

The payment capacity is defined as the ability of the member farmers to bear annual water charges after the irrigation development scheme. Four farm budgets for typical farm households for each development scheme without and with provision of small impounding dams are analysed. The analysis is performed on the basis of net income gain and ability to pay the water charge by typical farm households before and after the implementation of irrigation development. The size of paddy field per farm household is assumed as 0.25ha.

Under the condition of “without small impounding”, the net reserve “with project” condition per farm household was estimated USh. 174,000, 307,000, 543,000 and 245,000 respectively for each development type, even if the living expenditure is increased by 50% from “without project” conditions. Comparing the net reserve with the water charge and other recurrent costs shows that farmers can well afford these costs as shown in Table 5.7.5. The following table shows the summary in the case of “without small impounding construction”.

Farm Budgets in Small-Scale Irrigation Schemes Without Small Impounding

(Unit: USh. '000/year)

Irrigation Scheme Without Small Impounding	Small-Scale Irrigation Scheme Development							
	Rehabilitation		Improvement		Diversification		New Development	
	Without project	With project	Without project	With project	Without project	With project	Without project	With project
Net agric. income	429	747	665	983	944	1,447	671	1,173
Other income	133	141	132	142	151	197	446	531
Total net income	562	889	797	1,125	1,095	1,644	1,117	1,704
Living expenditure*	476	714	545	818	734	1,101	973	1,459
Net reserve	86	174	252	307	361	543	144	245
Water charge		19		21		47		53
O&M		(13)		(15)		(40)		(47)
Replacement fee		(1)		(2)		(2)		(1)
Membership fee		(5)		(5)		(5)		(5)

*: Living expenditure for "with project" condition is 150% up from "without project" condition

On the other hand, in the case of the locations where the installation of a small impounding dam is required, the possibility to utilise the water resources will effectively contribute in having two full crops a year. Hence the figure of net reserve for each development type is showing better reserve values respectively. The net reserve "with project" condition per farm household was estimated as USh. 390,000, 522,000, 759,000 and 461,000, respectively for each development, even if the living expenditure is increased by 50% from the "without project" condition.

Of course the additional maintenance cost for the small impounding dams will raise the level of water charge. However, the estimated increased net reserves can fully cover the additional charges. Comparing the net reserve with the water charge and other recurrent costs shows that farmers can well afford these costs as shown in the following table in the case "with small impounding construction".

Farm Budgets in Small-Scale Irrigation Schemes With Small Impounding

(Unit: USh. '000/year)

Irrigation Scheme With Small Impounding	Small-Scale Irrigation Scheme Development							
	Rehabilitation		Improvement		Diversification		New Development	
	Without project	With project	Without project	With project	Without project	With project	Without project	With project
Net agric. income	429	963	665	1,199	944	1,662	671	1,389
Other income	133	141	132	142	151	197	446	531
Total net income	562	1,104	797	1,340	1,095	1,860	1,117	1,919
Living expenditure*	476	714	545	818	734	1,101	973	1,459
Net reserve	86	390	252	522	361	759	144	461
Water charge		45		47		72		79
O&M		(34)		(35)		(61)		(68)
Replacement fee		(6)		(7)		(6)		(6)
Membership fee		(5)		(5)		(5)		(5)

*: Living expenditure for "with project" condition is 150% up from "without project" condition

In both cases of "with small impounding" and "without small impounding" conditions, it is shown that typical farmers will have enough capacity to pay.

Chapter 6 ACTION PLAN

6.1 Introduction

The original A/P, based on which the P/P plan was formulated and implemented, was modified to be one in which all the proposed components/programmes are implemented covering all the study area within 21 districts.

The 4 P/P areas were selected from 4 A/P areas, which were identified as the ones with respective area-specific constraints, evaluated mainly from the irrigation development point of view, i.e., priority areas for rehabilitation (Group-1), improvement (Group-2), new development for crop diversification from upland to lowland paddy (Group-3), and completely new development in seasonal wetland (Group-4). The A/P for the land and water resource development and environment conservation was then formulated only for 4 A/P areas in Budaka (Pallisa), Bugiri, Kumi and Sironko districts. As mentioned in Section 4.7.2 of the Pilot Project Report (Volume II of the Final Report), the A/P needs to be modified based on the following lessons learnt from the implementation of P/Ps:

1) The need for irrigation development is very high in the whole study area, and some districts outside of the previous A/P areas have already commenced their irrigation development work, applying the technologies introduced by the P/Ps. In addition, the capacity of farmers and local technical officers is good for the development.
2) The performance of 9 P/P areas was generally good in their organisational development and improvement of paddy cultivation technology, although irrigation facilities were not constructed in these P/P areas. The 9 P/P areas are now performing their role as a centre for paddy sub-sector development in each district. It is expected that their role for irrigation development will be reinforced if irrigation facilities are provided in these P/P areas.

This chapter thus presents the A/P modified based on lessons learnt from the P/Ps. Because of this modification the A/P basically covers all the proposed programmes formulated in the short-term plan of the D/P. However, the approach to the respective districts for land and water resource development still follows the concept of grouping them into Groups 1 to 4.

The A/P period is set for 3 years from 2008 to 2010. In other words, it will start after the completion of the present study in 2007.

6.2 A/P to Cope with Area-specific Constraints

6.2.1 Land and Water Resource Development

The A/P implementation plan has two characteristics in its purposes. One is that there are many constraints limiting further development of irrigation systems in this country, such as lack of irrigation engineers, lack of technology, etc. These existing

problems should be addressed and solved during the A/P period to guarantee a smooth implementation of the D/P. The other is the implementation policy for sustainable wetland development for 20,000ha of paddy area. How can we approach and adopt irrigation technology for sustainable and wise use of wetland? During the JICA Study period, 4 P/P have been constructed and environmentally monitored. It has been confirmed that there were no sensitive effects on the environmental conditions by the construction of the 4 P/Ps. However, the period of monitoring was quite a limited time, so it is necessary to further monitor the developments in wetlands to understand the sustainable and wise use of wetlands from a technical point of view during the A/P period.

(1) Approach to Preparation Period for D/P Implementation

The A/P to cope with area-specific constraints includes the land and water resource development component based on the categorisation of districts characteristics, which is not dealt with in the A/P to cope with overall constraints. The basic concept of the land and water resource development that is taken into account in the formulation of the A/P is as follows:

- Human resources development for irrigation engineering
- Planning and irrigation engineer OJT
- Pilot Schemes Implementation Plan
- Feasibility Study for Small Impounding Development
- Organisation management, O&M of Pilot Schemes.

(2) Approach to Sustainable Wetland Development

1) In order to utilise the water resources effectively, and discharge the necessary river maintenance water downstream, sufficient catchment area for the paddy field area should be secured. According to the minimum river flow analysis and paddy field water requirement, the catchment area should be at least 20 times the paddy field area in the rivers originating from Mt. Elgon and more than about 40 times the catchment area in the lower flat area.
2) Providing small irrigation ditches can shorten the required time for the supply of water and decrease the volume of water utilisation compared with the plot-to-plot irrigation method. As a result, the water in the wetland can be utilised effectively, evenly and in a sustainable way.
3) By introducing such an irrigation system it will be possible to control the water in the paddy fields and optimise water management. At harvest, water in the fields can be drained in order to dry up the fields, making harvest related work easier and more effective.
4) Introducing a water management technology that is integrated and adjusted to have the same cropping calendar applied all over the wetland area can make annual double cropping possible and ensure at least two months of non-cropping period. During these two months of non-cropping period, canal repair, maintenance such as cutting grasses, excavating deposited soil in the canal, and repairing the intake structures etc. can be done through farmers' cooperative

work.

5) The two months drying period can promote good aeration of the paddy plots, ensuring good field conditions for the next cropping. It can also reduce the carbon dioxide emission from the paddy fields due to the rotting of paddy straw, which will contribute to the betterment of the earth environment.
6) Drying up the fields can control and reduce bilharzias, as this will eliminate the fresh water snails, which carry and propagate the bilharzias parasites in the water. It is noteworthy to point out that bilharzias eradication in rivers and swampy areas will be rather difficult due to continuous water flow and connected wide epidemic areas.

(3) Implementation Plan for the Proposed A/P Areas

Based on the district categorisation for the original 13 districts, which have been separated into 21 districts as of the end of October 2006, the same categorisation of the original district has been adopted in the new districts for the land and water resource component by dividing them into the following four groups:

- Group-1: Rehabilitation of the existing paddy fields (Rehabilitation)
- Group-2: Improvement of the existing paddy fields (Improvement)
- Group-3: Diversification of production through conversion of other existing crops in the seasonal wetland to paddy (Diversification)
- Group-4: New paddy fields development.

In accordance with the selected A/P areas in the 21 districts, the following pilot schemes for each watershed area have been planned for implementation. The average size of the pilot schemes is estimated at 10 ha. The number of pilot schemes has been estimated on the basis of the water availability from the watershed and limitations on wetland development in the regulations. In order to distribute the implementation of pilot schemes during the A/P period to the wider area of the 21 districts, one scheme per year for each 3-year period has been proposed for implementation as shown in the following table. The planning and implementation of the pilot schemes should be utilised for OJT for irrigation engineers in the districts.

Categorisation of 21 Districts and A/P Implementation

Category	Original District (13 Districts)	New District (21 Districts)	A/P Construction
Group-1 (Rehabilitation)	Iganga	Namutumba	3
		Iganga	3
	Tororo	Butaleja	3
		Tororo	3
	Pallisa	Budaka	3
		Pallisa	3
Group-2 (Improvement)	Mayuge	Mayuge	3
	Bugiri	Bugiri	3
	Busia	Busia	3
	Mbale	Manafa	3
		Mbale	3
		Bududa	3
	Kamuli	Kaliro	3
		Kamuli	3
Group-3 (Diversification)	Sironko	Sironko	3
	Kumi	Kumi	3
		Bukedea	3
Group-4 (New Development)	Soroti	Soroti	3
	Katakwi	Amuria	3
		Katakwi	3
	Kaberamaido	Kaberamaido	3

(4) Action Required

a. Human resource development for irrigation engineering

- Irrigation engineer training will have priority. DIOs at district level will be trained making reference to the 13 DIOs trained in the P/P. An additional 5 DIOs in each district need to be trained in the Doho Rice Scheme or implemented Pilot Scheme areas.
- In order to train and develop capable executives for MAAIF, training abroad will be organised in a country advanced in irrigation technology, such as IRRI in the Philippines, Tanzania, Kenya or Japan. Two people will be trained every year in the A/P period of 3 years. The 6 staff trained will be assigned to the Ministry and Project office to be established in Mbale town. These staff members should communicate with the DIO and other necessary personnel in the district office.
- It is necessary and inevitable to establish a project office in eastern Uganda to integrate related district officers, MAAIF, NEMA and donors, in order to implement the Pilot Schemes smoothly. The location of the Project Office will be in Mbale town considering the facilities there and its relative easy accessibility to the related districts and Doho Rice Scheme. The Project Manager and Assistant Manager will be assigned from MAAIF and will be someone who was trained abroad. The Project Manager will perform the very important roles of budget preparation, execution and instruction to the district offices.

b. Planning and irrigation engineer OJT

- At first, proposed priority sites for the next stage of project implementation will be studied, and an implementation plan will be prepared with the cooperation of the Project Manager, DIOs and related personnel in the district on the basis of the "Field Inventory Report of the Potential Paddy Field Areas in each District" prepared by the Study Team.
- The implementation of Pilot Schemes during the A/P period will only involve one Scheme per year. To take this opportunity, OJT of DIOs will be undertaken by the trained DIOs in the first Pilot Scheme construction, referring to the 4 P/Ps constructed.
- The training activities will be conducted in the Doho Scheme and in the constructed 4 P/P sites. The trained DIOs in the district office together with the executive staff in MAAIF will prepare the plan and cost estimates for each proposed Pilot Scheme and explain them to the farmers who will be beneficiaries of the Scheme.
- The first 3 Pilot Schemes will be explained to farmers for agreement consensus, obtaining and establishing farmers' organisations and WUAs.
- Since a Pilot Scheme is small, about 10 ha only, the DIO will prepare a project brief and submit it to NEMA and obtain the approval for construction.
- In relation to the above, a CWMP will be prepared together with farmers and related stakeholders who are utilizing the wetland area. A WA will be established and registered to NEMA.

c. Pilot Schemes implementation planning

- During the A/P period, overall 3 schemes per district for 21 districts will involve 63 schemes for construction. The main purpose would be the OJT of new DIOs though the construction of the irrigation schemes. The trained DIOs will then be expected to have enough capacity and ability to implement and supervise the subsequent mid and long-term Small-scale Irrigation Schemes.

d. Feasibility Study for small impounding development

- In the inventory report of proposed irrigation schemes, potential dam sites will be studied and at least 2 sites will be selected for implementation. Feasibility studies, detailed design and implementation plans will be undertaken by hired local consultants. The selected local consultants should perform not only F/S and design of the dam, cost estimate and construction schedule, but also implement an EIA keeping close coordination with NEMA to obtain approval of construction. During the A/P period, the F/S and EIA of the proposed 22 dam sites should be finalised. Following the completion of the F/S, the Project Manager and DIOs will start negotiation of free land acquisition without any land compensation with farmers located in the dam site and reservoir area. In

order to compensate for the land, it will be possible to propose an inland fishery right for the landowners of the reservoir area.

f. Organisation management, O&M of Pilot Schemes

- Soon after finishing the construction of the Schemes, O&M should definitely be performed by farmers themselves. The training of farmers will, therefore, start immediately utilizing newly constructed facilities.

6.2.2 Environmental Conservation

Outline

Wetland cultivation is one of the activities regulated by NEMA. To carry out such an activity, a permit from NEMA is required, and NEMA requests the submission of a project brief for evaluation. The project brief has to give clear scientific details of the project and explain its intention, presenting comprehensive countermeasures for likely natural and social impacts on the project's wetland environment. As the DAO may not have the necessary experience and materials to prepare the project brief, the job shall be entrusted to a local environmental specialist who should work together with the DAO in its formulation.

Individual farmers will be organised in groups with the function of WUAs, rice production and marketing oriented associations, and WAs to help sensibly increase the present yields and prevent further degradation and encroachment of the wetlands. The establishment of the function of the WA makes it necessary to formulate a wetland management plan for the community to address the interest of the different stakeholders and also put in place management measures that will enhance conservation and the hydrological values of the area. For new developments, the notion of a buffer zone will be introduced to help preserve the areas concerned, which should be easily accepted by the new rice growers.

Acquiring water rights is also important for farmers groups as it guarantees sustainable use of water. It can contribute in stopping further encroachment of the wetlands because those who have the rights can stop those who don't and stop their actions. Though getting water rights may be too expensive for poor small-scale farmers, the project will promote getting them or officially waiving the fees for the farmers.

Future developments to be proposed for other areas of the wetland will be in line with what is proposed for the P/P. These developments should monitor the environment in order to take timely actions to prevent degradation of the wetland environment. The project promotes conducting water quality analysis 3 times/year and soil quality analysis ideally twice every other year. The location of sampling for water will be at inlet and outlet of the watershed. The location for soil samples will be at the upstream, midstream and downstream stretches on both sides of river flow.

Action required

1) Formulation of a project brief to seek a permit from NEMA
2) Establishment of the function of "wetland conservation association" in a farmers' group, including the formulation of a Community Wetland Management Plan (CWMP)
3) Authorisation of users' rights for water in irrigated paddy cultivation in the wetland
4) Sound monitoring of wetland resources, including water and soil.

The above action 2), related to the establishment of the function of "wetland conservation association", will be undertaken within those proposed in the organisational and institutional development component, while the formulation of the CWMP will be allocated to the environmental conservation component.

Rationality

1) Policies and laws have been put in place to regulate use and management of natural resources including lakeshores, rivers and wetlands. Formulating a project brief before implementation of any project in wetlands is in line with the set policies and laws.
2) The function of "wetland conservation association" in a farmers' group, including the formulation of a CWMP, is very important because measures for the protection of the wetlands natural and social environment can be effectively disseminated to the farmers' groups with such functions. They can be informed and get knowledge about how to use a wetland wisely and in a sustainable way.
3) Authorisation of users' rights for water in irrigated paddy cultivation in wetlands will guarantee sustainable use of the wetland resource and protect the legal wetland users against other potential encroachers. Though this procedure may cost too much money for poor small-scale farmers, the Water Act says that it can be waived for subsistence farmers. District officials with MAAIF and the Donor should try to officially get them waived for the farmers in the project who can be considered as subsistence farmers.
4) As monitoring of the wetland environment is very important to preserve it from degradation, this operation is to be continued by the district office, the sub-county agricultural officers and key farmers after acquiring sufficient knowledge during implementation of the first year of the A/P. In each of the A/P areas, 9 water and 4 soil samplings will be performed in total during the three years of the A/P implementation (2008-2010).

Responsible Agencies

MAAIF, District Agriculture Office, DEO, Wetland Officers, NGOs and Donors.

6.3 A/P to Cope with Overall Constraints

6.3.1 Production Technology Development

Outline

The local farmers identified the following as the most critical constraints in the present rice production:

- Lack of adequate information regarding paddy production technology
- Lack of technical skill, awareness and knowledge in paddy cultivation technology and field practices
- Lack of quality paddy seeds and poor farm input supply services.

To cope with the above constraints and then materialise modern paddy farming, there are two essential ways to perform technical improvement in paddy production technology and cultivation practices as follows:

- Improvement without capital investment, and
- Improvement with capital investment.

As illustrated in the detail presented in Table 6.3.1, improvement of "nursery work", "planting method" and "soil fertilisation practices" could be done without capital investment. Improvement of these three essential practices would have a significant effect on improvement of the paddy yielding conditions from the present 1.5 - 2.0 tons/ha to the 3.0 - 4.0 tons/ha level. To realise this technical improvement, satisfactorily and successfully, it is scheduled to conduct the "Participatory Crop Research" in the light of the specific policy of the NARO programme. To this end, Crop Experimental Farm Plots to a scale of 0.4 ha (1 acre) in total will be established, preferably in a part of the Doho Rice Scheme. The crop experiment will include a Varieties Adaptability Test for establishing the most applicable and promising varieties for propagation into the development scheme areas instead of the present old varieties. These crop experiments will be conducted by the district agricultural officers and extension service staff as one of their field practice exercises in paddy production technology. Accordingly, the NCRI should, as a follow on from the previous activities in the Doho Rice Scheme, have a responsibility for operation and management of this experimental farm. The paddy varieties to be used for the varieties adaptability test will be selected from amongst the most prevalent varieties in the advanced rice producing countries. Seeds of these varieties will be obtainable through WARDA and/or IRRI, Philippines and other helpful coordinating channels in South-east Asia.

Other than the crop experimental farm plots, it is also scheduled to establish seed farm plots, primarily in the Doho Rice Scheme, in the short-term development stage, and in each respective district in the medium and long-term development stages. Seed multiplication will then be conducted using the preferred varieties through the afore-mentioned varieties adaptability test. To execute seed multiplication, seed growers should be developed with provision of a specific training course.

To materialise improvement of the present paddy production technology to an

advanced level, technical training as well as capacity building of both extension service staff and paddy growers is essential and crucial in the project area. To this end, it is scheduled to organise a training workshop for both extension service staff and key farmers from each respective development scheme, as a first step. Training of paddy growers by means of technical demonstration and transfer of technology using the trained key farmers under the advisory service of the trained extension service staff, is the second step. The first step programme will respectively be conducted in the Doho Rice Scheme for the extension service staff and the four Core Pilot Project sites, e.g., Kamonkoli-Nabao P/P in Budaka, Buwunga P/P in Bugiri, Kanyumu-Mukongoro P/P in Kumi and Muyenbe P/P in Sironko districts. The second step programme will be provided at each development scheme.

Action required

(1) Establishment of rice research-cum-technical demonstration farm plot (RRTDFP)

As has been presented in detail in the preceding paragraph, the crop experimental farm plots having a scale of 0.4 ha (1 acre) will be established preferably in a part of the Doho Rice Scheme. These experimental farm plots will include the function for preservation of the recommended paddy varieties and multiplication of the extension seeds for commercial seed production and propagation of those varieties. RRTDFP will also have the function of technical demonstration of advanced paddy cultivation practices as well as providing exercises in field practices for training purposes for both extension service staff and seed growers.

The experimental work shall be conducted twice a year, e.g., the main rainy season from mid-March to July and the second rainy season from September to January. NARO will have a responsibility for administrative management of this experimental work. NCRI will then extend its technical supervisory services to field experimental work.

(2) Commercial seed multiplication and distribution

Practically, in the Pilot Project activity, 5 candidate seed growers have been trained through the training workshop provided by the JICA Study Team. After this training they have been repeatedly practicing seed production in the field using part of their own paddy fields (0.1 ha or 1/4 acre) under the technical support of the production manager of the Doho Rice Scheme with periodical follow-up service from the Study Team. They have already experienced four crop seasons up to October 2006, and accordingly have achieved a technically advanced level for proceeding with paddy seed production, successfully.

To implement the development schemes under the A/P programme, the quality seeds of the recommended paddy varieties, e.g., NM-1, NM-2, NM-3, NM-5 and NERICA-4, etc. could be sufficiently supplied from the above seed growers through the administration of the Doho Rice Scheme. Of course, training of the candidate

seed growers for the subsequent development stages will be continued, even in this A/P implementation period.

As for establishment of the Seed-banking Scheme, a "technical-cum-administrative coordinating linkage" amongst the respective districts, paddy growers' groups, interested seed company(s) and NARO will first be prepared in this A/P implementation period. Practical functioning will be scheduled in due course, preferably in the mid-term implementation or an early stage of the long-term programme, when a number of seed growers are trained up and able to commence commercial seed production in a practical way.

(3) Establishment of Technical Demonstration Farm Plot (TDFP)

In implementation of the target development schemes, TDFP shall first be established and demonstrate adequate farming practices as well as the necessary technology related to paddy cultivation, such as:

- Adaptability and productivity of the recommended paddy varieties
- Organic farming, including preparation and then utilisation of compost and azolla for soil/crop fertilisation
- Advanced farming practices, i.e. good soil preparation, regular transplantation with adequate planting spaces, mechanised weeding, threshing and winnowing, etc.

TDFP will share 0.4 ha (1 acre) and be operated by the member farmers in the scheme under full guidance of the key farmers and supervisory service of the extension service staff. Both the key farmers and extension service staff would attend to the training course to be organised under the Project. Through operation of this TDFP, farmers in and around the scheme could benefit from transfer of the paddy production technology and will achieve technical skills in advanced paddy cultivation practices.

(4) Technical training and capacity building of extension service staff

In the Pilot Project activities, the JICA Study Team trained 13 agricultural officers and 5 seed growers. After the training course, they went back to their home pilot project, and be repeatedly practiced the field extension work and transfer of technology to the local paddy growers. Now they would be able to undertake technical training of the key farmers as well as the local farmers at the TDFP. However, the remaining 8 districts have no such experienced extension staff in paddy production technology and paddy cultivation practices. To proceed with implementation of the A/P in all of the districts, smoothly and efficiently, the project will provide a further training programme as soon as the A/P is implemented.

Technical training and capacity building of the extension service staff, agricultural staff of NGOs and candidate seed growers will periodically be conducted using the function of RRTDFP in the Doho Rice Scheme as previously mentioned. The training course will be organised preferably in the first main rainy season (March to July) in

the A/P implementation. The training course will invite the extension service staff and agricultural officers from the respective districts as well as the agricultural staff of NGOs and the candidate seed growers to be recommended by the DAO in the respective districts. The course will have one classroom with a total of 35 participants. The training course consists of seven sessions that would be scheduled taking the essential growing stages of paddy as follows:

Staff Training Programme at RRTDFP, Doho Rice Scheme

	Working Days of Session	Essential Growing Stage of Paddy	Essential Technology to be Transferred
1st Session	4	Nursery Initiation Stage	Seed treatment practices, up-keep practices on seedlings
2nd Session	4	Transplantation Stage	Up-rooting practice, regular transplanting method, irrigation water management at young seedling stage
3rd Session	4	Active Tilling Stage	Fertilisation of young seedlings, plant protection against blast diseases, generation of effective tilling
4th Session	4	Neck-node Differential Stage	Crop fertilisation and control of effective tillers, up-keep practice at maximum tilling/neck node differential stage of paddy
5th Session	4	Reduction Division Stage	Up-keep practice at reduction division stage of paddy, intermediate drying practice in irrigation
6th Session	3	Full Heading & Flowering Stage	Up-keep practices at heading and milk-ripening stage of paddy, control of stem-borers, variety purification practice
7th Session	4	Yellow Ripening/ Harvesting Stage	Up-keep practice at ripening stage of paddy, practice of yield survey, harvesting and threshing practices, quality control of paddy product

(5) Training and capacity building of the key farmers

Prior to commencing the development schemes, the key farmers, who would be selected from amongst the members of farmers' organisations, shall be trained through provision of a training workshop that will be organised at the TDFPs in each core pilot project, which have been established in Budaka (Pallisa), Bugiri, Kumi and Sironko districts. The sessions of the training workshops will be almost the same as the training and capacity building courses to be provided for extension service staff.

The key farmers shall, immediately after going-back to their home schemes, take the initiative to establish a TDFP and repeatedly practise the learned farming technology. In this field exercise, the key farmers shall demonstrate the advanced paddy plantation practices such as the most adequate nursery work, a regular transplanting method using a transplantation-ruler, weeding by use of a rotary weeder, crop fertilisation using cow-dung and/or paddy straw compost, and harvesting and threshing practices using the pedal thresher, winnower, etc. Demonstration of the recommended varieties is also an essential part of the above activities.

(6) Supply of adequate farming tools and equipment

To modernise the existing paddy cultivation practices and improve the productivity to a reasonable level, adoption of adequate farming tools and equipment is essential and crucial. However, it is rather a problem that manufacturing of the proposed farming tools and equipment has stopped in most rice producing countries since paddy farming is being mechanised in those countries, and accordingly, it is becoming

difficult to purchase a number of the required set units. To deal with this situation in the international farming tool market, it is therefore proposed to manufacture all necessary farming tools and equipment within the project area for wide distribution in all the development scheme area. Thus, to train up technical staff to manufacture farming tools and equipment, it has been scheduled to organise particular training courses effectively using a function of the Nakawa Vocational Training Institute, Kampala. The proposed training course will be organised as one of the important components of the A/P, and be commenced at early stage of the implementation. The process will start with an advertisement for interested technicians in the latter half of 2008, and execution of the course using the early half of 2009. The training course will take three (3) months for completion. Fifteen technicians will be invited to participate in this course as trainees from such backgrounds as blacksmiths, carpenters, and welders .

Rationality

1) Introduction of organic farming (resources re-cycling system) is crucial in the eastern region so as to maintain soil and land productivity on a sustainable basis.
2) Introduction of new varieties instead of the existing old varieties is essential for maintaining economical rice farming.
3) Supply of quality seeds and adequate farming implements is the basis for successful establishment of economical rice production farming.
4) Introduction of the regular transplanting method is the base practice for proceeding with environmentally friendly organic farming for rice production.
5) Small-scale mechanisation as programmed is not directly effective for large reductions in the labour requirement, but it is surely helpful for improving working efficiency and the quality of paddy production as well as providing mitigation for field losses of paddy product.
6) Adoption of a seasonally uniform cropping pattern is very helpful, not only to minimise crop damage by birds and rodents, but also for reduction of field operation losses of irrigation water.
7) Accordingly, O&M of irrigation facilities could also be conducted smoothly and satisfactorily within the off-crop season.
8) Technical guidance and on-the-job practices in paddy cultivation technology will be very helpful for technical capacity building of the extension service staff, and will also contribute to privatisation of the extension service system that is primarily envisaged in the NAADS programme.
9) Creation of a cluster-type coordinating system providing close linkage amongst Pilot Schemes, and then, transfer of technology step at a time to the “target rice growers” via “key (or contact) farmers”. This process is considered to be effective so as to sustain smooth and efficient technical extension services.

Responsible Agencies

DA Office of the District Office under the supervision and guidance of MAAIF.

6.3.2 Organisational and Institutional Development

Outline

As discussed previously, an appropriate organisation for sustainable irrigation development shall be formulated to meet the objectives of sustainable management of irrigation facilities and wetland resource and a producer's cooperative. Therefore, the process requires coordination of technical assistance from various areas to train farmers in practical organisational management skills and the guidelines of wetland uses. To help farmers achieve such goals, the following two components will be implemented during the period 2008 to 2010.

1) Institutional Development: Establishing Coordination System

It is proposed that MAAIF will establish a Project Coordinating Committee and facilitate national level policy dialogue and develop a sustainable wetland development plan during 2008. The participants in the Committee include MAAIF, NARO, NAADS, NEMA, MW&E, WID, DWD, and concerned local government officials.

It is proposed that each district organise a Task Force (DTF) for wetland development and conservation to effectively support small-scale paddy growers including DAO, NAADS coordinator, CDO, DEO, DWO and DCO. The DTF is expected to develop the implementation plan and implement it in coordination with relevant offices. This is expected to increase the efficiency and effectiveness of the interventions.

2) Organisation: Nurturing Organisation for Sustainable Irrigation Development

This concerns the development of the farmers' organisations required for sustainable irrigation development and paddy cultivation in wetlands. The group of paddy growers (PRGA) will have the following three essential functions:

- Water Users Association
- Rice Production and Marketing Oriented Co-operative, and
- Wetland Association.

The representatives from PRGAs will receive training on organisational management in order to achieve self-reliance and guidance on community wetland management and participatory irrigation development. They shall also be guided to establish the function as a cooperative to carry out rice marketing activities and become federated to achieve effective and sustainable management and operation of the cooperatives in the long-term.

Action required

1) Provide training on procedures to obtain appropriate registration status and functions to become a PRGA and its authorisation
2) Technical training and capacity building of representative farmers in general as well as financial administration of the PRGA
3) Technical guidance and workshop to create a synergy between district technical staff and service providers regarding wetland management, paddy cultivation and sustainable irrigation development
4) Create a Task Force for wetland management to coordinate District Officers and service providers of various disciplines.

Rationality

1) Willingness is the most effective motive-power for development, thus capacity building of beneficiary farmers is crucial. Capacity building is also the basis for realisation of financial and administrative self-reliance in co-operative management.
2) Organisation of a PRGA and obtaining permits to use wetlands from WID/NEMA are essential.
3) Appropriate financial management and fund creation systems such as "In-kind based Micro-credit" with "Joint Guarantee", and "Revolving Funds" and Seed Banking are effective in supporting financial sustainability of PRGAs and irrigation facilities as well as improving members' livelihoods.
4) Establishing a better coordination system of technical services will advance the efficiency and effectiveness of interventions.

Outline of the Training Programme:

The programme intends to support two issues concerning farmers' organisation development. As the weaknesses of farmers' organisations identified by the farmers include the lack of knowledge in organisational and financial management, these will be addressed during the training programme.

Furthermore, they will have to comply with the guideline of wetland uses and have to manage irrigation facilities jointly with users as a group. To help them overcome the general management challenges as well as introducing and guiding them in appropriate irrigation management and wetland uses, the training programme will be conducted in 7 sessions for 20 days. The outline of the programme is presented later.

Preceding the farmers' training, the district technical staff and service providers concerning irrigation, agriculture, wetland, environment, cooperative and community development will be given guidance on skills in facilitation, wetland management, organisational management and participatory irrigation development. The trained officers will then arrange the training schedule for sessions 2 - 8. Each training session can be conducted separately according to the progress of irrigation development and organisational formation. The venue shall be arranged at the

convenience of the participants. One sub-county technical staff member will also participate so that s/he can provide follow up after the training.

Title of Sessions	No of Days	Outline
Session I: Nurturing Farmers' Organisation for Paddy Cultivation in Wetlands (Officers Only)	2	Introduction of the organisation and paddy cultivation in wetlands / participatory irrigation development / necessary permits to be acquired
Session II: Wetland Management and Livelihood	2	Introducing farmers to the sustainable uses of wetlands / analyzing linkage between livelihoods and wetland management
Session III: Organisation for Paddy Growers in Wetlands	3	Different types of organisations to help paddy growers / wetland users and irrigation users
Session IV: Registration of a Community Based Organisation (CBO)	2	Procedure of CBO registration
Session V: Organisational Capacity Building	3	Problem tree analysis / action planning / record keeping
Session VI: Financial Management for Farmers' Organisations	3	Financial record keeping / different types of funding sources
Session VII: Accessing Agriculture Supporting Services	3	How to access various agriculture supporting services
Session VIII: Participatory Irrigation Development / Wrap Up	4	Process of Participatory irrigation development / agreement exchange / O&M record keeping / WUA

Outputs:

During the A/P period, one Pilot Scheme is developed a year. From each district, two officers, one sub-county officer and two farmer representatives from each PRGA will receive training.

No. of Participants for Farmer Group Development / Capacity Building Training in 21 Districts (Short-term)

Year	Short-term		
	2008	2009	2010
No. of Schemes to be developed / district	1	1	1
Officers / NAADS Coordinator	42	42	42
	2 persons x 21 districts	2 persons x 21 districts	2 persons x 21 districts
Sub-County Officer	21	21	21
	1 person x 21 s/c	1 person x 21 s/c	1 person x 21 s/c
Farmer Representative	42	42	42
	2 persons/ scheme x 21 districts	2 persons/ scheme x 21 districts	2 persons/ scheme x 21 districts

Responsible Agencies

District Agriculture Office of each district office and NAADS will conduct the training activities.

6.3.3 Feasibility Study for Doho Integrated Development Project

(1) Outline

It is proposed to undertake a feasibility study (F/S) during the A/P period which will cover both the original Doho scheme area and the surrounding out-growers areas, because the Manafwa River supplies not only the water for the Doho scheme but also for the surrounding out-growers of Lwoba and other areas. The most important constraints are that the farmers in the Doho area not only fail to perform proper water management but also do insufficient maintenance work as a result of a low water charge rate and a collection rate less than about 50% of member farms. The farmers should have the incentive to manage, operate and maintain for the sustainable utilisation of the system. Recently, the WUA has raised the water charge to Ush. 40,000/year/acre. However, the collection rate still remains as one of the big problems. The important points that should be taken into account in the design of the F/S are as follows:

1) It is essential to establish regulations for water users associations that are strong enough to implement necessary actions regarding water control and management, including punitive rules for illegal actions such as construction of illegal water intakes, illegal blocking of drainage canals, non-payment of water charges, non-attendance to community work, etc. Also, these regulations should be promptly enforced by the management of the WUA.
2) In order to avoid water conflict in the future between the Doho Rice Scheme area, the Lwoba small-scale irrigation scheme, where the intake is located upstream of the Doho head works, and out-growers in the surrounding area, Doho and all of the neighbouring paddy field areas should be unified for the efficient utilisation of the limited Manafwa River water source through a simplified control system of irrigation water for sustainable use of the wetland.
3) For this purpose, new head works will be proposed for construction about 500m upstream of the existing Doho head works. An intake canal can be connected with the existing western main irrigation canal in the Lwoba area, which can be converted into the main lead canal for Doho, Lwoba and other surrounding out-grower areas. Its capacity will be enlarged to accommodate the required total maximum amount of water for irrigation. Just after the intake, a de-silting basin should be attached with lining. At the end of this canal, a siphon structure will be required to cross the Manafwa River to connect the lead canal with the diversion structure of the main canal at Block No.1 of the nucleus scheme. The new leading canal and main canal should be lined to reduce maintenance work and cost.

4) Through this plan, the unification of Doho and the surrounding areas can be achieved and a new water management system has to be established for the whole area that will operate as one project.
5) Currently, the main constraint of the out-growers' areas is that the irrigation and drainage functions are not clearly defined. As a result, farmers block the drainage canals to get water for their plots, which causes problems of poor drainage in the upstream end of these areas. For such areas, irrigation and drainage canals should be provided for separately and proper water management introduced in a well-established irrigation and drainage network system. An overview layout of the Doho Integrated Rehabilitation & Improvement Project is shown in Figure 6.3.1.
6) At first, the whole project area covering Doho, Lwoba, and other surrounding out-grower areas should be considered for an EIA to be undertaken along with the above-mentioned survey work, and approval should be sought from NEMA.
7) On the basis of the observed discharge data of the Manafwa River, the availability of irrigation water should be statistically analysed for reliability regarding the maximum potential irrigation acreage for double cropping in the surrounding Doho area. According to the observed discharge data recorded since 1997, the monthly minimum discharge in the dry season was recorded in July 2002 and was 3.337cu.m/sec. Such a discharge can irrigate a little bit less than 2000 ha, which is lower than the present Doho and out-grower areas estimated at 2,180 ha. It can be stated that the maximum irrigable acreage/command area for the Manafwa River has been reached. There cannot be any more expansion from the viewpoint of water availability.
8) The present water right for the Doho rice scheme is not clear. As a result, the Lwoba area located upstream is freely taking water, hence affecting the optimum water requirement of the original Doho Rice Scheme, despite the fact that it was the pioneer irrigation scheme which has no legal right to drive out the intruders. In future, such water conflicts should be avoided through proper registration permits on water rights.
9) Irrigation and Drainage Training Centre
   Currently, there are a limited number of irrigation engineers in Uganda, both amongst the staff of the MAAIF and districts. Consequently, there is need to not only promote the increase of irrigation engineers, but also plan and construct proper irrigation and drainage projects that can guarantee stable rice production. The existence of the Doho Rice Schemes in the country is of great significance. The Doho Integrated Development Project will not only include infrastructural development, but also strongly emphasize functions of training and extension of irrigation and drainage technology to engineers. Accordingly, it would be necessary, to attach a "Technology Development and Dissemination Programme for Irrigation and Drainage" to

the Doho Integrated Development Project. Accordingly, a Training Centre for Irrigation and Drainage with attached demonstration and training plots should be constructed.

10) The scheme area is lying on the alluvial plain (fan formation) that has been developed along the middle reaches of the Manafwa River. Thus the land of the scheme area is narrowly extended and has rather steep slopes with a gradient of 1/60 in the upper half portion, while it has gentle slopes of 1/200 in the lower half portion. Many old termite-mounds are scattered throughout the entire area. Accordingly, the distribution of the soils is rather complicated, especially in terms of the soil texture phases. The topographic conditions are also complicated with the micro as well as meso-reliefs under the fan-formation as well as the termites' activities. The present irrigation efficiency, as well as the cropping performance, is being directly influenced/disturbed by these two physical conditions. Thus, to assist the F/S study and then design the rehabilitation works, efficiently and satisfactorily, a detailed survey of these physical conditions is required.
11) Irrigated paddy cultivation started in 1989, immediately after construction of the irrigation facilities. However, no technical guidance or farmer training has so far been provided properly and satisfactorily, except the recent training programme, e.g., study tour to the Kilimanjaro Agricultural Development Centre (KADC), Tanzania and the workshop at Doho by the KADC expert assisted by a JICA expert. Accordingly, the majority of farmers still follow the traditional paddy cultivation practices, and hence harvest as low as 2 to 3 tons/ha on average. The advanced farmers who trained under the KADC programme are still limited to less than 10% of the total farmers in the scheme, at present. Accordingly, improvement of paddy cultivation practices shall be the basis for materialisation of sustainable irrigation and profitable paddy crop production.
12) In the scheme area, the land allotment to the participant farmers was performed in two phases, namely:
    - Phase-I: Block 1 to 3: 0.4 ha (1 acre) per household by even share
    - Phase-II: Block 4 to 6: land size per household varies widely from 0.4 to 4 ha or more due to a free offer of land allocation.

    The landholders are coming not only from the neighbouring villages but also from outside of the area (larger landholders).

    The small landholders grow paddy by themselves, while the larger landholders grow paddy by employment of farm labours. These larger landholders are not all devoted to improving paddy production technology. Thus, to achieve successful rehabilitation of the scheme, it would be necessary to re-allocate of the farmland, especially in the large holder and/or absentee portions. Accordingly, cadastre survey and mapping are essential in addressing the above concern.
13) Existing Experimental Farm Plot

The Doho Rice Scheme has the function of a crop experimental and technical demonstration plot (1.6 ha or 4 acres), and with the assistance of a JICA expert, executes crops season by season, at present. However, the performance progress is so far limited due to a lack of crop-researchers and technicians. To promote the paddy production sub-sector here in the east region, this function needs to be activated through an increase of skilled working staff and by setting up a more specific research programme with particular emphasis on the varieties adaptability test for identification of the tolerant varieties, the crop/soil fertilisation test, especially on organic manures, and the seasonal cropping test for identification of the best productive crop season. With respect to the varieties adaptability test, there is a need for tolerance to pests and diseases, especially leaf-blast, and yellow-mottled diseases.

Since none of the national agricultural research institutes under NARO have an adequate paddy research function, nor do they have irrigable farm plots for performing crop research on paddy, the experimental farm plots in the Doho Rice Scheme provide a valuable function for assisting further development of the paddy production sub-sector in Uganda.

14) Seed Multiplication Function

The Doho Rice Scheme also has the seed production function that has been created in the Pilot Project activities. Thus, other than the experimental crop work, the Scheme could undertake preservation of the recommended varieties and multiplication of the extension seeds as well as commercial seeds to assist with smooth propagation of the high-yielding and disease tolerant varieties.

(2) Action required

The F/S for the Doho Integrated Development Project will be carried out and the most suitable rehabilitation and improvement plans will be formulated covering both the original Doho Rice Scheme and the out-growers' area. For project formulation, it will be necessary to introduce a technical assistance programme and the required experts will be as follows:

1) Irrigation Engineer/Planning,
2) Hydrologist/Environment,
3) Agronomist/Soil,
4) Sociologist and Economist,
5) Architect for Design of building for Irrigation & Drainage Centre,
6) Locally, a Design Engineer, Surveyor and Cost Estimator are necessary.

Important investigations and survey items will be as follows:

1) Aerial photograph and Topographic survey,
2) Inventory survey of the existing irrigation and drainage, including a canal network survey,
3) Semi-detailed soil survey,

4) Meteorological and hydrological data collection,
5) Geological and soil mechanical investigation,
6) Agricultural and farm-economic survey,
7) Survey of the institutional supporting services in respect to the agricultural activities as well as the concerned water rights,
8) Socio-economic survey including cadastral and tenants survey,
9) Environmental impact assessment,
10) Layout plan of Irrigation and Drainage Centre.

In addition, during the F/S stage, DIOs from 21 districts and staff from MAAIF will be trained through on-the-job training, and also a plan for the establishment of an "Irrigation and drainage centre" will be formulated taking into account the appropriate scale and its financial sustainability.

(3) Rationality

The Doho Rice Scheme is categorised as a large-scale irrigation scheme. It has a great influence on the smallholders' paddy production in the Eastern Region. These smallholders imitate what the Doho farmers are doing in irrigated paddy production. However, the Doho Rice Scheme is not properly managed by the beneficiary farmers, and O&M work has not been not efficiently carried out so far. Accordingly, the irrigation facilities have malfunctioned in the major part, and now crucially need rehabilitation. Recently, the local farmers outside of the Scheme have created an intake facility in the upper stream area, and started irrigated paddy cultivation on more than 1,250 ha on the opposite side of the Manafwa River. This outside growers' activity leads to a water conflict with the Scheme. In fact, farmers in the Doho Rice Scheme are being directly affected by shortage of water, and it has become difficult to maintain the usual regular irrigation. To design rehabilitation work for the Scheme, this matter needs to be addressed and it is necessary to compile an integrated rehabilitation plan.

At the same time as the above engineering work, improvement and reinforcement of the existing water users' organisation will also be indispensable so as to maintain satisfactory and successful O&M work on the irrigation facilities. The proposed F/S was then conceived, although it is still at a preliminary level, paying particular attention to the afore-mentioned matters as the essential study items.

A plan for establishment of a "Technology Development and Dissemination Programme for Irrigation and Drainage" is envisaged taking into account the important role that the Doho Rice Scheme has played in the paddy production sub-sector in the Eastern Region. If proper training courses can be provided for capable irrigation engineers, they will play an important role in promoting sustainable irrigation development.

To materialise the afore-mentioned engineering rehabilitation work on the Doho Rice Scheme to a maximum extent, improvement of the existing paddy production technology shall be scheduled with particular emphasis on reinforcement of the

experimental crop work, settlement of the seed multiplication and distribution system, training and capacity building of the agricultural staff to execute efficient extension services for the paddy growers, and training of paddy growers to achieve technical skills in paddy cultivation practices.

(4) Responsible Agency

MAAIF with assistance from Donor(s) and NGO(s)

6.4 Cost Estimate for A/P

The cost for implementation of the A/P is presented in Table 6.4.1 and summarized in the following table.

Cost for Action Plan

(Unit: '000 Ush)

Action Plan	Land & Water Resources	Production Technology	Organisation & Institution	Environmental Conservation	Total
A/P to Cope with Area Specific Constraints		-	-	-	-
Group-1 districts	2,239,720	-	-	257,854	2,497,574
Group-2 districts	1,676,740	-	-	201,511	1,878,251
Group-3 districts	1,444,400	-	-	107,583	1,551,983
Group-4 districts	1,959,460	-	-	143,444	2,102,904
A/P to Cope with Overall Constraints		966,951	166,743		1,133,694
Management Consultants	-	-	-	-	916,441
Total	7,320,320	966,951	166,743	710,392	10,080,846

The cost for the F/S for the Doho Integrated Development Project has been separately estimated as presented in Table 6.4.1. Including this cost of Ush. 2.866 billion, the total cost for the A/P is estimated to be Ush. 12,946 billion.

6.5 Implementation Schedule of A/P

The implementation schedule has been prepared as shown in Table 6.5.1. For its preparation, the following conditions were taken into account:

1) Before the construction work, the programme for organisational and institutional development are commenced in order to get consensus for the project implementation among the community of beneficiaries,
2) Irrigation facilities are constructed during the dry season, particularly for the intake weirs,
3) Farming related programmes such as the operation of the experimental crop farm, demonstration farm and seed multiplication farm are scheduled during the crop season,
4) Activities for wetland environment monitoring are carried out basically before and after the crop season.

CHAPTER 7 CONCLUSION AND RECOMMENDATIONS

7.1 Conclusion

The implementation of the proposed Project through farmer participation is technically sound and economically feasible as verified in the P/Ps implemented in 14 locations. The Project will contribute greatly to the National target of poverty eradication through stabilisation and improvement of the smallholders' paddy production sub-sector. In addition, from an environmental viewpoint, the Project will function effectively in leading smallholders to wise use of wetland, as also verified in the P/Ps.

7.2 Recommendations

7.2.1 Recommendations to MAAIF

It is recommended to MAAIF to take the initiative as the leading Ministry for implementing the Project, in close coordination and collaboration with the other concerned authorities and agencies. However, there is a need to resolve the following hurdles as early as possible:

1) To organise a "Coordinating Committee" to operate a comprehensive monitoring and evaluation, and management of the Project and its implementation. The committee members should be the representative officials of key stakeholders and agencies, i.e., MAAIF as the chair organisation, NARO, NAADS, NEMA, MW&E, WID, DWD, and concerned local government officials;
2) To formulate and issue a practical policy for wetland development and conservation. The important issues that have to be taken into consideration in the formulation are presented in detail in Section 4.6.2 of the Pilot Project Report (Volume II) and are summarized as follows:
   - Unclear policy on buffer zones in the existing irrigation schemes as well as in the new developments to be carried out,
   - Expensive wetland water permits and annual water charges for small-scale farmers,
   - Unaffordable costs of carrying out CWMP for most farmers, and
   - Farmers' fear of government intervention.

   Regarding the above, it is crucial to demarcate possible development areas (arable land) for agricultural production, in collaboration with NEMA and WID;
3) To establish an Irrigation Department in MAAIF. This new department is to be responsible for enacting laws in irrigation development, including the small holders' sector, formulating irrigation development plans, including human resource development, technical support to district governments, supervision of irrigation development works, etc. The information presented in the final page of this chapter will contribute to MAAIF in enacting laws related to the irrigation

development. In irrigation development planning, it is proposed that the issues in the boxed article on the last page of this chapter be considered;

4) To support concerned local government to organise a Task Force (TF) for wetland development and conservation at the district level. The institutionalisation of this TF is also needed under MAAIF initiative. At the same time, the institutionalisation of PIE is also necessary at the district level through a District Irrigation Officer (DIO) in order to promote sustainable irrigation development in each district;

5) To give priority to paddy production in PMA and improve access to the NAADS programme.

7.2.2 Recommendations to NARO

It is recommended that NARO enhance the paddy research in the Doho Rice Scheme, and regularise more intensive research work in order to find out which varieties are to be recommended for paddy production. The varieties adaptability test introduced by the P/Ps should be repeated. It is recommended that more varieties are tested. Candidate varieties are made available in the international rice research institutes, i.e., IRRI and WARDA as well as in the advanced rice producing countries in Asia.

Preservation of the foundation seeds as well as the multiplication of the extension seeds of recommended varieties are also essential in NARO management. Finally, NARO should take charge of the administration related to seed production and its supply and distribution system. As for the multiplication of paddy seeds, the Doho Rice Scheme already has the most capable functions for creating a seed farm. For the supply and distribution of the paddy seeds to growers, it is necessary to create an institutional support system linked with the present function of the NAADS/Seed Company.

NARO shall also have an institutional support function for testing and selecting performing chemical fertilizers and agro-chemicals to be recommended, especially for paddy production, and then for advising the concerned trading companies for importing the most advanced fertilisers and chemicals.

In conducting paddy research, NARO is recommended to establish more close linkage with Makerere University, because it also undertakes research activities for crop production. Reinforcement of such a linkage will provide an effective function in paddy research for students and will create new researchers.

7.2.3 Recommendations to NEMA

NEMA, in collaboration with MAAIF, WID and the concerned local governments, shall correct the contradictory messages on wetland use that have been spread so far by some local leaders, civic and technical people, and hence, satisfy/relieve farmers' anxiety in the wise use of wetlands. It is proposed that NEMA, in collaboration with WID and MAAIF shall, as early as possible, demarcate the priority areas for reserves and/or conservation of the natural wetland environments as well as arable wetland

(mainly seasonal wetland) acceptable for agricultural production. Demarcation of these particular areas is essential and crucial to promote a conservation movement for wetlands in parallel with a practical land use for economic activities. The existing inventory map of wetlands and its relevant information must be useful for this land demarcation.

7.2.4 Recommendations to NAADS

NAADS needs to take up paddy production in the current programme as one of the promising crops for its scheduled programme. First it needs to extend practical programme services, preferably to the respective P/P areas, to accelerate the modernisation of paddy farming. Paddy production and such by-products as straw, husks and bran have a great added-value potential as not only staple foodstuff, but also industrial materials for various purposes, for instance, rice flour for food processing, alcohol and bran-oils for industrial use, fodder processing for animals and fish, straw-mats, rope, straw-sacks, compost for mushroom cultivation, etc. Thus, the paddy products would in the near future become one of the most important resources for generating rural industries, and hence, contribute to the socio-economic development of the eastern region.

In the Doho Rice Scheme, the foundation seeds of the promising paddy varieties have been well preserved, and in part, the extension seeds of the recommended paddy varieties have also been multiplied sufficiently for commercial seed production. Besides, potential paddy seed growers were trained through the workshop, and they have also experienced two practical exercises in the field. Thus, they are now ready to start paddy seed production, even at a commercial level. Based on the above, NAADS is therefore requested to apply its programme to the Doho Rice Scheme and assist in the promotion of the commercialisation of seed production in line with the present function of NAADS/Seed Company with the close collaboration of the authority and agencies concerned.

7.2.5 Recommendation to Local Government

The local government of the respective districts is recommended, as the implementing agency of the Project, to take the responsibility of leading the development work and then managing the performance of O&M work following the completion of the Project. To smoothly and efficiently conduct this work in the field, the concerned district offices should reinforce their working function, including staff assignment and capacity building and training of the assigned staff. In this regard, as presented in Section 7.2.1, the PIE should be institutionalised as the DIO responsible for sustainable irrigation development in each district. To deal with the preparatory work, the local government must prepare an allocated budget using a part of the local government development fund (LGDF) from LGDP.

In addition, the local government needs to organise a Task Force (TF) for wetland development and conservation to effectively support paddy growers. The TF members should include DAO, NAADS coordinator, CDO, DEO, DWO, DCO and they should

coordinate the interventions relevant to paddy growers. Because farmers and farmers' organisations, as necessary functions, have to acquire the knowledge in construction and management of irrigation facilities, paddy production, wetland management and collective marketing, all supporting services related to these technologies should be provided in a coordinated manner.

Multi-functionality of Paddy Field Irrigation

Conservation of Land

Paddy fields store rainwater temporarily. This function prevents a rapid rainwater flow, and therefore the damage that would be caused by flooding in the surrounding or downstream areas can be prevented or reduced. Moreover, fields also have a function to prevent disasters such as landslides. Paddy fields are thus contributing greatly to the conservation of land.

Fostering Water Resources

A large volume of water is stored both within and underneath paddy fields. Water led into and stored in paddy fields gradually penetrates into the ground and becomes groundwater, a part of which is slowly returned to the downstream areas rather than flowing directly through the river. Thus, paddy fields have functions to foster groundwater, an essential water resource, as well as to stabilize rivers and streams. Moreover, both paddy fields after harvest and other fields also contribute to fostering groundwater by assisting the penetration of rainwater into the ground.

Preservation of Natural Environment

There are a vast number of microorganisms, such as bacteria, living in farmland, including paddy fields and other farmland. Organic wastes such as garbage and livestock excretion are composted and recycled efficiently as resources. The existence of an enormous number of microorganisms and bacteria that exist in farmland enables plants to absorb decomposed organic matter easily through cultivation of farmland. Moreover, the plants that are grown in the fields maintain the air essential for the life of the people and animals, by absorbing carbon dioxide and emitting oxygen. In addition, fields and farm ponds greatly contribute to the preservation of the natural environment, by providing favourable habitats for various life forms.

Preservation of Wetland Environment

Normally, about 30% to 40% of irrigation water from paddy fields will be returned to the downstream area, unlike upland crop irrigation. The return flow will saturate wetland and maintain the wetland environment.

Source: Ministry of Agriculture, Forestry and Fishery, the Government of Japan

Tables

Table 3.5.1 Seasonal and Permanent Wetland Area in Each District (Excluding Open Water Area)

Name of District		Seasonal Wetland							Permanent Wetland						Total Area		District Area (km²)		
		Swamp Forest	Palms	Thickets	Grassland	Modified Small Scale	Modified Large Scale	Sub-total	Papyrus	Non Papyrus	Grassland	Modified Small Scale	Modified Large Scale	Sub-total	Total Modified	Total Wetland	District Area	Open water	District Dry Land
Iganga	Acreage (km²)	5.75	36.73	33.83	36.17	439.53		552.01	144.54			8.25		152.79	447.78	704.8	2,482.30	2.70	2,479.60
	% acreage of S/PWetland	1.04%	6.65%	6.13%	6.55%	79.62%		100%	94.60%			5.40%		100%					
	% acreage of Total Wetland	0.82%	5.21%	4.80%	5.13%	62.36%		78.32%	20.51%			1.17%		21.68%	63.53%	100%			
	% acreage Total Dryland	0.23%	1.48%	1.36%	1.46%	17.73%		22.26%	5.83%			0.33%		6.16%	18.06%	28.42%			100%
Mayuge	Acreage (km²)	0.23	12.94	18.08	33.15	67.16	0.13	131.69	56.36		2.34			58.7	67.29	190.39	4,638.50	3,556.00	1,082.50
	% acreage of S/PWetland	0.17%	9.83%	13.73%	25.17%	51.00%	0.10%	100.00%	96.01%		3.99%					100%			
	% acreage of Wetland	0.12%	6.80%	9.50%	17.41%	35.27%	0.07%	69.17%	29.60%		1.23%			30.83%	35.34%	100%			
	% acreage Total Dryland	0.02%	1.20%	1.67%	3.06%	6.20%	0.01%	12.17%	5.21%		0.22%			5.42%	6.22%	17.59%			100%
Bugiri	Acreage (km²)	3.28	90.91	24.2	21.05	64.22		203.66	103.6	0.52			11.81	115.93	76.03	319.59	5,670.90	4,101.70	1,569.20
	% acreage of S/PWetland	1.61%	44.64%	11.88%	10.34%	31.53%		100%	89.36%	0.45%			10.19%	100%					
	% acreage of Wetland	1.03%	28.45%	7.57%	6.59%	20.09%		63.73%	32.42%	0.16%			3.70%	36.27%	23.79%	100%			
	% acreage Total Dryland	0.21%	5.79%	1.54%	1.34%	4.09%		12.98%	6.60%	0.03%			0.75%	7.39%	4.85%	20.37%			100%
Busia	Acreage (km²)	1.43	67.47	37.83	7.58	14.39		128.7	13.12	9.01		29.09		51.22	43.48	179.92	759.40	28.50	730.90
	% acreage of S/PWetland	1.11%	52.42%	29.39%	5.89%	11.18%		100%	25.61%	17.59%		56.79%		100%					
	% acreage of Wetland	0.79%	37.50%	21.03%	4.21%	8.00%		71.53%	7.29%	5.01%		16.17%		28.47%	24.17%	100%			
	% acreage Total Dryland	0.20%	9.23%	5.18%	1.04%	1.97%		17.61%	1.80%	1.23%		3.98%		7.01%	5.95%	24.62%			100%
Tororo	Acreage (km²)	0.81	28.52	24.26	27.82	317.76		399.17	178.69		8.81		34.28	221.78	351.96	620.87	1,849.30	0.10	1,849.20
	% acreage of S/PWetland	0.20%	7.14%	6.08%	6.97%	79.61%		100%	80.60%		3.97%		15.43%	100%					
	% acreage of Wetland	0.13%	4.59%	3.91%	4.48%	51.18%		64.29%	28.78%		1.42%		5.51%	35.71%	56.69%	100%			
	% acreage Total Dryland	0.04%	1.54%	1.31%	1.50%	17.18%		21.59%	9.66%		0.48%		1.85%	11.99%	19.03%	33.58%			100%
Mbale	Acreage (km²)		0.1	1.09	42.15	61.83		105.17	5.15	17.96	2.29	1.87		27.27	63.7	132.44	1,372.80	-	1,372.80
	% acreage of S/Pwetland		0.10%	1.04%	40.08%	58.79%		100%	18.89%	65.86%	8.40%	6.86%		100%					
	% acreage of Wetland		0.08%	0.82%	31.83%	46.69%		79.41%	3.89%	13.56%	1.73%	1.41%		20.59%	48.10%	100%			
	% acreage Total Dryland		0.01%	0.08%	3.07%	4.50%		7.66%	0.38%	1.31%	0.17%	0.14%		1.99%	4.64%	9.63%			100%
Pallisa	Acreage (km²)		5.57	1.22	113.65	253.19		373.63	312.08		20.89	4.57		337.54	257.76	711.17	1,991.70	66.30	1,925.40
	% acreage of S/PWetland		1.49%	0.33%	30.42%	67.76%		100%	92.46%		6.19%	1.35%		100%					
	% acreage of Wetland		0.78%	0.17%	15.98%	35.60%		52.54%	43.88%		2.94%	0.64%		47.46%	36.24%	100%			
	% acreage Total Dryland		0.29%	0.06%	5.90%	13.15%		19.41%	16.21%		1.08%	0.24%		17.53%	13.39%	36.94%			100%
Kamuli	Acreage (km²)		31.15	15.4	328.93	315.69		691.17	396.83			0.25		397.08	315.94	1,088.25	4301.50	649.20	3652.30
	% acreage of S/PWetland		4.51%	2.23%	47.59%	45.67%		100%	99.94%			0.06%		100%					
	% acreage of Wetland		2.86%	1.42%	30.23%	29.01%		63.51%	36.46%			0.02%		36.49%	29.03%	100%			
	% acreage Total Dryland		0.85%	0.42%	9.01%	8.64%		18.92%	10.87%			0.01%		10.87%	8.65%	29.80%			100%
Sironko	Acreage (km²)		83.97		104.67	4.61		193.25			0.35			0.35	4.61	193.6	1,093.90	-	1,093.90
	% acreage of S/PWetland		43.43%		54.16%	2.39%		100%			100.00%			100%					
	% acreage of Wetland		43.37%		54.07%	2.38%		99.82%			0.18%			0.18%	2.38%	100%			
	% acreage Total Dryland		7.68%		9.57%	0.42%		17.67%			0.03%			0.03%	0.42%	17.70%			100%
Kumi	Acreage (km²)	0.37	72.37	0.75	555.42	60.78		689.69	106.44		193.04			299.48	60.78	989.17	2,848.10	115.70	2,732.40
	% acreage of S/PWetland	0.05%	10.49%	0.11%	80.53%	8.81%		100%	35.54%		64.46%			100.00%					
	% acreage of Wetland	0.04%	7.32%	0.08%	56.13%	6.14%		69.72%	10.76%		19.52%			30.28%	6.14%	100%			
	% acreage Total Dryland	0.01%	2.65%	0.03%	20.33%	2.22%		25.24%	3.90%		7.06%			10.96%	2.22%	36.20%			100%
Soroti	Acreage (km²)		21.04	6.39	518.2	7.48		553.11	225.2		192.05	1.14		418.39	8.62	971.5	3,377.70	503.70	2,874.00
	% acreage of S/PWetland		3.80%	1.16%	93.69%	1.35%		100%	53.83%		45.90%	0.27%		100%					
	% acreage of Wetland		2.17%	0.66%	53.34%	0.77%		56.93%	23.18%		19.77%	0.12%		43.07%	0.89%	100%			
	% acreage Total Dryland		0.73%	0.22%	18.03%	0.26%		19.23%	7.84%		6.68%	0.04%		14.56%	0.30%	33.80%			100%
Kotakwi	Acreage (km²)		22.51		1605.5	0.63		1628.64	65.45	3.46	218.01			286.92	0.63	1915.56	5,014.40	99.10	4,915.30
	% acreage of S/PWetland		1.38%		98.58%	0.04%		100%	22.81%	1.21%	75.98%			100%					
	% acreage of Wetland		1.18%		83.81%	0.03%		85.02%	3.42%	0.18%	11.38%			14.98%	0.03%	100%			
	% acreage Total Dryland		0.46%		32.66%	0.01%		33.13%	1.33%	0.07%	4.44%			5.84%	0.01%	38.97%			100%
Kaberamaido	Acreage (km²)			1.42	110.85			112.27	61.56	78.73	82.23			222.52	0	334.79	1,623.90	269.40	1,354.50
	% acreage of S/PWetland			1.26%	98.74%			100%	27.66%	35.38%	36.95%			100%					
	% acreage of Wetland			0.42%	33.11%			33.53%	18.39%	23.52%	24.56%			66.47%	0.00%	100%			
	% acreage Total Dryland			0.10%	8.18%			8.29%	4.54%	5.81%	6.07%			16.43%	0.00%	24.72%			100%
Total	Acreage (km²)	11.87	473.28	164.47	3,505.14	1,607.27	0.13	5,762.16	1,669.02	109.68	720.01	45.17	46.01	2,589.89	1,698.58	8,352.05	37,024.40	9,392.40	27,632.00
	Total % acreage S/P Wetland	0.21%	8.21%	2.85%	60.83%	27.89%	0.00%	100%	64.44%	4.23%	27.80%	1.74%	1.78%	100%					
	Total % acreage Wetland	0.14%	5.67%	1.97%	41.97%	19.24%	0.00%	68.99%	19.98%	1.31%	8.62%	0.54%	0.55%	31.01%	20.34%	100%			
	% acreage Total Dryland	0.04%	1.71%	0.60%	12.69%	5.82%	0.00%	20.85%	6.04%	0.40%	2.61%	0.16%	0.17%	9.37%	6.15%	30.23%			100%

Source: Wetland Cover Stratification Data, NBS

Table 3.5.2 Estimated Paddy Field Acreage in Each District in 2003 (Present Condition)

Name of District		Seasonal Wetland							Permanent Wetland							Total Area		District Area (km²)		
		Grassland	Potential Cultivable Area	Modified Small Scale	Cultivated Area	Modified Large Scale	Cultivated Area	Sub-total	Grassland	Cultivated Area	Modified Small Scale	Cultivated Area	Modified Large Scale	Cultivated Area	Sub-total	Total Modified	Total Wetland	District Area	Open water	District Dry Land
Iganga	Acreage (km²)	36.17		439.53				552.01			8.25				152.79	447.78	704.8	2,482.30	2.70	2,479.60
	Allocated % of Paddy & Acreage			35.00%	153.84			153.84			0.00%	0.00			0.00	153.84				
	Allocated % of Other Crops & Ac.			65.00%	285.69			285.69			100.00%	8.25			8.25	293.94				
	Total			100.00%	439.53			439.53			100.00%	8.25			8.25	447.78				100%
Mayuge	Acreage (km²)	33.15		67.16		0.13		131.69	2.34						58.7	67.29	190.39	4,638.50	3,556.00	1,082.50
	Allocated % of Paddy & Acreage			10.00%	6.72	0.00%	0.00	6.72							0.00	6.72				
	Allocated % of Other Crops & Ac.			90.00%	60.44	100.00%	0.13	60.57							0.00	60.57				
	Total			100.00%	67.16	100.00%	0.13	67.29							0	67.29				100%
Bugiri	Acreage (km²)	21.05		64.22				203.66					11.81		115.93	76.03	319.59	5,670.90	4,101.70	1,569.20
	Allocated % of Paddy & Acreage			40.00%	25.69			25.69					90.00%	10.63	10.63	36.32				
	Allocated % of Other Crops & Ac.			60.00%	38.53			38.53					10.00%	1.18	39.71					
	Total			100.00%	64.22			64.22					100.00%	11.81	11.81	76.03				100%
Busia	Acreage (km²)	7.58		14.39				128.7			29.09				51.22	43.48	179.92	759.40	28.50	730.90
	Allocated % of Paddy & Acreage			20.00%	2.88			2.88			0.00%	0.00			0.00	2.88				
	Allocated % of Other Crops & Ac.			80.00%	11.51			11.51			100.00%	29.09			29.09	40.60				
	Total			100.00%	14.39			14.39			100.00%	29.09			29.09	43.48				100%
Tororo	Acreage (km²)	27.82		317.76				399.17	8.81				34.20		221.70	351.96	620.87	1,849.30	0.10	1,849.20
	Allocated % of Paddy & Acreage			70.00%	222.43			222.43					65.00%	22.23	22.23	244.66				
	Allocated % of Other Crops & Ac.			30.00%	95.33			95.33					35.00%	4.13	4.13	99.46				
	Total			100.00%	317.76			317.76					100.00%	26.36	26.3635	344.12				100%
Mbale	Acreage (km²)	42.15		61.83				103.17	2.29		1.87				27.27	63.7	132.44	1,372.80	-	1,372.80
	Allocated % of Paddy & Acreage			40.00%	24.73			24.73			0.00%	0.00			0.00	24.73				
	Allocated % of Other Crops & Ac.			60.00%	37.10			37.10			100.00%	1.87			1.87	38.97				
	Total			100.00%	61.83			61.83			100.00%	1.87			1.87	63.70				100%
Pallisa	Acreage (km²)	113.65		253.19				373.63	20.89		4.57				337.54	257.76	711.17	1,991.70	66.30	1,925.40
	Allocated % of Paddy & Acreage			60.00%	151.91			151.91			0.00%	0.00			0.00	151.91				
	Allocated % of Other Crops & Ac.			40.00%	101.28			101.28			100.00%	4.57			4.57	105.85				
	Total			100.00%	253.19			253.19			100.00%	4.57			4.57	257.76				100%
Kumuli	Acreage (km²)	328.93		315.69				691.17			0.25				397.08	315.94	1,088.25	4,301.50	649.20	3,652.30
	Allocated % of Paddy & Acreage			15.00%	47.35			47.35			0.00%	0.00			0.00	47.35				
	Allocated % of Other Crops & Ac.			85.00%	268.34			268.34			100.00%	0.25			0.25	268.59				
	Total			100.00%	315.69			315.69			100.00%	0.25			0.25	315.94				100%
Sironko	Acreage (km²)	104.67		4.61				193.25	0.35						0.35	4.61	193.60	1,093.90	-	1,093.90
	Allocated % of Paddy & Acreage			5.00%	0.23			0.23							0.00	0.23				
	Allocated % of Other Crops & Ac.			95.00%	4.38			4.38							0.00	4.38				
	Total			100.00%	4.61			4.61							0	4.61				100%
Kumi	Acreage (km²)	555.42		60.78				689.69	193.04						299.48	60.78	989.17	2,848.10	115.70	2,732.40
	Allocated % of Paddy & Acreage			50.00%	30.39			30.39							0.00	30.39				
	Allocated % of Other Crops & Ac.			50.00%	30.39			30.39							0.00	30.39				
	Total			100.00%	60.78			60.78							0	60.78				100%
Soroti	Acreage (km²)	518.20		7.48				553.11	192.05		1.14				418.39	8.62	971.50	3,377.70	503.70	2,874.00
	Allocated % of Paddy & Acreage			20.00%	1.50			1.50			0.00%	0.00			0.00	1.50				
	Allocated % of Other Crops & Ac.			80.00%	5.98			5.98			100.00%	1.14			1.14	7.12				
	Total			100.00%	7.48			7.48			100.00%	1.14			1.14	8.62				100%
Katakwi	Acreage (km²)	1,605.50		0.63				1628.64	218.01						286.92	0.63	1,915.56	5,014.40	99.10	4,915.30
	Allocated % of Paddy & Acreage			10.00%	0.06			0.06							0.00	0.06				
	Allocated % of Other Crops & Ac.			90.00%	0.57			0.57							0.00	0.57				
	Total			100.00%	0.63			0.63							0	0.63				100%
Kaberamaido	Acreage (km²)	110.85		0				112.27	82.23						222.52	0	334.79	1,623.90	269.40	1,354.50
	Allocated % of Paddy & Acreage			0.00%	0.00			0.00							0.00	0.00				
	Allocated % of Other Crops & Ac.			100.00%	0.00			0.00							0.00	0.00				
	Total			100.00%	0			0							0	0.00				100%
Total	Acreage (km²)	3,505.14		1,607.27		0.13		5,762.16	720.01		45.17		48.61		2,192.81	1,698.58	8,352.05	37,024.40	9,392.40	27,632.00
	Allocated % of Paddy & Acreage	40.00%	1,402.06	41.54%	667.73	0.00%	0.00	667.73			0.00%	0.00	67.60%	32.86	32.86	700.59				
	Allocated % of Other Crops & Ac.	60.00%	2,103.08	58.46%	939.54	100.00%	0.13	939.67			100.00%	45.17	32.40%	6.45	50.48	990.16				
	Total	100.00%	3,505.14	100.00%	1607.27	100.00%	0.13	1607.40			100.00%	45.17	80.88%	39.3135	83.3435	1690.7435				100%

Source: Field investigation made by the JICA Study Team based on Wetland Cover Stratification Data, NBS and 1:50,000 topographical maps

Table 3.5.3 Categorisation of the Existing Paddy Field

(Unit: ha)

Categolization	No.	District	Agricultural Zone	Existing Small Scale				Existing Permanent Wetland			Existing Paddy Field Total
			% of the Modified Sesonal	Sub-total	Type I	Type II	Type III	Small Scale	Large Scale	Sub-total	
Extrimly Over Cultivated Districts	1	Tororo	I	(%)	15	70	15				
			79.61%	22,246	3,337	15,572	3,337	-	2,220	2,220	24,466
	2	Iganga	II	(%)	30	60	10				
			79.62%	15,384	4,615	9,230	1,538	-	-	-	15,384
	3	Pallisa	III	(%)	40	50	10				
			67.76%	15,191	6,076	7,596	1,519	-	-	-	15,191
		Sub-total		**52,821**	**14,029**	**32,398**	**6,394**	-	**2,220**	**2,220**	**55,041**
Over Cultivated District	4	Kamuli	III	(%)	45	50	5				
			45.67%	4,735	2,131	2,368	237	-	-	-	4,735
	5	Bugiri*	I	(%)	10	70	20				
			31.53%	2,572	257	1,800	514	-	1,060	1,060	3,632
	6	Mbale	I	(%)	20	60	20				
			58.79%	2,473	495	1,484	495	-	-	-	2,473
	7	Mayuge	II	%	40	60	0				
			51.00%	672	269	403	0	-	-	-	672
		Sub-total		**10,452**	**3,151**	**6,055**	**1,246**	-	**1,060**	**1,060**	**11,512**
Less cultivated Districts	8	Kumi	III	(%)	40	50	10				
			8.81%	3,039	1,216	1,520	304	-	-	-	3,039
	9	Busia	I	(%)	30	70	0				
			11.18%	288	86	202	0	-	-	-	288
	10	Soroti	IV	(%)	50	50	0				
			1.35%	150	75	75	0	-	-	-	150
	11	Sironko	I	(%)	20	50	30				
			2.39%	23	5	12	7	-	-	-	23
	12	Katakwi	IV	(%)	100	0	0				
			0.04%	6	6	0	0	-	-	-	6
	13	Kaberamaido	IV	(%)	0	0	0				
			0.00%	0	0	0	0	-	-	-	0
		Sub-total		**3,506**	**1,388**	**1,808**	**311**	-	-	-	**3,506**
	Total			**66,779**	**18,567**	**40,261**	**7,951**	-	**3,280**	**3,280**	**70,059**
	% of the Existing Small-Scale			100.00%	27.80%	60.29%	11.91%				
	% of the Existing Total			95.32%	26.50%	57.47%	11.35%	0.00%	4.68%	4.68%	100.00%

Note: *; Kibimba Rice Scheme (1,060 ha) in Bugiri district is leased to a privated company of "Tilda" and accordingly not covered by the Study. The paddy fields covered by the Study is thus calculated at about 69,000 ha in which the areas in and around the Doho Rice Scheme are included.

Source: Estimated by JICA Study Team based on data from NBS and field investigation

Table 4.1.1 Estimation of the Potential Paddy Field Area for Long-Term Plan

Unit: km²

Name of District	Potential Wetland Utilization						District Dry land	20	Possible Expansion of Cultivable Area	Grassland Area		Diversified Paddy Area from the other crop	Paddy Field Area		
	Present Paddy Field			Present Total Modified	Potential Seasonal Wetland	Maximum Allowable Cultivable Area(25%)		1/20 of the District Dry land		Grassland Area	New Paddy Area		Newly Developed Paddy Field	Total Potential Paddy Area	%of the Potential Wetland
Wetland	Seasonal	Permanent	Total	Seasonal	Seasonal	Seasonal	⑤	⑥=⑤/20	⑦=Min (⑧,④-②)	⑧	⑨	⑩=Min (⑥-①,②-①)	⑪=⑨+⑩	⑫=⑪+①	⑬=⑫/③
Estimation	①			②	③	④=③x0.25									
Iganga	**153.84**	-	**153.84**	**439.53**	552.01	138.00	2,479.60	123.98	-	36.17	-	-	-	153.84	27.87%
Mayuge	6.72	-	6.72	**67.16**	131.69	32.92	1,082.50	54.13	-	33.15	-	47.41	47.41	54.13	41.10%
Bugiri	25.69	10.63	36.32	**64.22**	203.66	50.92	1,569.20	78.46	-	21.05	-	38.53	38.53	74.85	36.75%
Busia	2.88	-	2.88	14.39	128.70	32.18	730.90	36.55	7.58	7.58	7.58	11.51	19.09	21.97	17.07%
Tororo	**222.43**	22.23	244.66	**317.76**	399.17	99.79	1,849.20	92.46	-	27.82	-	-	-	244.66	61.29%
Mbale	24.73	-	24.73	**61.83**	105.17	26.29	1,372.80	68.64	-	42.15	-	37.10	37.10	61.83	58.79%
Pallisa	**151.91**	-	151.91	**257.76**	373.63	93.41	1,925.40	96.27	-	113.65	-	-	-	151.91	40.66%
Kamuli	47.35	-	47.35	**315.69**	691.17	172.79	3,652.30	182.62	-	328.93	-	135.26	135.26	182.61	26.42%
Sironko	0.23	-	0.23	4.61	193.25	48.31	1,093.90	54.70	43.70	104.67	43.70	4.38	48.08	48.31	25.00%
Kumi	30.39	-	30.39	60.78	689.69	172.42	2,732.40	136.62	111.64	555.42	111.64	30.39	142.03	172.42	25.00%
Soroti	1.50	-	1.50	7.48	553.11	138.28	2,874.00	143.70	130.80	518.20	130.80	5.98	136.78	138.28	25.00%
Katakwi	0.06	-	0.06	0.63	1,628.64	407.16	4,915.30	245.77	406.53	1,605.50	406.53	0.57	407.10	407.16	25.00%
Kaberamaido	-	-	-	-	112.27	28.07	1,354.50	67.73	28.07	110.85	28.07	-	28.07	28.07	25.00%
Total	667.73	32.86	700.59	1,698.58	5,762.16	1,440.54	27,632.00	1,381.60	728.32	3,505.14	728.32	311.13	1,039.45	1,740.04	30.20%
% to the District Dry Land	2.4%			6.1%	20.9%	5.21%	100.00%	5.00%	2.64%	12.69%	2.64%	1.13%	3.76%	6.30%	6.30%
% to the Potential Wetland	11.59%			29.48%	100.00%	25.00%		23.98%	12.64%	60.83%	12.64%	5.40%	18.04%	30.20%	30.20%

Source: JICA Study Team

Note : ① The bold figures are already exceeded the necessary catchment area for the paddy field ⑥.

② The bold figures are already exceeded the maximum allowable wetland modification ④.

④ According to the wetland utilization, the allowable maximum utilization of the wetland is less than 25%

⑥ The necessary catchment area to secure the irrigation water for paddy field is estimated at 1:20

⑦ When the ② is still within the ④, the area ④—② can be cultivated for the paddy within the area of the grass land.

⑨ When the grass land area is more than the ⑦, the area can be newly cultivated for paddy field area.

⑩ When the present paddy field area ① is less than the ⑥, the present crop in the modified area can be converted into paddy field.

Table 4.1.2 Estimation of Potential Paddy Field Acreage in Each District for Long-Term Plan

Name of District		Seasonal Wetland								Permanent Wetland						Total Area		District Area (km²)		
		1/20 of the District Dryland (Catchment Area)	Grassland	Newly Cultivate Paddy Field	Modified Small Scale	Present Cultivated Area	Maximum Allowble Cultivation 25% of wetland	Newly Diversified	Total Seasonal Wetland	Grassland	Modified Small Scale	Cultivated Area	Modified Large Scale	Cultivated Area	Sub Total of Permanent Wetland	Total Modified	Total Wetland	District Area	Open water	District Dry Land
Iganga	Acreage (km²)		36.17		439.53	79.62%	138.00		552.01		8.25				152.79	447.78	704.8	2,482.30	2.70	2,479.60
	Allocated % of Paddy & Acreage	123.98		0.00	35.00%	153.84	0.00	0.00	153.84		0.00%	0.00			0.00	153.84	21.83%			
	Allocated % of Other Crops & Ac.				65.00%	285.69		285.69	285.69		100.00%	8.25			8.25	293.94	41.71%			
	Total				100.00%	439.53			439.53		100.00%	8.25			8.25	447.78	63.53%			100%
Mayuge	Acreage (km²)		33.15		67.16	51.00%	32.92		131.69	2.34					38.7	67.29	190.39	4,638.50	3,556.00	1,082.50
	Allocated % of Paddy & Acreage	54.13		0.00	10.00%	6.72	0.00	47.41	54.13						0.00	54.13	28.43%			
	Allocated % of Other Crops & Ac.				90.00%	60.44		13.04	13.04						0.00	13.04	6.85%			
	Total				100.00%	67.16			67.16						0.00	67.16	35.27%			100%
Bugiri	Acreage (km²)		21.05		64.22	31.53%	50.92		203.66				11.81		115.93	76.03	319.59	5,670.90	4,101.70	1,569.20
	Allocated % of Paddy & Acreage	78.46		0.00	40.00%	25.69	0.00	38.53	64.22				90.00%	18.63	10.63	74.85	23.42%			
	Allocated % of Other Crops & Ac.				60.00%	38.53		0.00	0.00				10.00%	1.18	1.18	1.18	0.37%			
	Total				100.00%	64.22			64.22				100.00%	11.81	11.81	76.03	23.79%			100%
Busia	Acreage (km²)		7.58		14.39	11.18%	32.18		128.70		29.09				51.22	43.48	179.92	759.40	28.50	730.90
	Allocated % of Paddy & Acreage	36.55		7.58	20.00%	2.88	17.79	11.51	21.97		0.00%	0.00			0.00	21.97	12.21%			
	Allocated % of Other Crops & Ac.				80.00%	11.51		0.00	0.00		100.00%	29.09			29.09	29.09	16.17%			
	Total				100.00%	14.39			21.97		100.00%	29.09			29.09	51.06	28.38%			100%
Tororo	Acreage (km²)		27.82		317.76	79.61%	99.79		399.17	8.81			34.20		221.70	351.96	620.87	1,849.30	0.10	1,849.20
	Allocated % of Paddy & Acreage	92.46		0.00	70.00%	222.43	0.00	0.00	222.43				65.00%	22.23	22.23	244.66	39.41%			
	Allocated % of Other Crops & Ac.				30.00%	95.33		95.33	95.33				35.00%	11.97	11.97	107.30	17.28%			
	Total				100.00%	317.76			317.76				100.00%	34.2	34.20	351.96	56.69%			100%
Mbale	Acreage (km²)		42.15		61.83	58.79%	26.29		105.17	2.29	1.87				27.27	63.70	132.44	1,372.80	-	1,372.80
	Allocated % of Paddy & Acreage	68.64		0.00	40.00%	24.73	0.00	37.10	61.83		0.00%	0.00			0.00	61.83	46.69%			
	Allocated % of Other Crops & Ac.				60.00%	37.10		0.00	0.00		100.00%	1.87			1.87	1.87	1.41%			
	Total				100.00%	61.83			61.83		100.00%	1.87			1.87	63.70	48.10%			100%
Pallisa	Acreage (km²)		113.65		253.19	67.76%	93.41		373.63	20.89	4.57				337.34	257.76	711.17	1,991.70	66.30	1,925.40
	Allocated % of Paddy & Acreage	96.27		0.00	60.00%	151.91	0.00	0.00	151.91		0.00%	0.00		0	0	151.91	21.36%			
	Allocated % of Other Crops & Ac.				40.00%	101.28		101.28	101.28		100.00%	4.57		0	5	105.85	14.88%			
	Total				100.00%	253.19			253.19		100.00%	4.57		0	5	257.76	36.24%			100%
Kamuli	Acreage (km²)		328.93		315.69	45.67%	172.79		691.17		0.25				397.08	315.94	1088.25	4301.50	649.20	3652.30
	Allocated % of Paddy & Acreage	182.62		0.00	15.00%	47.35	0.00	135.26	182.62		0.00%	0.00			0.00	182.62	16.78%			
	Allocated % of Other Crops & Ac.				85.00%	268.34		133.08	133.08		100.00%	0.25			0.25	133.33	12.25%			
	Total				100.00%	315.69			315.69		100.00%	0.25			0.25	315.94	29.03%			100%
Sironko	Acreage (km²)		104.67		4.61	2.39%	48.31		193.25	0.35					0.35	4.61	193.6	1,093.90	-	1,093.90
	Allocated % of Paddy & Acreage	54.70		43.70	5.00%	0.23	43.70	4.38	48.31						0.00	48.31	24.95%			
	Allocated % of Other Crops & Ac.				95.00%	4.38		0.00	0.00						0.00	0.00	0.00%			
	Total				100.00%	4.61			48.31						0.00	48.31	24.95%			100%
Kumi	Acreage (km²)		533.42		60.78	8.81%	172.42		689.69	193.04					299.48	60.78	989.17	2,848.10	115.70	2,732.40
	Allocated % of Paddy & Acreage	136.62		111.64	50.00%	30.39	111.64	30.39	172.42						0.00	172.42	17.43%			
	Allocated % of Other Crops & Ac.				50.00%	30.39		0.00	0.00						0.00	0.00	0.00%			
	Total				100.00%	60.78			172.42						0.00	172.42	17.43%			100%
Soroti	Acreage (km²)		318.20		7.48	1.35%	138.28		553.11	192.05	1.14				418.39	8.62	971.5	3,377.70	503.70	2,874.00
	Allocated % of Paddy & Acreage	143.70		130.80	20.00%	1.50	130.80	5.98	138.28		0.00%	0.00		0	0.00	138.28	14.23%			
	Allocated % of Other Crops & Ac.				80.00%	5.98		0.00	0.00		100.00%	1.14		0	1.14	1.14	0.12%			
	Total				100.00%	7.48			138.28		100.00%	1.14		0	1.14	139.42	14.35%			100%
Kotakwi	Acreage (km²)		1,505.50		0.63	0.04%	407.16		1,628.64	218.01					286.92	0.63	1915.56	5,014.40	99.10	4,915.30
	Allocated % of Paddy & Acreage	243.77		406.53	10.00%	0.06	406.53	0.57	407.16						0.00	407.16	21.26%			
	Allocated % of Other Crops & Ac.				90.00%	0.57		0.00	0.00						0.00	0.00	0.00%			
	Total				100.00%	0.63			407.16						0.00	407.16	21.26%			100%
Kaberamaido	Acreage (km²)		110.85		0	0.00%	28.07		112.27	82.23					222.52	0	334.79	1,623.90	269.40	1,354.50
	Allocated % of Paddy & Acreage	67.73		28.07	0.00%	0.00	28.07	0.00	28.07						0.00	28.07	8.38%			
	Allocated % of Other Crops & Ac.				100.00%	0.00		0.00	0.00						0.00	0.00	0.00%			
	Total				100.00%	0			28.07						0.00	28.07	8.38%			100%
Total	Acreage (km²)		3,505.14		1607.27	27.89%	1,440.54		5,762.16	720.01	45.17		46.01		2,192.81	1,698.58	8,352.05	37,024.40	9,392.40	27,632.00
	Allocated % of Paddy & Acreage	1,381.60		728.32	41.54%	667.73	738.53	311.13	1,707.18		0.00%	0.00	71.42%	32.86	32.86	1,740.04	20.83%			
	Allocated % of Other Crops & Ac.				58.46%	939.54		628.41	628.41		100.00%	45.17	28.58%	13.15	58.32	686.73	8.22%			
	Total				100.00%	1,607.27			2,335.59		100.00%	45.17	100.00%	46.01	91.18	2,426.77	29.06%			100%

Source: JICA Study Team

Table 5.4.1 Paddy Filed and Paddy Production under With and Without Project Conditions

		Unit	Present Condition (Yr.2006)	Without Project (Yr.2017)			With Project (Yr.2017)					Change in Area and Production (With - Without)
				From Existing Paddy Field	From Future Paddy Filed	Total	From Existing Paddy Field		From Future Paddy Filed		Total	
							Not Covered by the Project	Covered by the Project	Not Covered by the Project	Covered by the Project		
(1) Indivisual Smallholders												
Present Paddy Filed	a/	ha	66,780	66,780	0	66,780	56,300	10,000		0	66,300	-480
Future Development Area	a/	ha	0	0	40,000	40,000	0	0	30,000	10,000	40,000	0
Total Paddy Field	a/	ha	66,780	66,780	40,000	106,780	56,300	10,000	30,000	10,000	106,300	-480
Unit Yield (paddy with husk)		ton/ha	1.83	1.83	1.83		1.83	5.00	1.83	5.00		
Unit Yield (rice)	b/	ton/ha	1.24	1.24	1.24		1.24	3.40	1.24	3.40		
Cropping Intensity of Paddy Rice	b/		1.40	1.40	1.40		1.40	1.80	1.40	1.80		
Rice Production	b/	ton	116,341	115,930	69,440	185,370	97,737	61,200	52,080	61,200	272,217	86,847
(2) Doho Rice Scheme												
Present Paddy Filed	a/	ha	2,220	2,220	0	2,220	0	2,700	0	0	2,700	480
Future Development Area	a/	ha	0	0	0	0	0	0	0	0	0	0
Total Paddy Field	a/	ha	2,220	2,220	0	2,220	0	2,700	0	0	2,700	480
Unit Yield (paddy with husk)		ton/ha	2.85	2.85				6.00				
Unit Yield (rice)	b/	ton/ha	1.94	1.94				4.08				
Cropping Intensity of Paddy Rice	b/		1.70	1.70				2.00				
Rice Production	b/	ton	7,314	7,314		7,314		22,032			22,032	14,718
(3) Total Study Area (excl. Kibimba Scheme)												
Total Paddy Field	a/	ha	69,000	69,000	40,000	109,000	56,300	12,700	30,000	10,000	109,000	0
Rice Production in the Study Area	b/	ton	123,655	123,244	69,440	192,684	97,737	83,232	52,080	61,200	294,249	101,565
Momo. Items												
Production Share of the Study Area	b/	%	86			85					96	
Production in Other Area of Uganda	b/		20,345			33,890					33,890	0
Uganda's Total Production of Rice	b/	ton	144,000			226,574					306,107	79,533
Population	c/	1000	25,500			40,866					40,866	0
Per Capita Consumption of Rice	d/	kg/year	8.0			10.5					10.5	0
Uganda's Total Consumption of Rice	d/	ton	204,000			429,093					429,093	0
Uganda's Rice Import	d/	ton	60,000			202,519					122,986	-79,533

Source:

a/; JICA Study Team estimate based on "Wetland Cover Statification Data" from NBS (National Biomass Study).

b/; JICA Study Team estimate based on data and information obtained from the field survey and those from MAAIF and UBOS

c/; JICA Study Team estimate based on data from UBOS: Uganda's 2006 population is estimaed to be 27.48 millon by applying growth rate of 3.2% p.a. of 1991-2002 period. For this table, however, 25.5 million is applied taking into account other national conditions of rice production and import which estimates have been made based on data from other sources.

d/; JICA Study Team estimate based on data available in the Food Security and Exports, 1992/93, and those from FAO Sat.

Table 5.4.2 Evaluation of Needs and Potentials for Irrigation Development by Districts

	Unit	1	2	3	4	5	6	7	8	9	10	11	12	13
		Iganga	Mayuge	Bugiri	Busia	Tororo	Mbale	Pallisa	Kamuli	Sironko	Kumi	Soroti	Katakwi	Kabera maido
A. Degree of Seasonal Swamp Development (propotion of modified area to seasonal wetland)														
(1) Seasonal Wetland a/	(Sq. Km)	552.0	131.7	203.7	128.7	399.2	105.2	373.6	691.2	193.3	689.7	553.1	1,628.6	112.3
(2) Modified land a/	(Sq. Km)	439.5	67.2	64.2	14.4	317.8	61.8	253.2	315.7	4.6	60.8	7.5	0.6	0.0
(3) (2/1*100)	(%)	79.6	51.0	31.5	11.2	79.6	58.8	67.8	45.7	2.4	8.8	1.4	0.0	0.0
(4) Evaluated Score	(Score)	10	6.4	4.0	1.4	10.0	7.4	8.5	5.7	0.3	1.1	0.2	0.0	0.0
B. Existing Paddy Land (propotion of existing paddy land to agriculture land)														
(1) Agriculture land b/	(Sq. Km)	2196.7	684.8	1093.7	559.0	1535.9	1009.3	1464.1	2527.5	523.7	1671.8	1813.5	2254.2	898.6
(2) Existing paddy land c/	(Sq. Km)	162.1	6.7	37.5	32.0	256.6	26.6	156.5	47.6	0.2	30.4	2.6	0.1	0.0
(3) (2/1*100)	(%)	7.4	1.0	3.4	5.7	16.7	2.6	10.7	1.9	0.0	1.8	0.1	0.0	0.0
(4) Evaluated Score	(Score)	4.4	0.6	2.1	3.4	10.0	1.6	6.4	1.1	0.0	1.1	0.1	0.0	0.0
C. Paddy production system (paddy production Zone I - IV)														
(1) Paddy production zone d/	(Zone)	II	II	I	I	I	I	III	III	I	III	IV	IV	IV
(2) Evaluated Score	(Score)	7.5	7.5	10	10	10	10	5	5	10	5	2.5	2.5	2.5
D. Possible diversification (proportion of potential area for crop diversification to paddy to existing paddy land)														
(1) Existing paddy land c/	(Sq. Km)	162.1	6.7	37.5	32.0	256.6	26.6	156.5	47.6	0.2	30.4	2.6	0.1	0.0
(2) Potential area for crop diversification c/	(ha)	0	4741	3853	1151	0	3710	0	13526	438	3039	598	57	0
(3) (2/1*100)	(%)	0.0	705.5	102.7	36.0	0.0	139.5	0.0	284.2	1904.3	100.0	226.5	950.0	-
(4) Evaluated Score	(Score)	0.0	3.7	0.5	0.2	0.0	0.7	0.0	1.5	10.0	0.5	1.2	5.0	0.0
E. Possible new paddy development (proportion of potential new paddy development area to existing agriculture land)														
(1) Existing agriculture land b/	(Sq. Km)	2196.7	684.8	1093.7	559.0	1535.9	1009.3	1464.1	2527.5	523.7	1671.8	1813.5	2254.2	898.6
(2) Potential new paddy development area c/	(Sq. Km)	0.0	0.0	0.0	7.6	0.0	0.0	0.0	0.0	43.7	111.6	130.8	406.5	28.1
(3) (2/1*100)	(%)	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.0	8.3	6.7	7.2	18.0	3.1
(4) Evaluated Score	(Score)	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	4.6	3.7	4.0	10.0	1.7

Source: a/; Wetland maps (1/50,000)
b/; Topographic maps (1/50,000), land use and coverage maps (1/50,000), wetland maps (1/50,000), Statistical Abstract, 2003, UBOS
c/; Estimated by the JICA Study Team based on wetland maps (1/50,000), topographic maps (1/50,000), and Landsat data
d/; JICA Study Team

Table 5.4.3 Environmental Activities in Each District of Development Plan

Items	Name of Old District	Iganga		Tororo		Pallisa		Mayuge	Bugiri	Busia	Mbale			Kamuli		Sironko	Kumi		Soroti	Katakwi		Kaberamaido	Total
	Name of New Districts	Namutumba	Iganga	Butaleja	Tororo	Budaka	Pallisa	Mayuge	Bugiri	Busia	Mnafa	Mbale	Bududa	Kaliro	Kamuli	Sironko	Kumi	Bukedea	Soroti	Amuria	Katakwi	Kaberamaido	
	Categorization	1	1	1	1	1	1	2	2	2	2	2	2	2	2	1	1	3	4	1	1	4	
Number of Pilot Schemes	Short-term (2008-2010)	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	62
	Mid-term (2011-2013)	18	18	18	18	18	18	20	30	8	10	10	2	18	18	30	20	20	33	20	20	33	400
	Long-term (2014-2017)	100	100	100	100	100	100	21	27	17	14	14	1	28	28	67	100	100	200	100	100	120	1,537
	Total Area (ha)	1,210	1,210	1,210	1,210	1,210	1,210	440	600	280	270	270	60	490	490	1,000	1,230	1,230	2,260	1,230	1,230	1,560	20,000
Environmental activities in D/P	Type of Development	Rehabilitation						Improvement								Diversification			New Development				
	Nber of Watersheds	3	3	3	3	3	3	1	2	1	1	1	1	1	1	2	3	3	5	3	3	4	50
	Nber EIA	2	2			2	2	1	2					1	1		2	2	2	1	1	1	22
	Total nber of Project Briefs in Short- term (2008-2017)	1PB	1PB	1PB	1PB	1PB	1PB	1PB	1PB	1PB	1PB	1PB	1PB	1PB	1PB	1PB	1PB	1PB	1PB	1PB	1PB	1PB	21PB
	Total nber of Project Briefs in Mid- term (2011-2013)	2PB	2PB	2PB	2PB	2PB	2PB	0PB	1PB	0PB	0PB	0PB	0PB	0PB	0PB	1PB	0PB	0PB	2PB	1PB	1PB	2PB	20PB
	Total nber of Project Briefs in Long- term (2014-2017)	0PB	0PB	0PB	0PB	0PB	0PB	0PB	0PB	0PB	0PB	0PB	0PB	0PB	0PB	0PB	2PB	2PB	2PB	1PB	1PB	1PB	9PB
	Total nber of P/E in Short- term (2008-2017)	1P 0E	1P 0E	1P 0E	1P 0E	1P 0E	1P 0E	0P 0E	0P 0E	1P 0E	1P 0E	1P 0E	1P 0E	0P 0E	0P 0E	1P 0E	1P 0E	1P 0E	1P 0E	1P 0E	1P 0E	1P 0E	17P 0E
	Total nber of P/E in Mid- term (2011-2013)	0 P 2 E	0 P 2 E	2P 0E	2P 0E	0 P 2 E	0 P 2 E	0P 1E	0P 2E	0P 0E	0P 0E	0P 0E	0P 0E	0P 0E	0P 0E	1P 0E	0P 0E	0P 0E	2P 0E	1P 0E	1P 0E	2P 0E	11P 11E
	Total nber of P in Long- term (2014-2017)	0P 0E	0P 0E	0P 0E	0P 0E	0P 0E	0P 0E	0P 0E	0P 0E	0P 0E	0P 0E	0P 0E	0P 0E	0P 1E	0P 1E	0P 0E	0P 2E	0P 2E	0P 2E	0P 1E	0P 1E	0P 1E	0P 11E
	Total nber of w in Short- term (2008-2017)	9w	9w	9w	9w	9w	9w	9w	9w	9w	9w	9w	9w	9w	9w	9w	9w	9w	9w	9w	9w	9w	189w
	Total nber of s in Short- term (2008-2017)	4s	4s	4s	4s	4s	4s	4s	4s	4s	4s	4s	4s	4s	4s	4s	4s	4s	4s	4s	4s	4s	84s
	Total nber of w in Mid- term (2011-2013)	15w	15w	27w	27w	15w	15w	9w	18w	9w	9w	9w	9w	9w	9w	18w	9w	9w	27w	18w	18w	27w	321w
	Total nber of s in Mid- term (2011-2013)	6s	6s	10s	10s	6s	6s	2s	6s	2s	2s	2s	2s	2s	2s	6s	2s	2s	10s	6s	6s	10s	106s
	Total nber of w in Long- term (2014-2017)	36w	36w	36w	36w	36w	36w	12w	24w	12w	12w	12w	12w	12w	12w	24w	18w	18w	42w	27w	27w	39w	519w
	Total nber of s in Long- term (2014-2017)	12s	12s	12s	12s	12s	12s	4s	8s	4s	4s	4s	4s	4s	4s	8s	8s	8s	16s	10s	10s	14s	182s

Legend: w : water analysis
s: soil analysis
S08-S13: Short-term 2008-2010
M11-M13: Mid-term 2011-2013
L14-L17: Long -term 2014-2017

CWMP=P
EIA=E
Figures in [ ] refer to Watershed number

Assumptions and Activities in 1 watershed theme:

1/ At most 50 Pilot schemes of 10 ha each are grouped in one 500 ha watershed to constitute 1 watershed scheme
2/ Each district may have have one or several watershed schemes, e.g., Iganga has 3, Mayuge has 1, Bugiri 2, etc.
3/ Based on a cropping calendar of 2 annual crops, 3 water samplings (3w) are undertaken every year: 1 at the beginning of season, 1 at end of first growing season, 1 at end of second growing season
4/ Water samples are taken at 1 location of the main inlet of watershed and at 1 location (few meters) downstream of watershed outlet
5/ Ph and EC are measured at inlet location along with Nitrates, Phosphorus and Pollutants from Agrochemicals, again Nitrates, Phosphorus and Pollutants from Agrochemicals are measured at the outlet location (a total of 8 items in the whole watershed: 5items upstream and 3items at downstream location)
6/ Based on a cropping calendar of 2 annual crops, 2 soil samplings (2s) are undertaken every other year: 1 at the beginning of first growing season (to give advice to farmers before starting production), 1 at end of first growing season before the beginning of second growing season (to give advice to farmers for the second growing season)
7/ Soil samples are taken at 2 locations (1 point at each side of main river stream) at the upstream stretch of watershed, 2 locations (1 point at each side of main river stream) at midstream stretch of watershed and 2 locations (1 point at each side of main river stream) at the downstream stretch of watershed.
8/ 12 items are measured at each location, which pertain to parameters necessary in agricultural production, including pH, EC, calcium, Magnesium, Sodium and Potassium, etc.
9/ In the first 3 years of D/P (Short term or learning stage), all activities will be undertaken in only 1 watershed. From the Mid-term stage, they will be spread to other watersheds.

Table 5.5.1 Cost for Development Plan

(Unit: '000 Ush)

	Short-term									Mid-term									Long-term									Grand Total Cost
	Quantities					Cost			Total Cost	Quantities					Cost			Total Cost	Quantities						Cost			Total Cost	
	2008	2009	2010	Unit	Unit Cost	2008	2009	2010		2011	2012	2013	Unit	Unit Cost	2011	2012	2013		2014	2015	2016	2017	Unit	Unit Cost	2014	2015	2016	2017		
1. D/P to Cope with Area-specific Constrains																														
1-1. Group-1 D/P Area (Namutumba, Tororo, Budaka and Pallisa)																														
A) Land and Water Resources Development Component:																														
(Number of Pilot Schemes : 726 Schemes)																														
1) Rehabilitation Programme																														
- 1st Year	6			schemes	17,540	105,240	0	0	105,240	25			schemes	17,540	438,500	0	0	438,500	75				schemes	17,540	1,315,500	0	0	0	1,315,500	1,859,240
- 2nd Year		6		schemes	17,540	0	105,240	0	105,240		38		schemes	17,540	0	666,520	0	666,520		92			schemes	17,540	0	1,613,680	0	0	1,613,680	2,385,440
- 3rd Year			6	schemes	17,540	0	0	105,240	105,240			45	schemes	17,540	0	0	789,300	789,300			150		schemes	17,540	0	0	2,631,000	0	2,631,000	3,525,540
- 4th Year				schemes		0	0	0	0				schemes		0	0	0	0				283	schemes	17,540	0	0	0	4,963,820	4,963,820	4,963,820
2) Construction of Dam for Small Impounding																														
- Survey & F/S	3	3	2	sites	240,500	721,500	721,500	481,000	1,924,000				sites	240,500	0	0	0	0					sites	240,500	0	0	0	0	0	1,924,000
- Dams Construction				sites	1,387,500	0	0	0	0	3	2	2	sites	1,387,500	4,162,500	2,775,000	2,775,000	9,712,500	1				sites	1,387,500	1,387,500	0	0	0	1,387,500	11,100,000
Sub-Total						826,740	826,740	586,240	2,239,720						4,601,000	3,441,520	3,564,300	11,606,820							2,703,000	1,613,680	2,631,000	4,963,820	11,911,500	25,758,040
B) Environmental Conservation Components:																														
1) CWMP Cost for watersheds																														
Workshop	8			plans	21,344	170,752	0	0	170,752	4		8	plans	21,344	85,376	0	170,752	256,128					plans	21,344	0	0	0	0	0	426,880
2) Wetland Environment Monitering System Programme																														
- Local Consultant for Water Quality (only Year 2008)	6			L.S.	2,024	12,144	0	0	12,144				L.S.	2,024	0	0	0	0					L.S.	2,024	0	0	0	0	0	12,144
- Water Quality	18	18	18	tests	444	7,992	7,992	7,992	23,976	30	30	54	tests	444	13,320	13,320	23,976	50,616	54	54	54	54	tests	444	23,976	23,976	23,976	23,976	95,904	170,496
- Local Consultant for Soil Fertility (only Year 2008)	6			L.S.	2,024	12,144	0	0	12,144				L.S.	2,024	0	0	0	0					L.S.	2,024	0	0	0	0	0	12,144
- Soil Fertility	12		12	tests	908	10,893	0	10,893	21,786	8	12	24	tests	908	7,262	10,893	21,786	39,941	12	24	12	24	tests	908	10,893	21,786	10,893	21,786	65,358	127,085
3) Project Brief by Local Consultant (only Year 2008)	6			L.S.	2,842	17,052	0	0	17,052				L.S.	2,842	0	0	0	0					L.S.	2,842	0	0	0	0	0	17,052
Sub-Total						220,977	7,992	18,885	257,854						105,958	24,213	216,514	346,685							34,869	45,762	34,869	45,762	161,262	765,801
Total of Group-1						1,047,717	834,732	605,125	2,497,574						4,706,958	3,465,733	3,780,814	11,953,505							2,737,869	1,659,442	2,665,869	5,009,582	12,072,762	26,523,841
1-2. Group-2 D/P Area (Mayuge, Bugiri, Busia, Mbale, Budnda, Kaliro and Kamuli)																														
A) Land and Water Resources Development Component:																														
(Number of Pilot Schemes : 290 Schemes)																														
1) Improvement Programme																														
- 1st Year	8			schemes	19,760	158,080	0	0	158,080	25			schemes	19,760	494,000	0	0	494,000	75				schemes	19,760	1,482,000	0	0	0	1,482,000	2,134,080
- 2nd Year		8		schemes	19,760	0	158,080	0	158,080		38		schemes	19,760	0	750,880	0	750,880		75			schemes	19,760	0	1,482,000	0	0	1,482,000	2,390,960
- 3rd Year			8	schemes	19,760	0	0	158,080	158,080			53	schemes	19,760	0	0	1,047,280	1,047,280			0		schemes	19,760	0	0	0	0	0	1,205,360
- 4th Year				schemes		0	0	0	0				schemes		0	0	0	0				0	schemes	19,760	0	0	0	0	0	0
2) Construction of Dam for Small Impounding																														
- Survey & F/S	2	2	1	sites	240,500	481,000	481,000	240,500	1,202,500				sites	240,500	0	0	0	0					sites	240,500	0	0	0	0	0	1,202,500
- Dams Construction				sites	1,387,500	0	0	0	0	1	1	1	sites	1,387,500	1,387,500	1,387,500	1,387,500	4,162,500	1	1			sites	1,387,500	1,387,500	1,387,500	0	0	2,775,000	6,937,500
Sub-Total						639,080	639,080	398,580	1,676,740						1,881,500	2,138,380	2,434,780	6,454,660							2,869,500	2,869,500	0	0	5,739,000	13,870,400
B) Environmental Conservation Components:																														
1) CWMP Cost for watersheds																														
Workshop	4			plans	21,344	85,376	0	0	85,376			3	plans	21,344	0	0	64,032	64,032				2	plans	21,344	0	0	0	42,688	42,688	192,096
2) Wetland Environment Monitoring System Programme																														
- Local Consultant for Water Quality (only Year 2008)	8			L.S.	2,024	16,192	0	0	16,192				L.S.	2,024	0	0	0	0					L.S.	2,024	0	0	0	0	0	16,192
- Water Quality	24	24	24	tests	444	10,656	10,656	10,656	31,968	27	27	27	tests	444	11,988	11,988	11,988	35,964	27	27	27	27	tests	444	11,988	11,988	11,988	11,988	47,952	115,884
- Local Consultant for Soil Fertility (only Year 2008)	8			L.S.	2,024	16,192	0	0	16,192				L.S.	2,024	0	0	0	0					L.S.	2,024	0	0	0	0	0	16,192
- Soil Fertility	16		16	tests	908	14,524	0	14,524	29,048	2	16	2	tests	908	1,816	14,524	1,816	18,155	16	2	16	2	tests	908	14,524	1,816	14,524	1,816	32,679	79,882
3) Project Brief by Local Consultant (only Year 2008)	8			L.S.	2,842	22,735	0	0	22,735				L.S.	2,842	0	0	0	0					L.S.	2,842	0	0	0	0	0	22,735
Sub-Total						165,675	10,656	25,180	201,511						13,804	26,512	77,836	118,151							26,512	13,804	26,512	56,492	123,319	442,981
Total of Group-2						804,755	649,736	423,760	1,878,251						1,895,304	2,164,892	2,512,616	6,572,811							2,896,012	2,883,304	26,512	56,492	5,862,319	14,313,381

Table 5.5.1 Cost for Development Plan

(Unit: '000 Ush)

	Short-term									Mid-term									Long-term									Grand Total Cost
	Quantities					Cost			Total Cost	Quantities					Cost			Total Cost	Quantities						Cost				Total Cost	
	2008	2009	2010	Unit	Unit Cost	2008	2009	2010		2011	2012	2013	Unit	Unit Cost	2011	2012	2013		2014	2015	2016	2017	Unit	Unit Cost	2014	2015	2016	2017		
1-3. Group-3 D/P Area (Sironko, Kumi and Bukedea)																													
A) Land and Water Resources Development Component:																													
(Number of Pilot Schemes : 346 Schemes)																													
1) Diversification Programme																													
- 1st Year	3			schemes	53,600	160,800	0	0	160,800	25			schemes	53,600	1,340,000	0	0	1,340,000	75				schemes	53,600	4,020,000	0	0	0	4,020,000	5,520,800
- 2nd Year		3		schemes	53,600	0	160,800	0	160,800		37		schemes	53,600	0	1,983,200	0	1,983,200		91			schemes	53,600	0	4,877,600	0	0	4,877,600	7,021,600
- 3rd Year			3	schemes	53,600	0	0	160,800	160,800			8	schemes	53,600	0	0	428,800	428,800			101		schemes	53,600	0	0	5,413,600	0	5,413,600	6,003,200
- 4th Year				schemes		0	0	0	0				schemes		0	0	0	0				0	schemes	53,600	0	0	0	0	0	0
2) Construction of Dam for Small Impounding																													
- Survey & F/S	2	1	1	sites	240,500	481,000	240,500	240,500	962,000				sites	240,500	0	0	0	0					sites	240,500	0	0	0	0	0	962,000
- Dams Construction				sites	1,387,500	0	0	0	0				sites	1,387,500	0	0	0	0	1	1	1	1	sites	1,387,500	1,387,500	1,387,500	1,387,500	1,387,500	5,550,000	5,550,000
Sub-Total						641,800	401,300	401,300	1,444,400						1,340,000	1,983,200	428,800	3,752,000							5,407,500	6,265,100	6,801,100	1,387,500	19,861,200	25,057,600
B) Environmental Conservation Components:																													
1) CWMP Cost for watersheds																													
Workshop	3			plans	21,344	64,032	0	0	64,032	1			plans	21,344	21,344	0	0	21,344				4	plans	21,344	0	0	0	85,376	85,376	170,752
2) Wetland Environment Monitoring System Programme																													
- Local Consultant for Water Quality (only Year 2008)	3			L.S.	2,024	6,072	0	0	6,072				L.S.	2,024	0	0	0	0					L.S.	2,024	0	0	0	0	0	6,072
- Water Quality	9	9	9	tests	444	3,996	3,996	3,996	11,988	12	12	12	tests	444	5,328	5,328	5,328	15,984	12	12	12	24	tests	444	5,328	5,328	5,328	10,656	26,640	54,612
- Local Consultant for Soil Fertility (only Year 2008)	3			L.S.	2,024	6,072	0	0	6,072				L.S.	2,024	0	0	0	0					L.S.	2,024	0	0	0	0	0	6,072
- Soil Fertility	6		6	tests	908	5,447	0	5,447	10,893	2	6	2	tests	908	1,816	5,447	1,816	9,078	6	2	6	10	tests	908	5,447	1,816	5,447	9,078	21,786	41,757
3) Project Brief by Local Consultant (only Year 2008)	3			L.S.	2,842	8,526	0	0	8,526				L.S.	2,842	0	0	0	0					L.S.	2,842	0	0	0	0	0	8,526
Sub-Total						94,144	3,996	9,443	107,583						28,488	10,775	7,144	46,406							10,775	7,144	10,775	105,110	133,802	287,790
Total of Group-3						735,944	405,296	410,743	1,551,983						1,368,488	1,993,975	435,944	3,798,406							5,418,275	6,272,244	6,811,875	1,492,610	19,995,002	25,345,390
1-4. Group-4 D/P Area (Soroti, Amuria, Kuakwi and Kaberamaido)																													
A) Land and Water Resources Development Component:																													
(Number of Pilot Schemes : 638 Schemes)																													
1) New Development Programme																													
- 1st Year	4			schemes	63,080	252,320	0	0	252,320	25			schemes	63,080	1,577,000	0	0	1,577,000	75				schemes	63,080	4,731,000	0	0	0	4,731,000	6,560,320
- 2nd Year		4		schemes	63,080	0	252,320	0	252,320		37		schemes	63,080	0	2,333,960	0	2,333,960		92			schemes	63,080	0	5,803,360	0	0	5,803,360	8,389,640
- 3rd Year			4	schemes	63,080	0	0	252,320	252,320			44	schemes	63,080	0	0	2,775,520	2,775,520			149		schemes	63,080	0	0	9,398,920	0	9,398,920	12,426,760
- 4th Year				schemes		0	0	0	0				schemes		0	0	0	0				204	schemes	63,080	0	0	0	12,868,320	12,868,320	12,868,320
2) Construction of Dam for Small Impounding																													
- Survey & F/S	2	2	1	sites	240,500	481,000	481,000	240,500	1,202,500				sites	240,500	0	0	0	0					sites	240,500	0	0	0	0	0	1,202,500
- Dams Construction				sites	1,387,500	0	0	0	0				sites	1,387,500	0	0	0	0	2	1	1	1	sites	1,387,500	2,775,000	1,387,500	1,387,500	1,387,500	6,937,500	6,937,500
Sub-Total						733,320	733,320	492,820	1,959,460						1,577,000	2,333,960	2,775,520	6,686,480							7,506,000	7,190,860	10,786,420	14,255,820	39,739,100	48,385,040
B) Environmental Conservation Components:																													
1) CWMP Cost for watersheds																													
Workshop	4			plans	21,344	85,376	0	0	85,376	6			plans	21,344	128,064	0	0	128,064				5	plans	21,344	0	0	0	106,720	106,720	320,160
2) Wetland Environment Monitoring System Programme																													
- Local Consultant for Water Quality (only Year 2008)	4			L.S.	2,024	8,096	0	0	8,096				L.S.	2,024	0	0	0	0					L.S.	2,024	0	0	0	0	0	8,096
- Water Quality	12	12	12	tests	444	5,328	5,328	5,328	15,984	30	30	30	tests	444	13,320	13,320	13,320	39,960	30	30	30	45	tests	444	13,320	13,320	13,320	19,980	59,940	115,884
- Local Consultant for Soil Fertility (only Year 2008)	4			L.S.	2,024	8,096	0	0	8,096				L.S.	2,024	0	0	0	0					L.S.	2,024	0	0	0	0	0	8,096
- Soil Fertility	8		8	tests	908	7,262	0	7,262	14,524	12	8	12	tests	908	10,893	7,262	10,893	29,048	8	12	8	22	tests	908	7,262	10,893	7,262	19,971	45,188	88,960
3) Project Brief by Local Consultant (only Year 2008)	4			L.S.	2,842	11,368	0	0	11,368				L.S.	2,842	0	0	0	0					L.S.	2,842	0	0	0	0	0	11,368
Sub-Total						125,526	5,328	12,590	143,444						152,277	20,582	24,213	197,072							20,582	24,213	20,582	146,671	212,048	552,563
Total of Group-4						858,846	738,648	505,410	2,102,904						1,729,277	2,354,542	2,799,733	6,883,552							7,526,582	7,215,073	10,807,002	14,402,491	39,951,148	48,937,603
Sub-Total (Land and Water Resources Development Component)						2,340,540	2,000,540	1,878,840	7,220,320						3,299,306	9,897,060	9,301,406	28,499,960							28,496,000	17,979,140	29,218,420	39,893,120	97,349,800	132,071,080
Sub-Total (Environmental Conservation Component)						616,321	27,972	66,099	710,392						306,326	82,082	325,706	708,314							91,738	90,933	92,738	234,034	510,491	2,049,136

Table 5.5.1 Cost for Development Plan

(Unit: '000 Ush)

	Short-term									Mid-term										Long-term										Grand Total Cost
	Quantities					Cost			Total Cost	Quantities					Cost			Total Cost		Quantities						Cost			Total Cost	
	2008	2009	2010	Unit	Unit Cost	2008	2009	2010		2011	2012	2013	Unit	Unit Cost	2011	2012	2013		2014	2015	2016	2017	Unit	Unit Cost	2014	2015	2016	2017		
2. D/P.10 Cope with Overall Constraints																														
A) Production Technology Development Components:																														
1) Training of Extension Service Staff in DOHO																														
a. Training Materials and Utilities																														
1st Year	1			course	7,391	7,391	0	0	7,391	1			course	5,057	5,057	0	0	5,057	1				course	5,057	5,057	0	0	0	5,057	17,505
2nd Year		1		course	2,420	0	2,420	0	2,420		1		course	2,420	0	2,420	0	2,420		1			course	2,420	0	2,420	0	0	2,420	7,261
3rd Year			1	course	2,804	0	0	2,804	2,804			1	course	2,420	0	0	2,420	2,420			1		course	2,420	0	0	2,420	0	2,420	7,644
4th Year				course		0	0	0	0				course		0	0	0	0				1	course	2,804	0	0	0	2,804	2,804	2,804
b. Cost and Allowance for Trainees																														
1st Year	1			course	57,681	57,681	0	0	57,681	1			course	51,730	51,730	0	0	51,730	1				course	63,360	63,360	0	0	0	63,360	172,771
2nd Year		1		course	56,079	0	56,079	0	56,079		1		course	51,730	0	51,730	0	51,730		1			course	63,360	0	63,360	0	0	63,360	171,168
3rd Year			1	course	0	0	0	0	0			1	course	50,061	0	0	50,061	50,061			1		course	61,600	0	0	61,600	0	61,600	111,661
4th Year				course		0	0	0	0				course		0	0	0	0				1	course	0	0	0	0	0	0	0
c. Cost and Allowance for Lecturers																														
1st Year	1			course	4,850	4,850	0	0	4,850	1			course	4,850	4,850	0	0	4,850	1				course	4,850	4,850	0	0	0	4,850	14,550
2nd Year		1		course	4,850	0	4,850	0	4,850		1		course	4,850	0	4,850	0	4,850		1			course	4,850	0	4,850	0	0	4,850	14,550
3rd Year			1	course	0	0	0	0	0			1	course	4,850	0	0	4,850	4,850			1		course	4,850	0	0	4,850	0	4,850	9,700
4th Year				course		0	0	0	0				course		0	0	0	0				1	course	0	0	0	0	0	0	0
d. Technical Services by Local Consultant																														
1st Year	1			course	62,816	62,816	0	0	62,816	1			course	62,816	62,816	0	0	62,816	1				course	62,816	62,816	0	0	0	62,816	188,449
2nd Year		1		course	62,816	0	62,816	0	62,816		1		course	62,816	0	62,816	0	62,816		1			course	62,816	0	62,816	0	0	62,816	188,449
3rd Year			1	course	0	0	0	0	0			1	course	62,816	0	0	62,816	62,816			1		course	62,816	0	0	62,816	0	62,816	125,633
4th Year				course		0	0	0	0				course		0	0	0	0				1	course	0	0	0	0	0	0	0
2) Training Cost for Beneficiary Farmers in Core Pilot Project																														
a. Group-1 (Kamonkoli-Nabao Pilot Project, Budaka District)																														
1st Year	1			course	22,953	22,953	0	0	22,953				course	22,953	0	0	0	0					course	22,953	0	0	0	0	0	22,953
2nd Year		1		course	20,465	0	20,465	0	20,465				course	20,465	0	0	0	0					course	20,465	0	0	0	0	0	20,465
3rd Year			1	course	32	0	0	32	32				course	32	0	0	0	0					course	32	0	0	0	0	0	32
4th Year				course		0	0	0	0				course		0	0	0	0					course		0	0	0	0	0	0
b. Group-2 (Buwunsa Pilot Project, Busiri District)																														
1st Year	1			course	29,568	29,568	0	0	29,568				course	29,568	0	0	0	0					course	29,568	0	0	0	0	0	29,568
2nd Year		1		course	27,080	0	27,080	0	27,080				course	27,080	0	0	0	0					course	27,080	0	0	0	0	0	27,080
3rd Year			1	course	32	0	0	32	32				course	32	0	0	0	0					course	32	0	0	0	0	0	32
4th Year				course		0	0	0	0				course		0	0	0	0					course		0	0	0	0	0	0
c. Group-3 (Kaisamaka Pilot Project, Kumi District)																														
1st Year	1			course	22,953	22,953	0	0	22,953				course	22,953	0	0	0	0					course	22,953	0	0	0	0	0	22,953
2nd Year		1		course	32	0	32	0	32				course	32	0	0	0	0					course	32	0	0	0	0	0	32
3rd Year			1	course	32	0	0	32	32				course	32	0	0	0	0					course	32	0	0	0	0	0	32
4th Year				course		0	0	0	0				course		0	0	0	0					course		0	0	0	0	0	0
d. Group-4 (Muyembe Pilot Project, Sironko District)																														
1st Year	1			course	29,568	29,568	0	0	29,568				course	29,568	0	0	0	0					course	29,568	0	0	0	0	0	29,568
2nd Year		1		course	32	0	32	0	32				course	32	0	0	0	0					course	32	0	0	0	0	0	32
3rd Year			1	course	32	0	0	32	32				course	32	0	0	0	0					course	32	0	0	0	0	0	32
4th Year				course		0	0	0	0				course		0	0	0	0					course		0	0	0	0	0	0

Table 5.5.1 Cost for Development Plan

(Unit: '000 Ush)

	Short-term									Mid-term									Long-term										Grand Total Cost
	Quantities					Cost			Total Cost	Quantities					Cost			Total Cost	Quantities						Cost			Total Cost	
	2008	2009	2010	Unit	Unit Cost	2008	2009	2010		2011	2012	2013	Unit	Unit Cost	2011	2012	2013		2014	2015	2016	2017	Unit	Unit Cost	2014	2015	2016	2017		
3) Training Cost for Beneficiary Farmers in District Pilot Project																													
a. Training Cost for Beneficiary Farmers in District Pilot Project																													
1st Year	21			course	3,171	66,598	0	0	66,598	134			course	3,171	424,956	0	0	424,956	385				course	3,203	1,233,084	0	0	0	1,233,084	1,724,638
2nd Year		21		course	3,171	0	66,598	0	66,598		133		course	3,171	0	421,785	0	421,785		384			course	3,203	0	1,229,881	0	0	1,229,881	1,718,263
3rd Year			21	course	3,171	0	0	66,598	66,598			133	course	3,171	0	0	421,785	421,785			384		course	3,203	0	0	1,229,881	0	1,229,881	1,718,263
4th Year				course		0	0	0	0				course		0	0	0	0				384	course	3,203	0	0	0	1,229,881	1,229,881	1,229,881
4) Provision of Technical Training Course at NAKAWA during Short-term																													
a. Direct Cost		1		course	7,560	0	7,560	0	7,560				course	7,560	0	0	0	0					course	7,560	0	0	0	0	0	7,560
b. Other Related Cost		1		course	7,500	0	7,500	0	7,500				course	7,500	0	0	0	0					course	7,500	0	0	0	0	0	7,500
5) Promotion of the Resources-Cycle-Utilization Farming																													
a. Cost and Allowance for Trainees				course	16,250	0	0	0	0		1	1	course	16,250	0	16,250	16,250	32,500					course	16,250	0	0	0	0	0	32,500
b. Cost and Allowance for Lecturers				course	1,325	0	0	0	0		1	1	course	1,325	0	1,325	1,325	2,650					course	1,325	0	0	0	0	0	2,650
c. Facilitator (Local Consultant)				course	11,018	0	0	0	0		1	1	course	11,018	0	11,018	11,018	22,035					course	11,018	0	0	0	0	0	22,035
6) Technical Training on District Irrigation Officer																													
a. Trainees (21-district)x5	2	2	1	course	18,762	37,524	37,524	18,762	93,810				course	18,762	0	0	0	0					course	18,762	0	0	0	0	0	93,810
b. Facilitator (3-Lecturer & 1-Facilitator)	2	2	1	course	11,021	22,041	22,041	11,021	55,104				course	11,021	0	0	0	0					course	11,021	0	0	0	0	0	55,104
7) Technical Training on Irrigation Officer (MAAIF)																													
Training (2-MAAIF)x3	2	2	2	staffs	31,450	62,900	62,900	62,900	188,700				staffs	31,450	0	0	0	0					staffs	31,450	0	0	0	0	0	188,700
Sub-Total (Production Technology Development Components)						426,849	423,893	182,210	946,951						540,806	472,194	570,515	1,583,516							1,369,167	1,363,728	1,361,368	1,722,685	5,816,947	7,963,611
B) Organizational and Institutional Development Components:																													
1) Workshop for Capacity Building and Technical Training of Farmers' Organization																													
Cost for Lecturers to Capacity Building of Institutional Staff& Representative Farmers	1	1	1	course	29,085	29,085	29,085	29,085	87,255	1	1	1	course	34,400	34,400	34,400	34,400	103,200	1	1	1	1	course	80,704	80,704	80,704	80,704	80,704	322,815	513,270
Employment of Local Consultant	1	1	1	course	4,446	4,446	4,446	4,446	13,338	1	1	1	course	4,446	4,446	4,446	4,446	13,338	1	1	1	1	course	0	0	0	0	0	0	26,676
Village Workshop Material	1	1	1	course	22,050	22,050	22,050	22,050	66,150	1	1	1	course	18,667	18,667	18,667	18,667	56,000	1	1	1	1	course	36,050	36,050	36,050	36,050	36,050	144,200	266,350
Sub-Total (Organizational and Institutional Development Components)						55,581	55,581	55,581	166,743						57,513	57,513	57,513	172,538							116,754	116,754	116,754	116,754	467,015	806,296
Total						482,429	433,477	217,791	1,133,694						606,922	629,706	628,038	1,864,666							1,485,921	1,480,081	1,478,321	1,349,438	5,793,762	8,792,122
4. Management Consultants																													
A) Consultants																													
1) Management Consultant (10% of Cost on 4 Components)	1	1	1	L.S		393,969	306,192	216,281	916,441	1	1	1	L.S		1,070,493	1,060,885	1,015,714	3,147,092	1	1	1	1	L.S		1,206,466	1,931,014	4,178,918	7,231,061	8,167,499	12,391,234
5. Doho Integrated Development Project																													
A) Feasibility Study for Doho Integrated Development Project (D/P)																													
Sub-Total	1.00			site	2,865,650	955,217	955,217	955,217	2,865,650				site	2,865,650				0					site	2,865,650					0	0
B) Implementation of Construction Works for Doho Integrated Development Project																													
Sub-Total				site	5,550,000				0	1.00			site	5,550,000			5,550,000	5,550,000		1.00			site	22,200,000	5,550,000	5,550,000	5,550,000	5,550,000	22,200,000	27,750,000
Total						955,217	955,217	955,217	2,865,650						0	0	5,550,000	5,550,000							5,550,000	5,550,000	5,550,000	5,550,000	22,200,000	30,615,650
Grand Total						5,288,874	4,223,294	3,334,228	12,946,496						11,337,643	11,669,733	16,722,858	39,730,233							27,621,124	27,011,158	29,518,537	30,091,673	114,242,492	166,919,221

Source: JICA Study Team

Table 5.6.1 Implementation Schedule of Development Plan

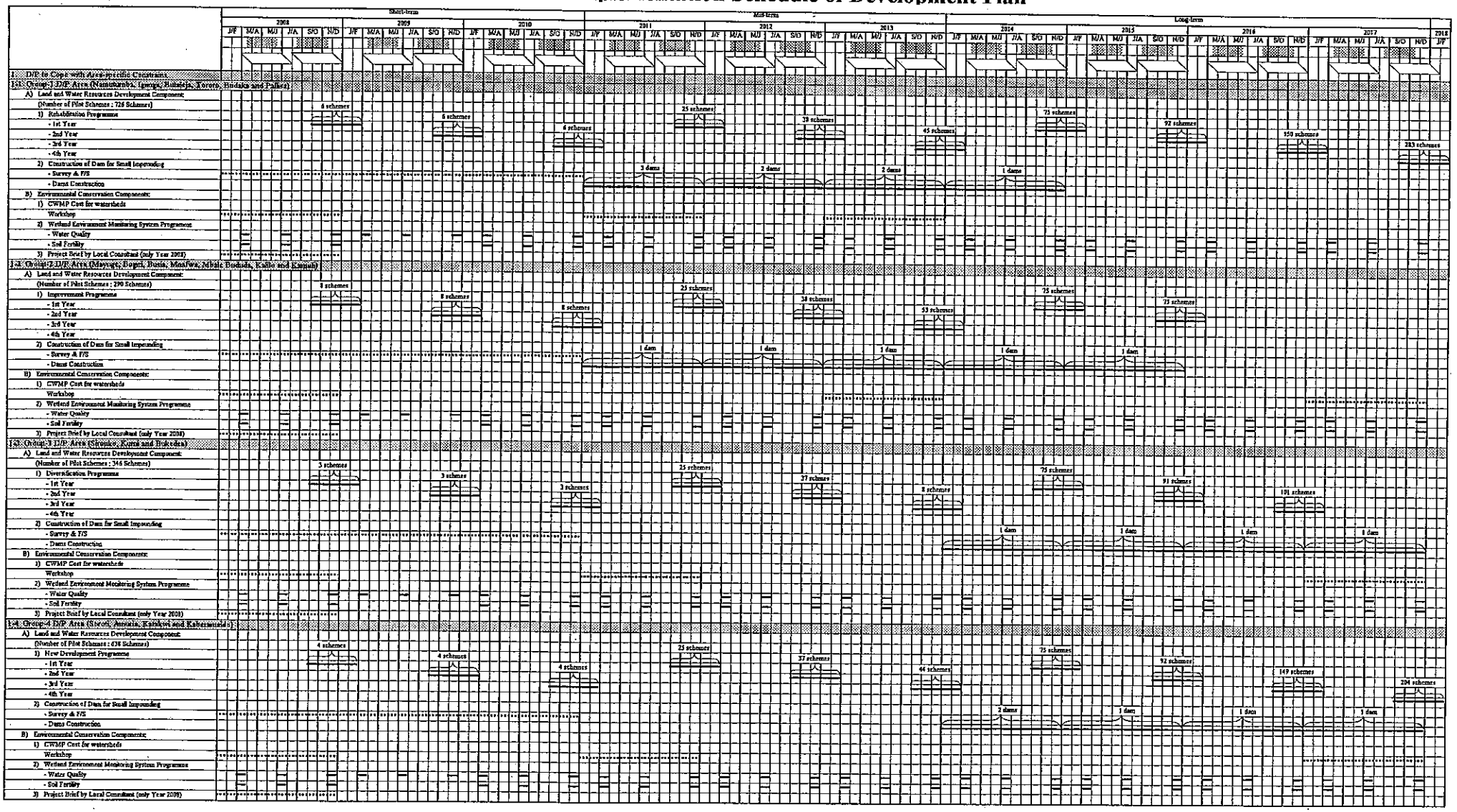
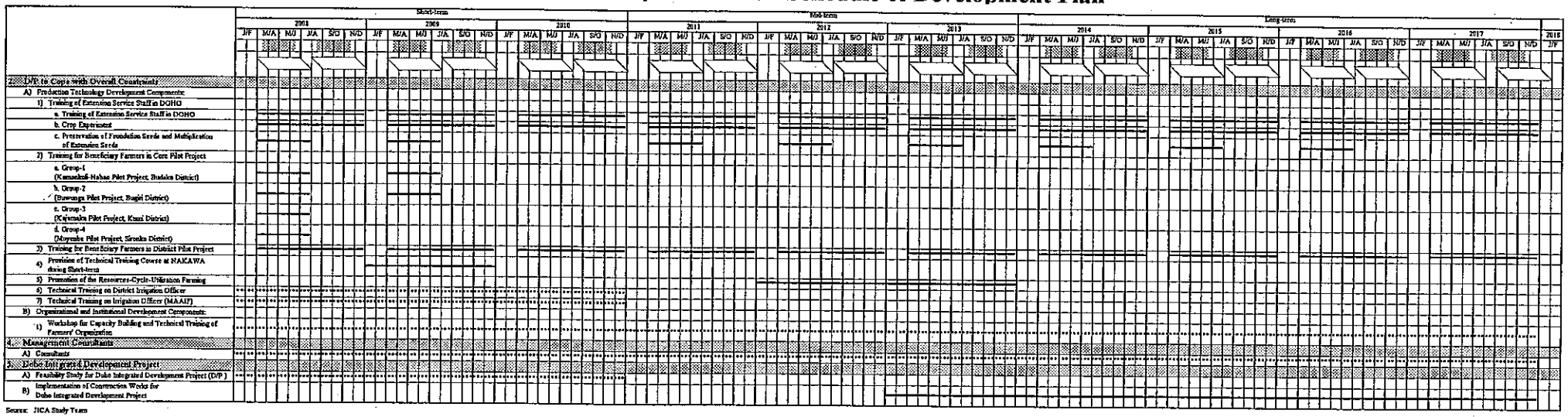


Table 5.6.1 Implementation Schedule of Development Plan



Source: JICA Study Team

Table 5.7.1 Financial and Economic Prices of Farm Outputs and Inputs at Farm-gate

Item	Unit	Financial Price (Ush.)	SCF	Economic Price (Ush.)
Milled rice	/kg	650		683
Seed of rice	/kg	1,250	-	683
Chemicals				
Urea, NPK, SSP	/kg	760	-	545
Insecticide	/kg	5,500	0.805	4,428
Fungicide	/kg	35,000	0.805	28,175
Herbicide	/ml	12,500	0.805	10,063
Equipment & Tools				
Hand hoe	/unit	3,000	0.805	2,415
Hatchet	/unit	1,000	0.805	805
Sickle	/unit	500	0.805	403
Spade	/unit	5,000	0.805	4,025
Fork	/unit	5,000	0.805	4,025
Cart	/unit	500,000	0.805	402,500
Oxen disc plough	/unit	136,500	0.805	109,883
Oxen paddler	/unit	176,000	0.805	141,680
Tooth hoe	/unit	500	0.805	403
Rotary weeder	/unit	132,000	0.805	106,260
Knapsack sprayer	unit	100,000	0.805	80,500
Saw edged sickle	/unit	22,000	0.805	17,710
Pedal thresher	/unit	440,000	0.805	354,200
Winnower	/unit	440,000	0.805	354,200
Polypropylene bag	/bag	600	0.805	483
Labour				
Skilled labour	/man-day	2,000~2,500	-	2,000~2,500
Unskilled labour	/man-day	1,500~2,000	-	1,500
Draft animal	/ox-day	7,500	-	7,500
Bags transport	/man-day	1,500~2,000	-	1,500

(1) Economic Price Structure of Rice (US$/ton)

2015 Rice Price (Thai ,5% broken) Forecast in 1990 prices*	215.1
+ Ocean freight and insurance to Mombassa	46.7
CIF Mombassa port price	261.8
+ Port charges	16.7
+ Inland transport by rail Mombassa~Tororo	58.5
Economic border price of milled rice	337
+ Importer's margin, 5% of border price	16.9
+ Domestic transport by truck, Tororo~Mbale town	10.9
+ Village transport, by pick-up or bicycle from town	4.4
Economic farm gate price of milled rice	369.2

Source: JICA Study Team estimate based on Global Economic Prospect 2004, World Bank

(2) Economic Price Structure of TSP (US$/ton)

2015 TSP Price Forecast in 1990 prices*	144.1
+ Ocean freight and insurance to Mombassa	46.7
CIF Mombassa port price	190.8
+ Port charges	16.7
+ Inland transport by rail Mombassa~Tororo	58.5
Economic border price of TSP	266
+ Importer's margin, 5% of border price	13.3
+ Domestic transport by truck, Tororo~Mbale town	10.9
+ Village transport, by pick-up or bicycle from town	4.4
Economic farm gate price of TSP	294.6

Source: JICA Study Team estimate based on Global Economic Prospect 2004, World Bank

(3) Calculation of Standard Conversion Factor

$$SCF = \frac{FOB + CIF}{(FOB - \text{Export Tax} + \text{Export subsidy}) + (CIF + \text{Import Tax} - \text{Import Subsidy})}$$

$$= 80.5\%$$

Data:

Imports and Export Value (million US$)

	2000/01	2001/02	2002/03	2003/04	2004/05	Average
Export (FO	458.30	474.04	507.91	647.18	786.32	574.75
Import (CIF	941.30	1,004.30	1,128.69	1,319.30	1,623.27	1,203.37

source: Quarterly Economic Report March 2006 Bank of Uganda

Revenue collections (billion USh) *

	2000/01	2001/02	2002/03	2003/04	2004/05	Average
Import taxe:	605.95	627.07	714.98	850.54	945.43	748.79
Export taxe:	0	0	0	0	0	0

Source: Uganda Revenue Authority

Note (1): Foreign Exchange Rate, Official Middle Rate of 2001/02 : USh. 1,737.69/US$ (Bank of Uganda)

(2): Import and export subsidies were negligible small.

Table 5.7.2 Economic Crop Budget of Paddy per Hectare

			(1) Small Scale Irrigation Scheme Development				(2) Doho Integrated Development Project							
	Unit	Unit price (Ush)	Without Project		With Project		Without Project		With Project (1st Step: 4t paddy/ha)		With Project (2nd Step: 5t paddy/ha)		With Project (Terminal: 6t paddy/ha)	
			Q'ty	Value (Ush)	Q'ty	Value (Ush)	Q'ty	Value (USh)	Q'ty	Value (USh)	Q'ty	Value (USh)	Q'ty	Value (USh)
1. Gross Income														
Yield (Rice)	(kg)	683	1,244	849,652	3,400	2,322,200	1,938	1,323,654	2,720	1,857,760	3,400	2,322,200	4,080	2,786,640
2. Production Cost														
1) Seed	(kg)	683	70.0	47,810	8.0	5,464	70.0	47,810	8.0	5,464	8.0	5,464	8.0	5,464
2) Fertilizer														
- Urea, NPK, SSP	(kg)	545		0	100.0	54,500		0	100.0	54,500	100.0	54,500	100.0	54,500
3) Agro-chemicals														
- Insecticide	(kg)	4,428		0	1.0	4,428		0	1.0	4,428	1.0	4,428	1.0	4,428
- Fungicide	(kg)	28,175		0	1.0	28,175		0	1.0	28,175	1.0	28,175	1.0	28,175
- Herbicide	(ml)	10,063		0		0		0		0		0		0
4) Equipment & Tools *														
- Hand hoe	(unit)	483	4.0	1,932	4.0	1,932	4.0	1,932	4.0	1,932	4.0	1,932	4.0	1,932
- Hatchet	(unit)	161	2.0	322	2.0	322	2.0	322	2.0	322	2.0	322	2.0	322
- Sickle	(unit)	81	4.0	324		0	4.0	324		0		0		0
- Spade	(unit)	805		0	5.0	4,025		0	5.0	4,025	5.0	4,025	5.0	4,025
- Fork	(unit)	805		0	5.0	4,025		0	5.0	4,025	5.0	4,025	5.0	4,025
- Cart	(unit)	40,250		0	0.2	8,050		0	0.2	8,050	0.2	8,050	0.2	8,050
- Oxen disc plough	(unit)	11,834		0	1.0	11,834		0	1.0	11,834	1.0	11,834	1.0	11,834
- Oxen paddler	(unit)	14,168		0	1.0	14,168		0	1.0	14,168	1.0	14,168	1.0	14,168
- Tooth hoe	(unit)	81		0	2.0	162		0	2.0	162	2.0	162	2.0	162
- Rotary weeder	(unit)	21,252		0	2.0	42,504		0	2.0	42,504	2.0	42,504	2.0	42,504
- Knapsack sprayer	(unit)	16,100		0	0.07	1,127		0	0.07	1,127	0.07	1,127	0.07	1,127
- Saw edged sickle	(unit)	3,542		0	5.0	17,710		0	5.0	17,710	5.0	17,710	5.0	17,710
- Pedal thresher	(unit)	35,420		0	0.2	7,084		0	0.2	7,084	0.2	7,084	0.2	7,084
- Winnower	(unit)	35,420		0	0.2	7,084		0	0.2	7,084	0.2	7,084	0.2	7,084
- Polypropylene bag	(bag)	483	12.4	5,989	34.0	16,422	19.4	9,361	27.2	13,138	34.0	16,422	40.8	19,706
5) Labour														
-Manpower	(man-day)	1,500	245.5	368,250	170.8	256,200	250.7	376,050	163.1	244,650	168.1	252,150	175.8	263,700
-Animal draft power	(ox-day)	7,500	10.0	75,000	30.0	225,000	10.0	75,000	30.0	225,000	30.0	225,000	30.0	225,000
-Milling	(kg)	21	1,829.0	38,409	5,000.0	105,000	2,850.0	59,850	4,000.0	84,000	5,000.0	105,000	6,000.0	126,000
Total				538,036		815,216		570,649		779,382		811,166		847,000
3. Net Return	(USh)			311,616		1,506,984		753,005		1,078,378		1,511,034		1,939,640

Note: *: Unit prices of equipment and tools are estimated based on their useful lives.
Source: JICA Study Team

Table 5.7.3 Economic Internal Rate of Return from Small-scale Irrigation Scheme Development

years		outflow								incremental inflow	net cash flow		
		Constriction	Maintenance	Replacement	Prod.develop	Org & Inst	Env.	Consultants	sub total				
1	2008	-2,992,310,000			-343,508,437	-44,742,745	-496,139,234	-329,319,997	-4,206,020,413	0	-4,206,020,413		
2	2009	-2,751,810,000	-24,834,300	-99,743,667	-304,103,937	-44,742,745	-22,517,460	-258,657,120	-3,506,409,229	503,360,015	-3,003,049,214	B/C (10%)	1.79
3	2010	-2,030,310,000	-49,668,600	-191,470,667	-130,363,931	-44,742,745	-53,208,488	-186,271,471	-2,686,035,902	1,006,720,030	-1,679,315,872	B/C (12%)	1.61
4	2011	-10,518,500,000	-74,502,900	-259,147,667	-442,274,429	-46,297,737	-241,923,430	-919,788,810	-12,502,434,973	1,510,080,045	-10,992,354,928	NPV (10%)	93,184,004,460
5	2012	-11,551,290,000	-390,057,900	-609,764,334	-460,615,798	-46,297,737	-66,075,608	-987,177,760	-14,111,279,137	3,961,330,120	-10,149,949,017	NPV (12%)	61,074,889,207
6	2013	-10,392,830,000	-736,596,600	-994,807,334	-459,272,499	-46,297,737	-262,193,330	-913,399,172	-13,805,396,672	7,634,700,232	-6,170,696,440		
7	2014	-21,843,000,000	-1,048,381,500	-1,341,235,001	-1,102,179,619	-93,986,769	-74,653,688	-1,885,443,508	-27,388,880,085	11,262,100,337	-16,126,779,748	IRR	22.3%
8	2015	-22,057,490,000	-1,703,671,500	-2,069,335,001	-1,097,478,668	-93,986,769	-73,192,210	-1,902,093,710	-28,997,247,858	18,615,850,562	-10,381,397,296		
9	2016	-26,054,030,000	-2,365,396,200	-2,804,584,668	-1,096,061,868	-93,986,769	-74,653,688	-2,223,819,648	-34,712,532,841	27,224,130,820	-7,488,402,021		
10	2017	-25,599,790,000	-3,147,017,100	-3,673,052,335	-992,311,196	-93,986,769	-284,996,968	-2,197,912,589	-35,989,066,957	37,245,901,070	1,256,834,113		
11	2018		-3,915,010,800	-4,526,378,668					-8,441,389,468	49,221,501,274	40,780,111,806		
12	2019		-3,915,010,800	-4,526,378,668					-8,441,389,468	49,221,501,274	40,780,111,806		
13	2020		-3,915,010,800	-4,526,378,668					-8,441,389,468	49,221,501,274	40,780,111,806		
14	2021		-3,915,010,800	-4,526,378,668					-8,441,389,468	49,221,501,274	40,780,111,806		
15	2022		-3,915,010,800	-4,526,378,668					-8,441,389,468	49,221,501,274	40,780,111,806		
16	2023		-3,915,010,800	-4,526,378,668					-8,441,389,468	49,221,501,274	40,780,111,806		
17	2024		-3,915,010,800	-4,526,378,668					-8,441,389,468	49,221,501,274	40,780,111,806		
18	2025		-3,915,010,800	-4,526,378,668					-8,441,389,468	49,221,501,274	40,780,111,806		
19	2026		-3,915,010,800	-4,526,378,668					-8,441,389,468	49,221,501,274	40,780,111,806		
20	2027		-3,915,010,800	-4,526,378,668					-8,441,389,468	49,221,501,274	40,780,111,806		
21	2028		-3,915,010,800	-4,526,378,668					-8,441,389,468	49,221,501,274	40,780,111,806		
22	2029		-3,915,010,800	-4,526,378,668					-8,441,389,468	49,221,501,274	40,780,111,806		
23	2030		-3,915,010,800	-4,526,378,668					-8,441,389,468	49,221,501,274	40,780,111,806		
24	2031		-3,915,010,800	-4,526,378,668					-8,441,389,468	49,221,501,274	40,780,111,806		
25	2032		-3,915,010,800	-4,526,378,668					-8,441,389,468	49,221,501,274	40,780,111,806		
26	2033		-3,915,010,800	-4,526,378,668					-8,441,389,468	49,221,501,274	40,780,111,806		
27	2034		-3,915,010,800	-4,526,378,668					-8,441,389,468	49,221,501,274	40,780,111,806		
28	2035		-3,915,010,800	-4,526,378,668					-8,441,389,468	49,221,501,274	40,780,111,806		
29	2036		-3,915,010,800	-4,526,378,668					-8,441,389,468	49,221,501,274	40,780,111,806		
30	2037		-3,915,010,800	-4,526,378,668					-8,441,389,468	49,221,501,274	40,780,111,806		

Table 5.7.4 Economic Internal Rate of Return from Doho Integrated Development Project

years		outflow				incremental inflow	net cash flow		
		Constriction	Maintenance	Replacement	sub total				
1	2013	-3,996,000,000			-3,996,000,000	0	-3,996,000,000		
2	2014	-3,996,000,000	-119,880,000	-133,200,000	-4,249,080,000	2,367,900,000	-1,881,180,000	B/C (10%)	2.06
3	2015	-3,996,000,000	-239,760,000	-266,400,000	-4,502,160,000	2,367,900,000	-2,134,260,000	B/C (12%)	1.87
4	2016	-3,996,000,000	-359,640,000	-399,600,000	-4,755,240,000	4,700,700,000	-54,540,000	NPV (10%)	25,399,260,918
5	2017	-3,996,000,000	-479,520,000	-532,800,000	-5,008,320,000	4,700,700,000	-307,620,000	NPV (12%)	18,802,440,987
6	2018		-599,400,000	-666,000,000	-1,265,400,000	7,017,300,000	5,751,900,000		
7	2019		-599,400,000	-666,000,000	-1,265,400,000	7,017,300,000	5,751,900,000	IRR	29.7%
8	2020		-599,400,000	-666,000,000	-1,265,400,000	7,017,300,000	5,751,900,000		
9	2021		-599,400,000	-666,000,000	-1,265,400,000	7,017,300,000	5,751,900,000		
10	2022		-599,400,000	-666,000,000	-1,265,400,000	7,017,300,000	5,751,900,000		
11	2023		-599,400,000	-666,000,000	-1,265,400,000	7,017,300,000	5,751,900,000		
12	2024		-599,400,000	-666,000,000	-1,265,400,000	7,017,300,000	5,751,900,000		
13	2025		-599,400,000	-666,000,000	-1,265,400,000	7,017,300,000	5,751,900,000		
14	2026		-599,400,000	-666,000,000	-1,265,400,000	7,017,300,000	5,751,900,000		
15	2027		-599,400,000	-666,000,000	-1,265,400,000	7,017,300,000	5,751,900,000		
16	2028		-599,400,000	-666,000,000	-1,265,400,000	7,017,300,000	5,751,900,000		
17	2029		-599,400,000	-666,000,000	-1,265,400,000	7,017,300,000	5,751,900,000		
18	2030		-599,400,000	-666,000,000	-1,265,400,000	7,017,300,000	5,751,900,000		
19	2031		-599,400,000	-666,000,000	-1,265,400,000	7,017,300,000	5,751,900,000		
20	2032		-599,400,000	-666,000,000	-1,265,400,000	7,017,300,000	5,751,900,000		
21	2033		-599,400,000	-666,000,000	-1,265,400,000	7,017,300,000	5,751,900,000		
22	2034		-599,400,000	-666,000,000	-1,265,400,000	7,017,300,000	5,751,900,000		
23	2035		-599,400,000	-666,000,000	-1,265,400,000	7,017,300,000	5,751,900,000		
24	2036		-599,400,000	-666,000,000	-1,265,400,000	7,017,300,000	5,751,900,000		
25	2037		-599,400,000	-666,000,000	-1,265,400,000	7,017,300,000	5,751,900,000		
26	2038		-599,400,000	-666,000,000	-1,265,400,000	7,017,300,000	5,751,900,000		
27	2039		-599,400,000	-666,000,000	-1,265,400,000	7,017,300,000	5,751,900,000		
28	2040		-599,400,000	-666,000,000	-1,265,400,000	7,017,300,000	5,751,900,000		
29	2041		-599,400,000	-666,000,000	-1,265,400,000	7,017,300,000	5,751,900,000		
30	2042		-599,400,000	-666,000,000	-1,265,400,000	7,017,300,000	5,751,900,000		

Table 5.7.5 Farm Budget for Small-scale Irrigation Scheme Development

Without Small Impounding Dam

Project Type Paddy field size: ha/HH Upland field size: ha/HH Household size: persons/HH	Rehabilitation (Group 1) 0.25ha 0.95ha 5.6		Improvement (Group 2) 0.25ha 1.10ha 5.0		Diversification (Group 3) 0.25ha 2.28ha 4.5		New Development (Group 4) 0.25ha 2.04ha 4.7	
Without or With Project	Without Project	With Project	Without Project	With Project	Without Project	With Project	Without Project	With Project
Paddy field intensity	1.2	1.4	1.2	1.4	0.0	1.4	0.0	1.4
1)Gross income(USh)	677,054	1,215,974	931,536	1,471,873	1,202,063	2,022,188	1,286,837	2,144,744
-Rice income	242,580	773,500	242,580	773,500	0	773,500	0	773,500
-Upland crop income	300,979	300,979	556,790	556,790	1,051,230	1,051,230	840,649	840,649
-Other income	133,495	141,495	132,166	141,583	150,833	197,458	446,188	530,595
+Livestock	*16,000*	*24,000*	*18,833*	*28,250*	*93,250*	*139,875*	*168,813*	*253,220*
+Land rent	*21,870*	*21,870*	*35,000*	*35,000*	*21,250*	*21,250*	*104,375*	*104,375*
+Off-farm income	*95,000*	*95,000*	*78,333*	*78,333*	*6,333*	*6,333*	*48,000*	*48,000*
+Others	*625*	*625*	*0*	*0*	*30,000*	*30,000*	*125,000*	*125,000*
2)Gross outgo(USh)	590,951	1,041,568	679,777	1,164,946	841,300	1,479,163	1,142,695	1,899,698
-Production cost	114,730	327,236	134,451	346,957	107,025	377,750	170,140	440,865
-Living expenses	476,221	714,332	545,326	817,989	734,275	1,101,413	972,555	1,458,833
3)Net reserve(USh)	86,103	174,406	251,759	306,927	360,763	543,025	144,142	245,046
4)Incremental net income(USh)	88,303		55,168		182,262		100,904	

Water Charge Without Small Impounding Dam

Annual payment to PRGA (USh)	19,334	21,486	46,740	53,414
member fee	5,000	5,000	5,000	5,000
O&M cost for irrigation	12,998	14,675	40,224	47,378
replacement cost for intake	1,336	1,811	1,516	1,036
% to Net reserve with project	11.1%	7.0%	8.6%	21.8%
member fee	2.9%	1.6%	0.9%	2.0%
O&M cost for irrigation	7.5%	4.8%	7.4%	19.3%
replacement cost for intake	0.8%	0.6%	0.3%	0.4%

With Small Impounding Dam

Project Type Paddy field size: ha/HH Upland field size: ha/HH Household size: persons/HH	Rehabilitation (Group 1) 0.25ha 0.95ha 5.6		Improvement (Group 2) 0.25ha 1.10ha 5.0		Diversification (Group 3) 0.25ha 2.28ha 4.5		New Development (Group 4) 0.25ha 2.04ha 4.7	
Without or With Project	Without Project	With Project	Without Project	With Project	Without Project	With Project	Without Project	With Project
Paddy field intensity	1.2	2.0	1.2	2.0	0.0	2.0	0.0	2.0
1)Gross income(USh)	677,054	1,547,474	931,536	1,803,373	1,202,063	2,353,688	1,286,837	2,476,244
-Rice income	242,580	1,105,000	242,580	1,105,000	0	1,105,000	0	1,105,000
-Upland crop income	300,979	300,979	556,790	556,790	1,051,230	1,051,230	840,649	840,649
-Other income	133,495	141,495	132,166	141,583	150,833	197,458	446,188	530,595
+Livestock	*16,000*	*24,000*	*18,833*	*28,250*	*93,250*	*139,875*	*168,813*	*253,220*
+Land rent	*21,870*	*21,870*	*35,000*	*35,000*	*21,250*	*21,250*	*104,375*	*104,375*
+Off-farm income	*95,000*	*95,000*	*78,333*	*78,333*	*6,333*	*6,333*	*48,000*	*48,000*
+Others	*625*	*625*	*0*	*0*	*30,000*	*30,000*	*125,000*	*125,000*
2)Gross outgo(USh)	590,951	1,157,593	679,777	1,280,971	841,300	1,595,188	1,142,695	2,015,723
-Production cost	114,730	443,261	134,451	462,982	107,025	493,775	170,140	556,890
-Living expenses	476,221	714,332	545,326	817,989	734,275	1,101,413	972,555	1,458,833
3)Net reserve(USh)	86,103	389,881	251,759	522,402	360,763	758,500	144,142	460,521
4)Incremental net income(USh)	303,778		270,643		397,737		316,379	

Water Charge With Small Impounding Dam

Annual payment to PRGA (USh)	44,959	47,111	72,365	79,039
member fee	5,000	5,000	5,000	5,000
O&M cost for irrigation	12,998	14,675	40,224	47,378
O&M cost for reservoir	20,813	20,813	20,813	20,813
replacement cost for intake	1,336	1,811	1,516	1,036
replacement cost for reservoir	4,812	4,812	4,812	4,812
% to Net reserve with project	3.3%	2.8%	5.3%	10.3%
member fee	1.3%	1.0%	0.7%	1.1%
O&M cost for irrigation	3.3%	2.8%	5.3%	10.3%
O&M cost for reservoir	5.3%	4.0%	2.7%	4.5%
replacement cost for intake	0.3%	0.3%	0.2%	0.2%
replacement cost for reservoir	1.2%	0.9%	0.6%	1.0%

Note: The above figures have been estimated based on data from baseline survey and the following assumptions.

- Livestock income will be increased by 50% under with the project condition due to increase use of by-products.
- Living expenses under with the project condition will be increased by 50%.

Table 6.3.1 Improvement Impacts in Paddy Production Technology and Field Practices

	Essential Works or Practices	Necessity or Adequate Action for Improvement of Existing Practices	Capital Investment to be required for Improvement	Improvement to be possible without Capital Investment	Impacts to be arisen out of Technical Improvement	Improvement of Working Efficiency or Reduction of Inputs	Production Increase	Quality Improvement
1	**Consolidation Works on Farm Plots**							
	Paddy field is being extensively reclaimed. Only limited farm plots are developed with provision of farm ridges and traditional irrigation system. No terrace formation and then land leveling is not completed in most plots. Thus, rain-water is drained out freely as surface run-off.	1 Provision of Farm Ridge	◎		Creating water harvesting function (increase water retaining capacity of farm plots, and then, improve irrigation efficiency even under rain-fed conditions		◎	
		2 Land Leveling	◎		Improvement not only working conditions and irrigation water management but also working efficiency. Growing conditions of paddy rice are also improved to a large extent.	◎	◎	
		3 Irrigation & Drainage System a. Structural Improvement of Facilities	◎		Improvement of Irrigation efficiency as well as making possible to manage irrigation water control much easier.	◎	◎	
		b. Capacity Building both of Water Users' Association and its Member Farmers		◎	Materialization of Self Reliance in Communal-based-O & M Services System	◎	◎	
2	**Soil Preparation Work**							
	Ploughing by use of blade hoes is predominant. Oxen-ploughing is still limited to smaller extent. No precise puddling is practiced so far. Thus, it made difficult to manage irrigation as well as weeding works.	1 Introduction of Oxen-Ploughing more extensively	◎		Improvement of soil preparation efficiency, i.e. ploughing depth, tum-over of plough-sols, ploughing of organic manures into deep soil layer, etc.	◎	◎	
		2 Introduction of Soil Puddling and Leveling Practices in Farm Plots	◎		Structural improvement of plough-sols, and hence, generating good-cum-smooth rooting of paddy seedlings, making easiness of weeding using rotary-weeders as well as irrigation water management. Ploughing of azolla into soil also become easy.	◎	◎	
3	**Nursery Work**							
	Small nursery beds is prepared patchy in the paddy field. Due to seeds are being densely sown in a bed, seedlings are all so slender and weak for transplantation. Nursery period is also as long as 30 day or more (overgrow- ing/ maturation to trans- plantation). Accordingly, rooting after transplantation is always delayed and poor growth at an active tillering stage.	1 Precise Preparation of Nursery Beds	◎			◎	◎	
		2 Selection of Good Seeds and Practice of Pre-Germination Treatment		◎	Maintaining successful germination/seedling establishment ratio	◎	◎	
		3 Control of Sowing Density		◎	Possible to reduce seed requirement	◎		
		4 Shortening of Nursery Period to 20 days		◎	Possible to reduce farm inputs Maintain successful establishment (rooting) of seedling and generation of an active tillering immediately after rooting	◎ ◎	 ◎	
		5 Precise Up-rooting for Transplantation		◎	No physical damage to seedlings, and hence, smooth rooting immediately after transplantation		◎	

Table 6.3.1 Improvement Impacts in Paddy Production Technology and Field Practices

	Essential Works or Practices	Necessity or Adequate Action for Improvement of Existing Practices	Capital Investment to be required for Improvement	Improvement to be possible without Capital Investment	Impacts to be arisen out of Technical Improvement	Improvement of Working Efficiency or Reduction of Inputs	Production Increase	Quality Improvement
4	**Plantation Work**							
	Direct seeding (broadcasting method) and random transplanting method are predominant in the Study Area, at present. Regular transplanting method is so far prevailed in a very small extent.	Introduction of Regular Transplanting Method		◎	Labour intensive, but effective for controlling plant spacing, weeding work, pest and diseases, and elimination of foreign varieties of paddy as well as properly managing azolla growing, etc.	◎	◎	◎
5	**Crop/Soil Fertilization Practices**							
	At present, almost all farmers apply either compost nor chemical fertilizers. azolla is growing so vigorously, but not used effectively due to densely populated paddy hills..	1 Use of Paddy Straws as Organic Manure (Compost) for both Upland and Paddy Fields		◎	Maintaining basic soil fertility and land productivity; In case of upland field, structural improvement of plough-sols is highly effective for enlargement of moisture holding capacity	◎	◎	◎
		2 Effective Use of "azolla" as Green Manure		◎	It is highly useful as a "Nitrogen Resource" if precisely ploughed into soils.	◎	◎	
		3 Precise Management of Irrigation Water Depth, Paddy Growing Stage and Stage		◎	For paddy rice growing, it is practically not necessary to fill water into farm plots. A just saturated soil moisture condition is the best for normal growing of paddy rice. However, deep water irrigation is highly effective for controlling ineffective tillering, and germination of weed seeds.		◎	◎
		4 Use of Chemical Fertilizers for Further Production Increase	◎		Application of chemical fertilizers are surely effective for increase paddy rice production. Application dosage should be reasonable level, technically, economically and also environmentally secure level to the natural vegetation in and around the farm plots.		◎	◎

Table 6.3.1 Improvement Impacts in Paddy Production Technology and Field Practices

	Essential Works or Practices		Necessity or Adequate Action for Improvement of Existing Practices	Capital Investment to be required for Improvement	Improvement to be possible without Capital Investment	Impacts to be arisen out of Technical Improvement	Improvement of Working Efficiency or Reduction of Inputs	Production Increase	Quality Improvement
6	**Plant Protection Practices against Pest and Diseases**								
	No farmers use agro-chemicals eventhough "rice blast" is seriously influenced in a plots. Influence of the "Yellow-Mottle Disease (virus)" is also becoming serious in certain plots due to continuous use of own-seeds.	1	Introduction of Resistible Varieties to Pest and Diseases	◎		For introduction of the said varieties, a small but reasonable capital investment will be required for variety adaptability test as well as seed multiplication. But the varieties are surely effective for reduction of a demand of grow-chemicals, and accordingly, for environmental conservation services.	◎	◎	
		2	Replacement of Privately Owned Seeds and Introduce Purified-cum-Disease Free Seeds	◎		Replacement of seeds is essential and crucially needed in the Eastern Region. Capital investment is also small only for purchasing of the said seeds, but highly effective for reduction of farm inputs as well as serious influence of diseases. Working efficiency as well as quality of rice also be improved to a significant extent.		◎	◎
		3	Physically eliminating (cutting-out and burning-out) infected tillers (straws) or hills by stem-borers, yellow-mottle diseases, etc.		◎	This practice is essential and crucially needed so as to protect against further influence and/or expansion of the damages.	◎	◎	
		4	Use of Agro-chemicals as Emergency Measure	◎		Application of agro-chemicals are surely effective for plant protection against pest and diseases influence. However, application dosage should be reasonable level, technically, economically and also environmentally secure level to the natural inhabits in and around the farm plots.		◎	◎
7	**Weeding and Varieties Purification Works**								
	Hand weeding twice a season is predominant practice. No farmers eliminate foreign varieties of paddy. Thus, variety contamination become serious, and it directly causes poor rice quality. It also made difficult to harvest paddy timely and efficiently.		Weeding by Introduction of "Rotary Weeder"	◎		Rotary weeder is a new farming equipment in Uganda. Thus for introduction of the said equipment, the capital investment is required but at reasonable amount. Rotary weeder is highly effective not only for weeding efficiency but also reduction of labour requirement for weeding work. Rotary weeder is also indispensable for inter-tillage of azolla into soils.	◎	◎	
			Elimination of foreign varieties of paddy varieties		◎	This practice is essential and crucially needed so as to maintain pure variety of paddy rice and hence quality of rice production.		◎	◎

Table 6.3.1 Improvement Impacts in Paddy Production Technology and Field Practices

	Essential Works or Practices		Necessity or Adequate Action for Improvement of Existing Practices	Capital Investment to be required for Improvement	Improvement to be possible without Capital Investment	Impacts to be arisen out of Technical Improvement	Improvement of Working Efficiency or Reduction of Inputs	Production Increase	Quality Improvement
8	**Mitigation of Field Operation Losses of Paddy Rice**								
	At present, variety contamination (mixed varieties) is serious due to continuous use of own seeds. Variety contamination causes difficulty to catch timely harvesting due to irregular maturation, variety and variety. Over matured paddy rice grains are easily to fall-down from the panicles even with small shock, accordingly, field losses become large during the harvesting time. The traditional threshing by means of beating method is also one of the serious causes on the field losses of the paddy grains. The field losses are also attributed to such field works as gathering of harvested paddy, threshing, drying, winnowing works, etc, that are being done extensively without use of ground-sheets (tarpaulin, mats, etc.).	1	Introduction of Resistible Varieties to Shattering Hazard	◎		A capital investment is required for introduction (adaptability test and seed multiplication) of the subjected varieties, but it will be small at reasonable amount. A shattering hazard is one of the most serious problems in rice production work. Introduction of resistible varieties is surely effective for reduction of field operation losses of production.	◎	◎	
		2	Management of Best-Timing of Harvesting		◎	Timely harvesting (at just grains 70 % maturation in panicle) is essential and crucial so as to reduce grain shattering losses. To this end, it should control uniform heading/flowering in each ploy through variety purification practices.	◎	◎	◎
		3	Use Sharpe Sickles (saw-edged sickles) for Harvesting of Paddy	◎		At present, a crescent-saw-edged sickle is prevailed in a part. However, this type of sickles is not adequate for paddy harvesting. In stead of the said sickle, a shape saw-edged sickle be used so as to reduce field operation losses of grains.	◎		
		4	Use Tarpaulin, Straw-mat, etc. for Gathering, Threshing and Drying Works	◎		Majority of farmers does not use any sheets, tarpaulin, mats, etc. for doing the subjected works. Accordingly, the field operation losses of grains are becoming as large as 10% or more. Contamination with sand and gravels also cause a low quality of milled rice.	◎		◎
		5	Use Adequate Threshing Machine and Winnower, etc.	◎		Threshing and cleaning of paddy rice are still primitive practices, at present. To maintain working efficiency and improve quality of product, "pedal-thresher" and "winnower" are recommended to introduce at the initiation stage of modernization programme.	◎		◎

Source: JICA Study Team

Table 6.4.1 Cost for Action Plan

(Unit: '000 Ush)

	Action Plan Period								
	Quantities					Cost			Total
	2008	2009	2010	Unit	Unit Cost	2008	2009	2010	Cost
1. A/P to Cope with Area-specific Constrains									
1-1. Group-1 A/P Area (Namutumba, Iganga, Butaleja, Tororo, Budaka and Pallisa)									
A) Land and Water Resources Development Component:									
(Number of Pilot Schemes : 726 Schemes)									
1) Rehabilitation Programme									
- 1st Year	6			schemes	17,540	105,240	0	0	105,240
- 2nd Year		6		schemes	17,540	0	105,240	0	105,240
- 3rd Year			6	schemes	17,540	0	0	105,240	105,240
- 4th Year				schemes		0	0	0	0
2) Construction of Dam for Small Impounding									
- Survey & F/S	3	3	2	sites	240,500	721,500	721,500	481,000	1,924,000
- Dams Construction				sites	1,387,500	0	0	0	0
Sub-Total						826,740	826,740	586,240	2,239,720
B) Environmental Conservation Components:									
1) CWMP Cost for watersheds									
Workshop	8			plans	21,344	170,752	0	0	170,752
2) Wetland Environment Monitoring System Programme									
- Local Consultant for Water Quality (only Year 2008)	6			L.S.	2,024	12,144	0	0	12,144
- Water Quality	18	18	18	tests	444	7,992	7,992	7,992	23,976
- Local Consultant for Soil Fertility (only Year 2008)	6			L.S.	2,024	12,144	0	0	12,144
- Soil Fertility	12		12	tests	908	10,893	0	10,893	21,786
3) Project Brief by Local Consultant (only Year 2008)	6			L.S.	2,842	17,052	0	0	17,052
Sub-Total						230,977	7,992	18,885	257,854
Total of Group-1						1,057,717	834,732	605,125	2,497,574
1-2. Group-2 A/P Area (Mayuge, Bugiri, Busia, Mnafwa, Mbale Bududa, Kalilo and Kamuli)									
A) Land and Water Resources Development Component:									
(Number of Pilot Schemes : 290 Schemes)									
1) Improvement Programme									
- 1st Year	8			schemes	19,760	158,080	0	0	158,080
- 2nd Year		8		schemes	19,760	0	158,080	0	158,080
- 3rd Year			8	schemes	19,760	0	0	158,080	158,080
- 4th Year				schemes		0	0	0	0
2) Construction of Dam for Small Impounding									
- Survey & F/S	2	2	1	sites	240,500	481,000	481,000	240,500	1,202,500
- Dams Construction				sites	1,387,500	0	0	0	0
Sub-Total						639,080	639,080	398,580	1,676,740
B) Environmental Conservation Components:									
1) CWMP Cost for watersheds									
Workshop	4			plans	21,344	85,376	0	0	85,376
2) Wetland Environment Monitoring System Programme									
- Local Consultant for Water Quality (only Year 2008)	8			L.S.	2,024	16,192	0	0	16,192
- Water Quality	24	24	24	tests	444	10,656	10,656	10,656	31,968
- Local Consultant for Soil Fertility (only Year 2008)	8			L.S.	2,024	16,192	0	0	16,192
- Soil Fertility	16		16	tests	908	14,524	0	14,524	29,048
3) Project Brief by Local Consultant (only Year 2008)	8			L.S.	2,842	22,735	0	0	22,735
Sub-Total						165,675	10,656	25,180	201,511
Total of Group-2						804,755	649,736	423,760	1,878,251

Table 6.4.1 Cost for Action Plan

(Unit: '000 Ush)

	Action Plan Period								
	Quantities					Cost			Total
	2008	2009	2010	Unit	Unit Cost	2008	2009	2010	Cost
1-3 Group-3 A/P Area (Sironko, Kumi and Bukedea)									
A) Land and Water Resources Development Component:									
(Number of Pilot Schemes : 346 Schemes)									
1) Diversification Programme									
- 1st Year	3			schemes	53,600	160,800	0	0	160,800
- 2nd Year		3		schemes	53,600	0	160,800	0	160,800
- 3rd Year			3	schemes	53,600	0	0	160,800	160,800
- 4th Year				schemes		0	0	0	0
2) Construction of Dam for Small Impounding									
- Survey & F/S	2	1	1	sites	240,500	481,000	240,500	240,500	962,000
- Dams Construction				sites	1,387,500	0	0	0	0
Sub-Total						641,800	401,300	401,300	1,444,400
B) Environmental Conservation Components:									
1) CWMP Cost for watersheds									
Workshop	3			plans	21,344	64,032	0	0	64,032
2) Wetland Environment Monitoring System Programme									
- Local Consultant for Water Quality (only Year 2008)	3			L.S.	2,024	6,072	0	0	6,072
- Water Quality	9	9	9	tests	444	3,996	3,996	3,996	11,988
- Local Consultant for Soil Fertility (only Year 2008)	3			L.S.	2,024	6,072	0	0	6,072
- Soil Fertility	6		6	tests	908	5,447	0	5,447	10,893
3) Project Brief by Local Consultant (only Year 2008)	3			L.S.	2,842	8,526	0	0	8,526
Sub-Total						94,144	3,996	9,443	107,583
Total of Group-3						735,944	405,296	410,743	1,551,983
1-4 Group-4 A/P Area (Soroti, Amuria, Katakwi and Kaberamaido)									
A) Land and Water Resources Development Component:									
(Number of Pilot Schemes : 638 Schemes)									
1) New Development Programme									
- 1st Year	4			schemes	63,080	252,320	0	0	252,320
- 2nd Year		4		schemes	63,080	0	252,320	0	252,320
- 3rd Year			4	schemes	63,080	0	0	252,320	252,320
- 4th Year				schemes		0	0	0	0
2) Construction of Dam for Small Impounding									
- Survey & F/S	2	2	1	sites	240,500	481,000	481,000	240,500	1,202,500
- Dams Construction				sites	1,387,500	0	0	0	0
Sub-Total						733,320	733,320	492,820	1,959,460
B) Environmental Conservation Components:									
1) CWMP Cost for watersheds									
Workshop	4			plans	21,344	85,376	0	0	85,376
2) Wetland Environment Monitoring System Programme									
- Local Consultant for Water Quality (only Year 2008)	4			L.S.	2,024	8,096	0	0	8,096
- Water Quality	12	12	12	tests	444	5,328	5,328	5,328	15,984
- Local Consultant for Soil Fertility (only Year 2008)	4			L.S.	2,024	8,096	0	0	8,096
- Soil Fertility	8		8	tests	908	7,262	0	7,262	14,524
3) Project Brief by Local Consultant (only Year 2008)	4			L.S.	2,842	11,368	0	0	11,368
Sub-Total						125,526	5,328	12,590	143,444
Total of Group-4						858,846	738,648	505,410	2,102,904
Sub-Total (Land and Water Resources Development Component)						2,840,940	2,600,440	1,878,940	7,320,320
Sub-Total (Environmental Conservation Component)						616,322	27,972	66,098	710,392

Table 6.4.1 Cost for Action Plan

(3/4)

(Unit: '000 Ush)

	Action Plan Period								
	Quantities					Cost			Total
	2008	2009	2010	Unit	Unit Cost	2008	2009	2010	Cost
2. A/P to Cope with Overall Constraints									
A) Production Technology Development Components:									
1) Training of Extension Service Staff in DOHO									
a. Training Materials and Utilities									
1st Year	1			course	7,391	7,391	0	0	7,391
2nd Year		1		course	2,420	0	2,420	0	2,420
3rd Year			1	course	2,804	0	0	2,804	2,804
4th Year				course		0	0	0	0
b. Cost and Allowance for Trainees									
1st Year	1			course	57,681	57,681	0	0	57,681
2nd Year		1		course	56,079	0	56,079	0	56,079
3rd Year			1	course	0	0	0	0	0
4th Year				course		0	0	0	0
c. Cost and Allowance for Lecturers									
1st Year	1			course	4,850	4,850	0	0	4,850
2nd Year		1		course	4,850	0	4,850	0	4,850
3rd Year			1	course	0	0	0	0	0
4th Year				course		0	0	0	0
d. Technical Services by Local Consultant									
1st Year	1			course	62,816	62,816	0	0	62,816
2nd Year		1		course	62,816	0	62,816	0	62,816
3rd Year			1	course	0	0	0	0	0
4th Year				course		0	0	0	0
2) Training Cost for Beneficiary Farmers in Core Pilot Project									
a. Group-1 (Kamonkoli-Nabao Pilot Project, Budaka District)									
1st Year	1			course	22,953	22,953	0	0	22,953
2nd Year		1		course	20,465	0	20,465	0	20,465
3rd Year			1	course	32	0	0	32	32
4th Year				course		0	0	0	0
b. Group-2 (Buwunga Pilot Project, Bugiri District)									
1st Year	1			course	29,568	29,568	0	0	29,568
2nd Year		1		course	27,080	0	27,080	0	27,080
3rd Year			1	course	32	0	0	32	32
4th Year				course		0	0	0	0
c. Group-3 (Kajamaka Pilot Project, Kumi District)									
1st Year	1			course	22,953	22,953	0	0	22,953
2nd Year		1		course	32	0	32	0	32
3rd Year			1	course	32	0	0	32	32
4th Year				course		0	0	0	0
d. Group-4 (Muyenbe Pilot Project, Sironko District)									
1st Year	1			course	29,568	29,568	0	0	29,568
2nd Year		1		course	32	0	32	0	32
3rd Year			1	course	32	0	0	32	32
4th Year				course		0	0	0	0

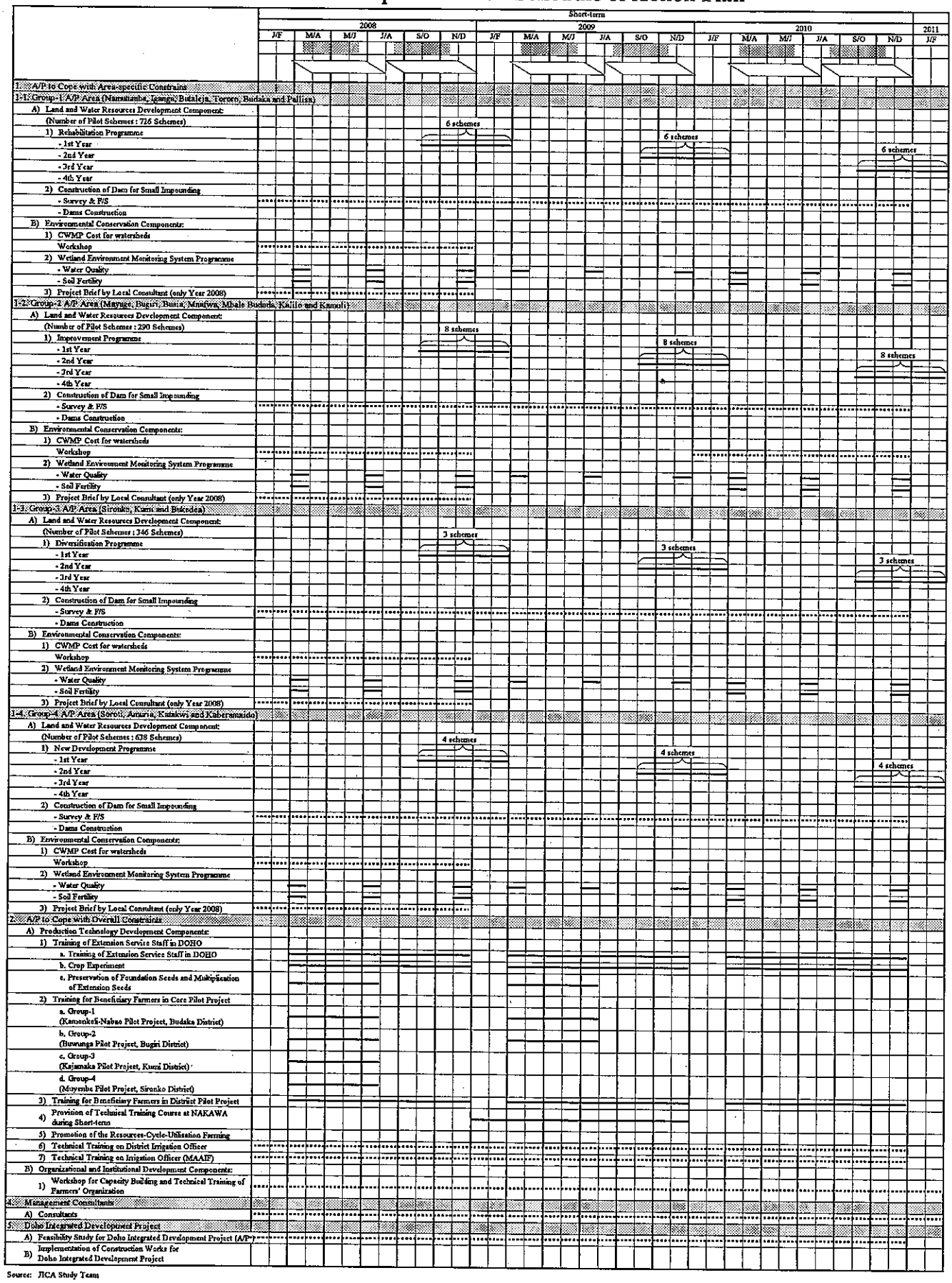
Table 6.4.1 Cost for Action Plan

(Unit: '000 Ush)

	Action Plan Period								
	Quantities					Cost			Total Cost
	2008	2009	2010	Unit	Unit Cost	2008	2009	2010	
3) Training Cost for Beneficiary Farmers in Distriict Pilot Project									
a. Training Cost for Beneficiary Farmers in Distriict Pilot Project									
1st Year	21			course	3,171	66,598	0	0	66,598
2nd Year		21		course	3,171	0	66,598	0	66,598
3rd Year			21	course	3,171	0	0	66,598	66,598
4th Year				course		0	0	0	0
4) Provision of Technical Training Course at NAKAWA during Short-term									
a. Direct Cost		1		course	7,560	0	7,560	0	7,560
b. Other Related Cost		1		course	7,500	0	7,500	0	7,500
5) Promotion of the Resources-Cycle-Utilisation Farming									
a. Cost and Allowance for Trainees				course	16,250	0	0	0	0
b. Cost and Allowance for Lecturers				course	1,325	0	0	0	0
c. Facilitator (Local Consultant)				course	11,018	0	0	0	0
6) Technical Training on District Irrigation Officer									
Trainees (21-district)x5	2	2	1	course	18,762	37,524	37,524	18,762	93,810
Facilitator (3-Lecturer & 1-Facilitator)	2	2	1	course	11,021	22,041	22,041	11,021	55,104
7) Technical Training on Irrigation Officer (MAAIF)									
Training (2-MAAIF)x3	2	2	2	staffs	31,450	62,900	62,900	62,900	188,700
Sub-Total (Production Technology Development Components)						425,845	377,895	162,210	965,951
B) Organizational and Institutional Development Components:									
1) Workshop for Capacity Building and Technical Training of Farmers' Organization									
Cost for Lecturers to Capacity Building of Institutional Staff & Representative Farmers	1	1	1	course	29,085	29,085	29,085	29,085	87,255
Employment of Local Consultant	1	1	1	course	4,446	4,446	4,446	4,446	13,338
Village Workshop Material	1	1	1	course	22,050	22,050	22,050	22,050	66,150
Sub-Total (Organizational and Institutional Development Components)						55,581	55,581	55,581	166,743
Total						482,426	433,477	217,791	1,133,694
4. Management Consultants									
A) Consultants									
1) Management Consultant (15% of Cost on 4 Component)	1	1	1	LS		393,969	406,189	216,283	916,441
5. Doho Integrated Development Project									
A) Feasibility Study for Doho Integrated Development Project (A/P)									
Sub-Total	1.00			site	2,865,650	955,217	955,217	955,217	2,865,650
B) Implementation of Construction Works for Doho Integrated Development Project									
Sub-Total				site	5,550,000				0
Total						955,217	955,217	955,217	2,865,650
Grand Total						5,288,874	4,323,294	3,334,328	12,946,496

Source: JICA Study Team

Table 6.5.1 Implementation Schedule of Action Plan



Source: JICA Study Team