

CHAPTER5 THE QUICK PROJECT (QP)

5.1 Objects of QP

One of the characteristics of this Study lies in the implementation of quick project (QP), a proposed manner by the Study Team as an antecedent stage of pilot project. This QP is launched to meet what the Government of Rwanda requested in the consultation therewith, i.e., request of "starting concrete activities as early as possible". It also serves as an important tool for the Study Team in pursuing development in which local population takes their own initiatives. The objects of the QP are

- 1) To extract the basal needs of the community within a short period, then proposes "highly and immediately effective project components that can readily be dealt by the initiative of local population and that do not need sophisticated technology". In other words proposed components are debated based on the concept that "they should be in a small scale, have low risk, be based on adequate techniques, and also include ideas of ready and profitable practices".
- 2) In the process of the training and monitoring through implementing the QP, Communication between the local population and administrative agencies concerned will be developed and potential of human recourses, current situation of the community as well as the local organizations. These outputs and lessons learnt will be referred to the performance contract as well as reexamine the District Development Plan.

5.2 Selection of Quick Project Site

Quick project¹ (QP) was originally scheduled to be implemented in the second field survey period which would start in November 2006. However, its implementation was moved to start earlier as the various processes were begun with the commencement of the Study, May 2006. This advanced schedule resulted from the requests from local authorities such as Eastern Province and Bugesera District to implement QP from the early stage of the Study. Moreover, both parties requested to select Ntarama Sector as the QP site for the following reasons.

- The JICA's limited fund for QP should be concentrated on one Sector, not dispersed in several Sectors for effective practice. (Otherwise the impact would not be tangible.)
- There are no intensive activities by other donors in Ntarama Sector.
- People are still struggling with the damages caused by the 1994 Genocide.

In response to the requests by the District, the Study Team carried out the field survey in Ntarama

¹ Quick project (QP) intends to quickly realize diversification of income and improvement of living conditions as a measure to derive initiatives from local population. As compared to pilot projects (PP), which will be implemented in the phase II of the Study, QP has several characteristics in terms of emergency, efficiency and quickness of project results. Hence, it is readily be dealt by the initiatives of local population in small-scale at low-risk.

Sector and other Sectors to grasp the current situation of farmers' problems/needs and to judge the validity of Ntarama Sector as a QP site.

After the field survey, the Study Team acknowledged appropriateness to select Ntarama Sector as the QP site based on the above-mentioned factors. Like other Sectors, Ntarama Sector has a fragile administrative system due to the recent administrative reform, and it has similar problems/needs as well as natural physical features - hilly area and marshlands - to the other Sectors in Bugesera. Accordingly outcome or lessons learned from the QP could be disseminated to other Sectors and they would not constitute an obstacle in formulating the Action Plan in future. In the end, Ntarama Sector was selected as the site for QP implementation. Summary of the processes is shown below.

Table 5.2.1 Selection Process of QP Site

Date	Activities
24 April 2006	Explanation and discussion of Inception Report to MINAGRI
25 April 2006	Meeting with the Governor of Eastern Province - Ntarama Sector is a possible site for Quick Project because of serious damage during the genocide in 1994. - QP should be in the framework of Province and District development plan.
25 April 2006	Explanation of Inception Report to the Mayor of Bugesera District
5 May 2006	Meeting with the Mayor of Bugesera District - Request to implement QP in Ntarama Sector
9-10 May 2006	Interview survey with Cell officers of three Cells, Ntarama Sector
18-19 May 2006	Interview survey with Sector officers of 15 Sectors, Bugesera District

5.3 Selection of Quick Project Component

Regarding the components of QP, Bugesera District also requested the Study Team to be in line with the national policy (e.g. One Cow, One Family) and Bugesera Action Plan as indicated by the Performance Contract, which has been made and entered by and between District and the President of the Republic in April 2006. After the field survey, the Study Team proposed following possible components and had discussions with the leaders in 3 Cells and Sector officers in Ntarama Sector.

Improvement of Living Conditions

- Improved Cooking Stove
- Household Rainwater Storage
- Two-wheeled Cart
- Expansion of Nursery at Schools and Cells

Diversification of Income

- Provision of Mosaic Disease Resistant Cassava
- Small-scale Grain Storage Facility
- Introduction of Small Livestock (poultry, goat, etc.)
- Establishment of Bulletin Boards

Extra Proposal Based on the Field Survey

- Shallow Well Irrigation at Wetland used by Watering Can

- On-farm Level Drainage System for Soil Conservation
- Rainwater Harvesting (roadside irrigation system)
- Repairing of Rural Roads
- Rehabilitation of Small Canals, etc.
- Compost and Silage making
- Charcoal Making from Euphorbia Trees

After having discussions at a Cell level, each Cell prioritized the above possible project components. The Study Team brought the results of project components prioritization to the District and had a meeting. The District side excluded some of the components because the District and/or other donors have plans to implement them. Finally, the following components were selected as the QP components with the consent of both JICA headquarters and MINAGRI.

Supported by JICA Study Team

- Introduction of Modern Cow
- Installation of Household Rainwater Storage
- Introduction of Shallow Well Irrigation
- Introduction of Road Side Irrigation System

Supported by Bugesera District

- Bulletin Boards at Ntarama Sector and three Cells
- Nursery of Fruit Trees at Schools and Cells

If additional components are proposed by the stakeholders through discussions/workshops at Cell levels, District Mayor and the Study Team will discuss and consider them as the QP components or not. The objectives and preconditions of the four components supported by JICA are summarized in the following table.

Table 5.3.1 Summaries of the Four QP Components

<p><u>Modern Cow Distribution</u></p> <p>Objective: Income generation, Nutritional improvement, Soil Improvement by manure</p> <p>Preconditions:</p> <ul style="list-style-type: none"> Model farmers have a shed-house for cow. Model farmers have enough fodder crop plot (at least 0.5 ha). Model farmers have experience to raise cattle before. Model farmers have strong motivation to raise cows. Model farmers are reliable farmers. Model farmers reside within sphere where vet-technician can follow.
<p><u>Rainwater Storage Installation</u></p> <p>Objective: Improvement of living conditions</p> <p>Preconditions:</p> <ul style="list-style-type: none"> Priority should be given to the houses far from water source. Priority should be given to vulnerable people.
<p><u>Shallow Well Irrigation</u></p> <p>Objective: Income generation, Nutritional improvement (Small scale irrigation for dry season)</p> <p>Preconditions:</p>

The sites should be near wetland.
<u>Roadside Irrigation</u>
Objective: Soil conservation, Income generation (Rainwater utilization)
Preconditions:
The field should locate along the rural road.

Following table summarizes the processes for the selection of QP components.

Table 5.3.2 Selection Process of the QP Component

Date	Activities																																
9-10 May 2006	Interview survey with three Cell officers (Cyugaro, Kanzenze, Kibungo) in Ntarama																																
12 May 2006	Proposal of the QP components to Cell and Sector officers in Ntarama Sector based on the field survey <ol style="list-style-type: none"> 1. Improvement of Living Conditions <ul style="list-style-type: none"> - Improved Cooking Stove - Household Rainwater Storage - Two-wheeled Cart - Expansion of Nursery at Schools 2. Diversification of Income <ul style="list-style-type: none"> - Provision of Mosaic Disease Resistant Cassava - Small-scale Grain Storage Facility - Introduction of Small Livestock (poultry, goat, etc.) - Establishment of Bulletin Board 																																
17 May 2006	Feedback from the Cell officers on the results of discussions in terms of priority of QP components in each Cell <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>Priority</th> <th>Cyugaro</th> <th>Kanzenze</th> <th>Kibungo</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Modern Cow</td> <td>Modern cow and Poultry</td> <td>Rainwater Storage Facility at each HH</td> </tr> <tr> <td>2</td> <td>Improved Cooking Stove</td> <td>Rainwater Storage Facility at each HH</td> <td>Improved Cooking Stove</td> </tr> <tr> <td>3</td> <td>Rainwater Storage Facility at each HH</td> <td>Mosaic Virus Disease Resistant Cassava</td> <td>Modern cow, goat, rabbit and Poultry</td> </tr> <tr> <td>4</td> <td>Mosaic Virus Disease Resistant Cassava</td> <td>Storage for grains</td> <td>Mosaic Virus Disease Resistant Cassava</td> </tr> <tr> <td>5</td> <td>Fruit Trees (papaya, avocado, mango, etc.)</td> <td>One wheel cart</td> <td>Fruit Trees (papaya, avocado, mango, etc.)</td> </tr> <tr> <td>6</td> <td>-</td> <td>Improved Cooking Stove</td> <td>One wheel cart</td> </tr> <tr> <td>7</td> <td>-</td> <td>-</td> <td>Classroom, latrine at school</td> </tr> </tbody> </table>	Priority	Cyugaro	Kanzenze	Kibungo	1	Modern Cow	Modern cow and Poultry	Rainwater Storage Facility at each HH	2	Improved Cooking Stove	Rainwater Storage Facility at each HH	Improved Cooking Stove	3	Rainwater Storage Facility at each HH	Mosaic Virus Disease Resistant Cassava	Modern cow, goat, rabbit and Poultry	4	Mosaic Virus Disease Resistant Cassava	Storage for grains	Mosaic Virus Disease Resistant Cassava	5	Fruit Trees (papaya, avocado, mango, etc.)	One wheel cart	Fruit Trees (papaya, avocado, mango, etc.)	6	-	Improved Cooking Stove	One wheel cart	7	-	-	Classroom, latrine at school
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7	-	-	Classroom, latrine at school																														
18-19 May 2006	Interview survey with Sector officers of 15 Sectors, Bugesera District <ul style="list-style-type: none"> - Confirmed that the issues observed in Ntarama are common and widespread among other Sectors. - The lessons learned could be applied and/or extended to other Sectors. 																																
26 May 2006	7 extra proposals were indicated to the Mayor of Bugesera District by the Study Team based on the field investigation. The Mayor excluded some components because some of the components could be done by the Bugesera District, and the following ones were finally remained as component candidates. <ul style="list-style-type: none"> - Modern Cow - Household Rainwater Storage - Fruit Trees (papaya, avocado, mango, etc.) - Shallow well irrigation at wetland used by watering can - Rainwater harvesting (road side irrigation system) - Drainage system at on-farm level for soil conservation - Repairing of rural roads 																																

Date	Activities
1 June 2006	The Study Team submitted a proposal with the cost and benefit of each component to the Mayor of Bugesera District, and he excluded some of the components since they would be implemented by District and/or other donors. Finally, the four QP components supported by JICA were selected.

After the selection of the QP components, the Study Team explained basic idea of the work and material sharing with the QP beneficiaries to the officers from the three Cells since the Team considered that contribution from beneficiaries and local authorities was indispensable to facilitate ownership and motivations of the QP by the people.

Table 5.3.3 Basic Idea of the Work and Material Sharing

Component	Share of Beneficiaries	Share of the Study Team
Modern Cow	Labor, Fodder crop, Cow shed, Wood, Nail, Stone	Cow, Sprayer, Cement, Roofing sheet, Technical training, Monitoring costs
Rainwater Storage	Labor, Stone, Sand	Cement, Technical training, Sand, Iron sheets
Shallow Well	Labor, Stone, Tree for fence	Cement, Sand, Rope, Tools (shovel, wheel barrow, etc.), A-Frame, Seeds, Technical training
Roadside Irrigation	Labor, Stone	Tools (shovel, wheel barrow, etc), A-Frame, Technical training

The Cell officers were asked to discuss the priority among the four components with people in each Cell. Through the discussions with people at each Cell, the introduction of modern cow was selected as the first priority in every Cell.

Table 5.3.4 Priority of the Four Components by Cell

Component	Cyugaro	Kanzenze	Kibungo
Modern Cow	1	1	1
Rainwater Storage	2	2	2
Shallow Well Irrigation	3	4	4
Roadside Irrigation	4	3	3

Table 5.3.5 Activities before Making Plan of Operation

Date	Activities
8 June 2006	Meeting with the Cell council members and Sector officers in Ntarama Sector <ul style="list-style-type: none"> - Informed the past of meeting with the Mayor. - Explained the four QP components together with various preconditions. - Asked the participants to discuss the four components to be prioritized considering various preconditions indicated and their own needs in each Cell.
15 June 2006	Meeting with three Cell representatives and Sector officers in Ntarama Sector <ul style="list-style-type: none"> - Presentation of prioritization result by Cell

For the smooth implementation of the QP, the Study Team considered that a participatory approach should be adopted since it allows all the beneficiaries to incorporate their ideas and needs, to be committed and have a sense of ownership; they understand it is their own projects, not JICA projects. Therefore the Study Team tried to involve possible beneficiaries in the meeting from the beginning.

5.4 Socio-Economic Survey and Analysis

The quick projects in rural and agricultural sectors financed by JICA have been commenced in Ntarama Sector in Bugesera District under the scope of work in the study on sustainable rural and

agricultural development in Bugesera District since June, 2006. The quick projects consisted of the four components, namely QP-1: Rainwater storage installation, QP-2: Shallow well irrigation, QP-3: Roadside irrigation and QP-4: Modern cow distribution, benefiting around 200 households in the three Cells of Ntarama Sector. Each QP has different objectives based on each component. In this survey carried out during the August in 2006- to January 2007, around 50 households over the four QPs were interviewed by QP in order to extract possible index for monitoring and evaluation of QPs and Pilot Projects as the baseline of August 2005 to July 2006.

5.4.1 Objectives and Method

(1) Objectives

The rural socio-economic survey on the beneficiaries in the quick projects aims at the followings;

Acquiring basic information for analyzing agricultural and rural development potential and constraints together with index on evaluation of the four QPs and pilot study (PP) impacts based on the following project outline as per each QP.

Concerning each QP profile, the outline is shown in below Table.

Table 5.4.1 Numbers of Beneficiaries by QP and QP Outline

No	Component	No of Beneficiaries	Quick Project Outline	
QP1	Rainwater storage installation	100	Cyugaro Cell	30 model farmers
			Kanzenze Cell	30 model farmers
			Kibungo Cell	30 model farmers
			Objectives: To secure safety domestic water during the rainy season by mitigating burden work for fetching water and contributing to generate spare time for their life. To construct rainwater storage with 1 m ³ cap in each household under cost sharing system. Structure of rainwater storage consists of three types as follows: a. Traditional type with stone b. Brick type storage c. Wooden frame type	
QP2	Shallow well irrigation	60	Cyugaro Cell	20 model farmers
			Kanzenze Cell	20 model farmers
			Kibungo Cell	20 model farmers
			Objectives: Improving farming activity (productivity, income generation) of marshland (Igishanga) during the dry season (Season C) by introducing shallow well. To dig three types of shallow well in the border of marshland and hilly side as follow; a. Pit type of shallow well with 2 *2* 1.5 m size b. Canal type of shallow well to connect from water source in marshland to upland field around of 10- 15 m under participatory work sharing approach.	
QP3	Roadside irrigation	30	Cyugaro Cell : 2 sites	10 model farmers
			Kanzenze Cell: 2 sites	10 model farmers
			Kanzenze Cell: 2 sites	10 model farmers

No	Component	No of Beneficiaries	Quick Project Outline	
			Objectives: Improving farming activity (productivity, income) by trapping runoff of rainwater into hilly side fields during the rainy season	
			To make ditches from roadside to upland fields so as to trap runoff into the upland field expanded in hilly terrain	
QP4	Modern cow distribution	18	Cyugaro Cell:	6 model farmers
			Kibungo Cell:	6 model farmers
			Kanzenze Cell:	6 model farmers
			Objectives: To improve farming activity (income generation by selling milk, applying cow dung manure to field, nutritious condition by consuming fresh milk)	
			To distribute crossbred cow in calf to the selected model farmers under cost sharing system regarding cowshed construction and animal health. This QP includes a revolving mechanism to redistribute new born calf to next generation in future.	
Total		About 208		

(2) Method

1) Component of questionnaire

The rural socio-economic survey covers the following aspect consisting of the 6 categories as follows.

Table 5.4.2 Outline of Questionnaire

Categories	Major survey items
General	Family aspect, decision making, meal, land tenure
Income	Income (August-05 to July-06) by crop and by season, i.e, annual crop, permanent crop, season A, season B and season C
Expenditure	Expenditure (August-05 to July-06) by agricultural input, hired labor, food items, non-food items, others
Association Activities	General, land tenure, income, expenditure
Traditional supporting system	Umuganda, Ubudehe, Ibibina, kugurizanya
Others	Fetching water, collecting firewood, spare time, soil fertility, health, drought coping strategy

The questionnaires focusing on the rural community in Ntarama Sector was drafted by JICA Study Team based on preliminary information and briefed to the surveyors including objectives and target households involved in the quick projects on late August, 2006. The questionnaire consisting of structured and semi-structured questions was revised so as to fit to the current socio-economic situation via preliminary test carried out in Kibungo Cell late August, 2006. This preliminary test includes training of the survey assistants as well.

2) Sampling method

Selection and arrangement of the households for interview was requested to the Cell office concerned or group head of the QP beneficiaries prior to interview under guidance of JICA Study Team. The numbers of the sampling households per each QP ranges from 20% to 50% as below.

Table 5.4.3 Numbers of Sampled Farm Households

QP components		Total No of Model Farmers	Sampling Households	Ratio
QP1	Rainwater storage installation	100	18	20%
QP2	Shallow well irrigation	60	12	20%
QP3	Roadside irrigation	30	9	30 %
QP4	Modern cow distribution	18	9	50%

3) Analysis of income and expenditure

Total annual income and expenditure were estimated based on the following formula and information.

(a) Income

Annual income of the farm household consists of the three sources such as agricultural income, livestock income and off-farm activities as below.

Table 5.4.4 Standing Points of Annual Income

Total annual household income (TAI) = Agricultural Income + Off Farm Income
Agricultural Income = Farming Income + Livestock Income
Farming = Seasonal Crop Income + Permanent Crop Income
Annual Seasonal Crop Income = (Season A + Season B + Season C) Income
Seasonal Crop Income = Sum of quantities sold per each sale x Unit price
<u>How to approach :</u> The collected data includes : inventory of seasonal crops exploited, planting and harvesting month, form of crop sold (green, dry, cobs, grain, flour, others), number of times sold, unit for sale (kg, bag, basket, plate, heap, piece, others), quantities sold per each sale
Permanent Crop Income = Sum of quantities sold per each sale x Unit price
<u>How to approach :</u> The collected data includes: inventory of permanent crops exploited, number of pieces harvested, number of pieces sold, sale price /unit
Livestock Income = Sum of products sold per each sale x Unit price
<u>How to approach :</u> The collected data includes: inventory of animals types exploited, rearing numbers, unit for sale (head, liter, piece, kg, others), quantities sold, unit price ...
Off Farm Income = Sum of casual work income, lending land income, banana wine income, sorghum beer income, donation income, pension income, others
<u>How to approach:</u> The collected data includes: inventory of off farm income sources ; casual work : quantity (in terms of day/year), unit price ... lending land : area (Ha), unit price ... banana wine : quantity (jerry cans/year), unit price sorghum beer : quantity (jerry cans/year), unit price pension : amount/3 months

(b) Expenditure

Annual expenditure comprises agricultural input, hired labor, food and non-food as follows.

Table 5.4.5 Standing Points of Annual Expenditure

Total annual household expenditure (TAE)=Expenditure of agricultural input + Cost of Hired labor + Food cost + Non Food cost
<u>How to approach :</u>

The collected data includes:
inventory of agricultural input, food, and non food purchase, sale unit, quantities, and unit price of each item.

The raw data collected have been entered, processed and analyzed by using Microsoft word and Excel.

5.4.2 Results

In accordance with the overall objectives as per each quick project, the results were summarized by comparing four QPs, focusing on each main objective mentioned in the aforementioned method.(See Annex V.5.4.1)

(1) General

1) Family aspect

Table 5.4.6 shows the average general characteristics of the household per each QP.

Table 5.4.6 General Characteristics of the Household

QP	Average HH head Age (year)		% of widows*	Average HH head schooling years		Family size		Family members engaged in farming	
	Range	Average		Range	Average	Range	Average	Range	Average
QP1	23-72	49	50%	0-12	5	1-10	7	1-3	1.9
QP2	21-69	41	17%	0-8	4.5	1-11	4.5	1-2	1.8
QP3	33-62	45	22%	0-8	5.7	3-10	6.4	1-5	2.3
QP4	25-54	40	33%	3-12	8	2-8	5	1-2	1.6

Source: Interview Results by JICA Study Team, 2006 / *% of widows among the interviewed sampled interviewees

Tables above show that family general characteristics are more or less the same among the QPs. Average HH head age is around 44, schooling years is ranging from 4.5 and 8, family size is ranged from 4.5 and 7, and family members engaged in farming is around 2 persons per HH. However, some significant differences are noticed. The average HH head, percentage of widows and family size in the QP1 are higher. The main reason is that the QP1 targets vulnerable persons as beneficiaries, especially old people, with objective of securing safety domestic water during the rainy season. Schooling years of 8 in the QP4 is higher, because its interviewees are younger and have had more chance to be sent to school.

2) Meal and food

No significant difference was observed on daily meal and food. The daily meal among the QPs' interviewees is around 2 times comprising of lunch and dinner. Food crop types included beans, sweet potatoes, maize, banana, cassava flour, sweet cassava, groundnut, taro, sorghum, and Irish potatoes. Beans, sweet potatoes, maize, banana and sweet cassava were dominant. More than 65% of HHs had annually at least between 2 and 3 types of food crop in the staple food.

3) Land tenure system

Land tenure system is same among the interviewees. Farm size is ranged from 1 to 3 ha per family. Almost all lands owned and/or leased are on hillsides under rain-fed regime. Only few families had access to wetlands. However, the QP2 interviewees had relatively more access to wetlands, because

they have been targeted for shallow well irrigation activities.

Among the interviewees, no landless case has been noted. However, about 25% of the HHs borrows lands, either in some cases, because of the small size of the farmlands, or to avoid high costs in plowing when the land is covered by dense bush after a long fallow, or when their own parcels yield poorly. They didn't have official rules to guide the land borrowing/lending arrangement between the both parties; the deal was based up on an amicable agreement.

Farm plots on the hillsides belonged to individual households under the control of the owners. However, wetlands belong to the Government which decides on its utilization. The current Government policy on wetland utilization is to promote high value crops, especially cereals, through associative/cooperative farming. However, this strategy is not yet strictly implemented at the grass-root level, and individual farmers still continue to cultivate food crops in wetlands, because the customary rules and the newly established Land Organic Law are juxtaposed.

(2) Income

Figure 5.4.1 and Tables 5.4.7 below show the average household income per each QP. It contains the main points to be compared and discussed (See Annex V.5.4.1 , Table 5.4.1 to 5.4.5).

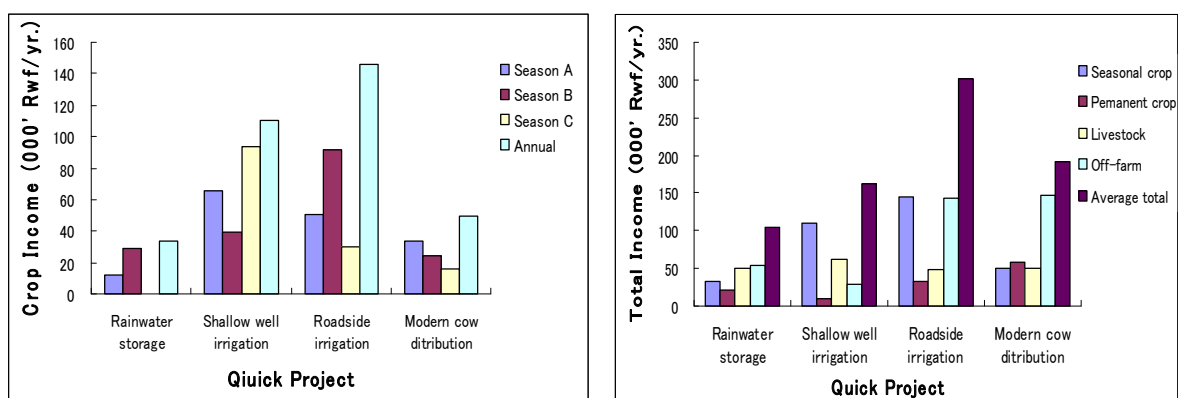


Figure 5.4.1 Income from Seasonal Crop and Total Annual Income

Table 5.4.7 Total Annual Income by QP

QP	Total		
	%HHs selling	Money received	
		Range	Average
QP1	94%	12,000 - 406,200	103,791
QP2	100%	26,700 - 575,870	163,106
QP3	100%	60,000 - 806,100	301,144
QP4	100%	9,000 - 1,032,000	191,928

Source: Interview Results by JICA Study Team, 2006

(3) Agriculture

1) Crops cultivated

Cultivated seasonal crops by QP were no significant difference. It included maize, bean, sweet

potatoes, sorghum, sweet cassava, bitter cassava, groundnut, soy beans, and vegetables. Beans, sweet potatoes, maize and sorghum were the major crops. The produce of the seasonal crops was usually utilized for home consumption, and for sale of surplus at local market. It is noted that exceptionally, Irish potatoes was planted by only 1 interviewee of the QP2. Vegetables were not cultivated by the QP1 interviewees. Seasonal crop pattern was the same and corresponded with the normal seasonal crop pattern of Bugesera region. Its trend is presented below.

Table 5.4.8 Seasonal Crop Pattern on the Period of 2005-2006

Crop	Season A				Season B				Season C			
	Planting		Harvesting		Planting		Harvesting		Planting		Harvesting	
	From	To	From	To	From	To	From	To	From	To	From	To
Maize	Sept	Nov	Dec	Feb	Feb	Marc	May	Jul	Jul	Jul	Oct	Nov
Bean	Sept	Nov	Dec	Feb	Jan	Marc	Apr	Jun	Jul	Jul	Oct	Nov
S. potatoes	Oct	Dec	Jan	Jul	March	May	Aug	Dec	Jun	Jul	Oct	Dec
S. cassava	Oct	Dec	-	-	Feb	Apr	-	-	-	-	-	-
B. cassava	Oct	Nov	-	-	-	-	-	-	-	-	-	-
Groundnut	Oct	Oct	Jan	Jan	Feb	Marc	Jul	Aug	-	-	-	-
Soy bean	Oct	Oct	Jan	Jan	-	-	-	-	-	-	-	-
Sorghum	-	-	-	-	Jan	Marc	Jun	Jul	-	-	-	-
Vegetables	Nov	Nov	Marc	Jun	Apr	May	Jul	Aug	May	Oct	Feb	Sept
Irish potato	-	-	-	-	Marc	Marc	Jul	Jul	-	-	-	-

Source: Interview Survey Results by JICA Study Team, 2006

Permanent crops cultivated were also no difference. It included banana and tree plants. However, one of interviewee of the QP4 planted a fodder perennial crop (*Pennisetum purpureum*).

2) Season A

Season A income was relatively higher in the QP2 and QP3, while it was very low in the QP1 (See Annex V.5.4.2, Table 5.4.1). Major crops sold were almost same, including maize, beans and sweet potatoes. However, in the QP2, one HH cultivated and sold vegetables at a sale amount of 300,000 Rwf. Another planted and sold bitter cassava at a sale amount of 20,000 Rwf. That sale of vegetables had significantly contributed to increase the average season A income of the QP2.

3) Season B

QP3 season B income is far higher than others (See Annex V.5.4.2, Table 5.4.1). The rest was no significant different among the other three QPs. Major crops sold were similar, including maize, beans, sweet potatoes and sorghum. Sorghum was leading. However, in the QP2, one HH cultivated and sold vegetables at a sale amount of 240,000 Rwf. Others planted and sold Irish potatoes, and groundnut, with modest sale amount. Vegetables were planted upland and sold by some QP2 and QP4 interviewees.

4) Season C

QP2 season C income is far higher than others (See Annex V.5.4.2, Table 5.4.2). QP3 and QP4 season income were modest, while no season C income in the QP1 was noted. Major crop planted and sold in marshlands were vegetables, sweet potatoes and maize; and vegetables were leading crops. More

access to wetlands by the QP2 interviewees was an opportunity to plant and sell, especially vegetables which relatively procure high income.

5) Total seasons

The QP3 and QP2 annual seasonal crop income were ranked top and the second among QPs, respectively and with earning relatively high income over the three cropping seasons (See Annex V.5.4.2, Table 5.4.2).

6) Permanent and perennial crop income:

The QP4 income by permanent and perennial crops was higher than the others (See Annex V.5.4.2, Table 5.4.3). This was also due to especially, one HH which planted and sold *Pennisetum purpureum* (a perennial fodder plant) at a high sale amount of 110,000 Rwf. Meanwhile in the QP2, the income was the lowest. Permanent and perennial crops sold were banana (cooking and fruit), tree plants and fodder plants (only planted by 1 HH of the QP4, as mentioned above).

7) Livestock

There is no significant difference among the 4 QPs' livestock income. Livestock income consisted of sale of goat, cow, cow milk, chicken and sheep. However, the QP4 interviewees didn't sale cow milk; and in the QP4 and QP1 no sale of cow were noticed.

8) Off-farm activities

QP3 off-farm income, followed by that of QP4 was outstanding (See Annex V.5.4.2, Table 5.4.4). One interviewee in the QP4 and another in the QP3 had an off-farm income of around 600,000 Rwf each, extremely outstanding among them. These high revenue was especially received from the other business rubric. The off-farm income consisted of money received from casual work, from lending lands, sale of banana wine, sale of sorghum beer, donations, training allowances and other business (not specified by the interviewees). However, one QP2 interviewee received money from pension, and another interviewee received a salary in the QP3.

9) Total annual income

Regarding total income among the QPs, there was significant difference. The QP3 income is the highest (See Table 5.4.7 above). It was followed by the QP4 income and QP2 incomes which were close with each other. The QP1 was the least.

(4) Expenditure

Below present the average household expenditure per each QP. It contains the main points to be compared and discussed.

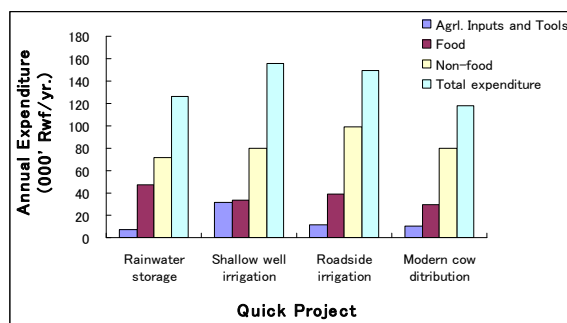


Figure 5.4.2 Expenditure

Table 5.4.9 Expenditure (Final Part)

QPs	Non food items			TOTAL	
	% HHS buying	Expenditure		Expenditure	
		Range	Average	Range	Average
QP1	100%	5,530 – 377,200	71,677	18,100 - 474,950	126,831
QP2	100%	26,400 – 255,700	79,926	48,510 - 406,900	156,287
QP3	100%	28,500 – 472,650	98,550	51,900 - 520,850	149,261
QP4	100%	3,500 – 389,200	80,508	15,500 - 489,680	117,488

Source: Interview Results by JICA Study Team, 2006

1) Agricultural inputs

Regarding expenditure of agricultural input, there was significant difference. The QP2 presented the highest expenditure on fertilizers, agrochemical and tools than others (See Annex V.5.4.2, Table 5.4.6 and 5.4.7). The interviewees used to cultivate vegetables in marshlands; and vegetables consume more input than traditional food crop. Meanwhile, the QP3 interviewees expended more in food crop seeds planted on hillsides. The inputs consisted of vegetables and food crop seeds including bean, groundnut, sweet potatoes cuttings and maize. Fertilizers were procured and used by only some QP2 and QP3 interviewees. Agrochemicals were used for vegetable production and on stored food crop for protection. Tools mainly consisted of hoes and machetes.

2) Food

Regarding food expenditure, no significant difference was observed. Meanwhile, food expenditure in the QP4 seemed to be slightly lower than the others (See Annex V.5.4.2, Table 5.4.7). Expenditure for food items consisted of 16 main items as shown below box:

1.sorghum grains, 2.sweet potatoes, 3.sweet cassava tuber, 4.bitter cassava flour, 5.maize flour, 6.beans, 7.soybeans, 8.groundnut, 9.cooking banana, 9.brewing banana, 10.Irish potatoes, 11.meat, 12.rice, 13.vegetables, 14.sugar, 15.coking oil and 16.salt

3) Non food items

Regarding non food expenditure, no significant difference was noted. Meanwhile, non food expenditure in the QP3 seemed to be slightly higher than the others (See Annex V.5.4.2, Table 5.4.8). That is justified by the highest income observed in that Quick Project. The QP1, QP3 and QP4 presented each, one HH spending very big amount of between around 400,000 and 500,000 Rwf for non food items. Expenditure for non-food items consisted of 20 main items as shown below box.

1.domestic water, 2.kerosene, 3.firewood, 4.clothes, 5.soap, 6.lotion, 7.tooth cream, 8.shoe cream, 9.bed sheets, 10.blankets, 11.belt, 12.radio, 13.radio batteries, 14.bicycle, 15.domestic animals, 16.construction materials, 17.school fees, 18.medical fees, 19.land rental, 20.ceremonial occasion and others

4) Annual expenditure

Annual expenditure among the 4 QPs was slightly significant. The QP2 and QP3 annual expenditure were higher than that of another two. The QP1 and the QP4 were almost same level on expenditure. (see Table 5.4.9 above).

(5) Balance

Figure 5.4.3 and Table 5.4.10 below show a balance (income/expenditure) figures per each QP. It contains the main points to be compared and discussed.

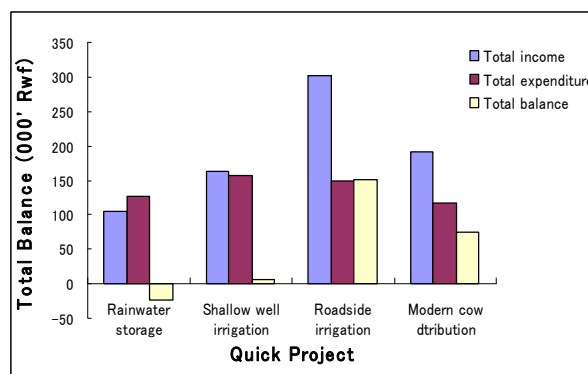


Figure 5.4.3 Balance Income/Expenditure

Table 5.4.10 Balance Income/Expenditure

QPs	Income	Expenditure	Balance	Range
QP1	103,791	126,831	-23,040	-125,400 ... +110,010
QP2	163,106	156,287	68,19	-79,560 ... +391,570
QP3	301,144	149,261	151,883	-41,900 ... +475,700
QP4	191,928	117,488	74,440	-80,550 ... +542,320

Source: Interview Results by JICA Study Team, 2006

Regarding to balance, there was significant difference. The QP3 balance was the highest among other QPs. It was followed by the QP4 balance, itself followed by the QP2 balance, while the QP1 balance was the least ranked.

QP1 presented an annual balance deficit, while annual surplus balance was noticed in other QPs. From these results, the following hypothesis could be made on the cases of deficit. Some interviewed HH heads of the QP1 (especially, old people) had difficulty to remember the exact data of previous months, because they do not record household income and expenditures. Again, depending on some sensitive situations, some farmers do not deliberately declare some income from donations or other suspicious sources, thus the declared expenses could be more than the declared income, showing a deficit.

(6) Others

1) Fetching water

Regarding to general characteristics of domestic water security, no significant difference was noticed among the 4 QPs. Average water demand per HH per day was around 80 liters from the range of 40 to 150 liters among the interviewees. 77.3% of HHs fetched water from swamps and rivers, while the rest, only 22.3%, fetched water from hand pump and tap water. Quantity of water fetched per day, times to fetch water per day and time consumed for fetching it in a round-trip depended on seasons (rainy and dry seasons) (Figure 5.4.4 and 5.4.5). This is because availability of water for domestic use was different among the cropping seasons. Considering the average household members of 5.7 and the standard requirement of water per day in African countries (20 Lt/person), the result above indicates absolute insufficiency of daily water amount per capita in the project sites.

According to the interview results, the local ecosystem offers more water during the season B (February - end of June, commonly called long rainy season) than that in the season A (called the short rainy season, September - January). On the other hand, the season C (end of June - mi-September, the long dry season) is ranked as least in terms of water availability. Therefore, availability of domestic water and its accessibility is subject to seasonal water fluctuation. Thus, people fetched more domestic water in terms of quantity and frequency per day, and consumed more hours for fetching water in a round-trip during the dry season than that in the rainy season. In fact, during the rainy season, 85% of HHs used rainwater harvesting systems, and collected around 80 liters after normal raining hours.

In the season C, an average quantity of water fetched per day per HH was about 60 liters. That water was fetched around 2 times per day on average and average time consumed for fetching it in a round-trip was around 1.5 hours. In the season A, quantity of water fetched per day per HH was 50 liters. That water was fetched around 2 times per day and time consumed for fetching in a round-trip was slightly less than 1.5 hours. In the season B, an average quantity of water fetched per day per HH was about 33 liters. That water was fetched around 1.3 times per day and an average time consumed for fetching it in a round-trip was around 1 hour (see Figure 5.4.6).

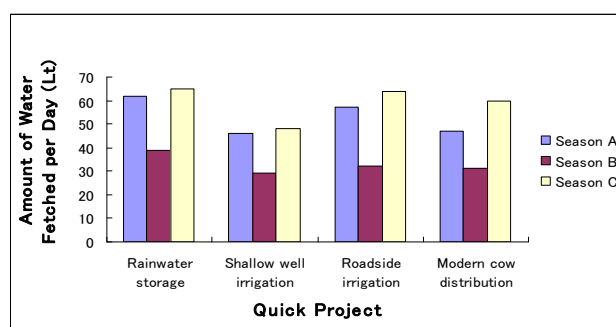


Figure 5.4.4 Amount of Water fetched and Frequency of Water fetching per day by Season (Lt)

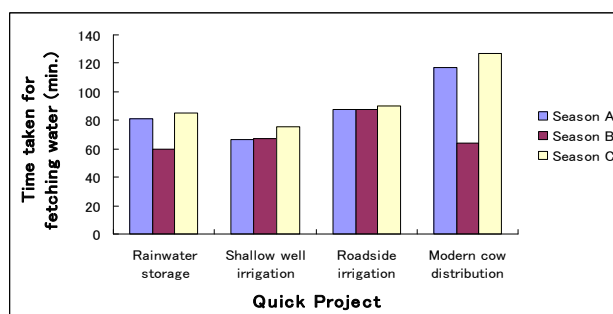


Figure 5.4.5 Time taken for a Round-trip of Water fetching by Season

2) Collecting firewood

Regarding to general characteristics on collecting firewood, no significant difference was noted among the 4 QPs. Time required to collect firewood was correlated with the rainy seasons. It is noted that in the rainy season, it takes more time to collect firewood than that in the dry season because of spending

more time to collect dried firewood. Regarding to frequency of firewood collection per week, some slight differences are observed. There is a tendency to collect firewood required less time per week in the dry season than that in the rainy season. In fact, in the dry seasons people could collect big bundles of sticks than that in the rainy seasons, because dried stick are more available (period of decrease of rain and increase of sunshine). Further in the dry seasons, farmers used plant residues for firewood which are more available in the farm. In the season C, frequency to collect fire wood per week was 3.5 times and time consumed in a round-trip was around 1 hour. In the season A, frequency to collect firewood per week was 4 and time consumed in a round-trip was around 1.25 hours. In the season B, frequency per week to collect firewood was 3.6 and time consumed in a round-trip was more than 1.5 hours.

3) Soil fertility

No significant difference was noted among the 4 QPs on how the interviewees perceived trend of crop yield fluctuation over the years. Almost all farmers perceived a decrease of crop yield year by year. However, one QP3 interviewee and another one of the QP4 considered that crop yield was stable over the years. According to the model farmers, decrease of crop yield is caused by decrease of soil fertility, while the plant diseases have aggravated the situation, especially on the tuber crops such as cassava and sweet potatoes. Infertility of soil or disease incidence could be caused by crop rotation without fallowing period or continuous cultivation of same crops.

4) Drought coping strategy

Regarding drought coping strategy, no significant difference was noticed among the 4 QPs. In the past and future time, the interviewees have coped and will cope with drought by taking several countermeasures including asking donation, sale of livestock, cultivating wetlands, casual work, sale of farmlands, requesting loan, sale of trees, making and sale of charcoals and migration. Cultivating wetlands, sale of livestock and asking donation were dominant countermeasures. In fact, wetland cultivation seems to be a promising and sustainable drought coping measure in the region.

5.5 Modern Cow Distribution

5.5.1 Background and Purpose of the Project

This component aims at income generation, soil improvement by applying cow dung manure and nutritional improvement of the local people. In total, 18 modern cows would be introduced in the three cells (6 cows per each cell). The kick-off workshop was held on 20, 22 and 23 June in Cyugaro, Kanzenze and Kibungo cells, respectively by inviting Cell staff including executive secretary and council members. Two experts from RARDA were also invited to attend the workshop to provide brief lectures on animal husbandry and health. Following programs were done with the cell representatives.

- 1) Self introduction of the participants (ice breaking)
- 2) Explanation of cow distribution component and its preconditions
- 3) Lectures in terms of cattle management by RARDA staff
- 4) Questions & Answers
- 5) Request to select possible beneficiaries of modern cow in the cell

The following nine preconditions were consistent with “One cow, one family” policy promoted by MINAGRI. The workshop focusing on the final candidate model farmer was held on July 11, 2006 and the Plan of Operation was formulated.

- 1) Model farmer should be resided in applicable Cell where vet-technician could follow up.
- 2) *Model farmer should have a cow shed.
- 3) *Model farmer should have an enough fodder crop plot at least 0.5 ha.
- 4) Model farmer should have an experience to raise cattle before.
- 5) Model farmer should have a strong motivation to raise cows.
- 6) Model farmer should be reliable farmer in the community.
- 7) *Model farmer should be a member of Association or Cooperatives. Concerning this precondition, it is possible to organize newly association after nomination for interviewee.
- 8) Model farmer should not have any crossbred and exotic cows.
- 9) Model farmer should be tackling protection of soil erosion and should provide soil pits for compost making at his/her farmyard.

(The preconditions with asterisk should be cleared by the time to deliver crossbred cow.)

5.5.2 Process and Results of the Project

(1) Formulation of Training Program for the Model Farmers

Based on the formulated PO, the training module for MF's (Model Farmer) training was prepared in collaboration with RARDA. The existing training materials by RARDA was strictly confined to text only without any illustration, thus the model farmers including poor ability of reading and writing were appeared to hardly understand. Therefore, an improvement of training module was attempted by inserting many illustrations such as advanced cowshed, cutting of fodder crop, disposal of cow dung

and etc, so as to make them well perceive via illustrations. The training module consists of four subjects with 37 pages of Kinyarwanda language comprising of i)improved cowshed, ii)animal nutrition, iii)animal health and iv)animal reproduction (refer to The Technical Guideline of Modern Cow).

(2) Technical Training Program

The WS for the technical training program was held on August 1-3, 2006 by RARDA-JICA joint team (See Annex V.5.5.1 and V.5.5.2).

Date & Time: August 1 – 3, 8:30~14:00

Place: MANDERA Woman Promotion Center, Kanzenze Cell

Participant: 18 Model Farmers, Cell office, Sector office, District Office, Local vet-technicians, NGO (Caritas)、RARDA experts, JICA Study Team

(3) Study Tour

Study tour was carried out on August 8, 2006 for visiting the two large-scale livestock farms in and around Ntrama Sector in order to broaden knowledge of the Model Farmers. The visiting sites are as follows.

Visiting site 1	<ul style="list-style-type: none"> ▪ 9:45~11:45: Dr. David Farm (50 cows) ▪ Located in Gahanga Sector(South of Kigali city) and rearing of 50 Frieasians imported from Germany
Visiting site 2	<ul style="list-style-type: none"> ▪ 13:00~14:30: Dr. Jacques Farm(Fattening farm) ▪ Located in Kanzenze Cell in Ntrama Sector ▪ Farm size: Slope of 80 ha including cowshed, pasture field



Visiting site 1: Large scale dairy farm

(4) Construction of the Prototype Cowshed

1) Recommendation of prototype cowshed design

Model cowshed for “One cow, one family” was neither designed by MINAGRI nor RARDA so far. Thus, JICA team attempted to collect any training module with illustration for dairy farming and draw a small cowshed accommodating one cow and calf with walking area, crush pen and pits for cow dung manure in collaboration with RARDA staff concerned (See Annex V.5.5.3).

2) Construction of cowshed

Construction work of cowshed included concrete work which required specific knowledge, thus most of the model farmers do not have experiences, while the proposed model cowshed was positioned as proto type for future extent of modern cow distribution. Thus, the JICA study team recruited three teams comprising of masonry and assistant for cowshed construction of each Cell group, and construction work commenced from September 13 and completed on October 18(See Annex V.5.5.4).



(5) Monitoring of Model Farmer’s Progress for Preparation of Cow Reception

Preconditions of the model farmers receiving modern cow including cowshed function was strictly monitored based on the below checklist. As a result, all model farmers cleared the instructed matter guided by RARDA-JICA joint team(See Annex V.5.5.5).

Table 5.5.1 Monitoring Checklist on Progress of Receiving Modern Cow

	Check category	Contents
1	Cowshed condition	Cowshed type, site of construction, cowshed function, walking area, crush pen, water trough, feed trough, drain ditch and soil pit for cow dung and urine, compost pits
2	Fodder crop condition	Species, acreage, growth condition, distance to cowshed
3	Care of cow	Distance of fetching water point to cowshed, rainwater storage, key person in charge of cow keeping, numbers of helpers
4	Remark	Pay special attention if any.

Source: JICA Study Team, 2006

(6) Purchase of Crossbred Cow

At the period of QP implementation, GoR has restricted to import cattle from neighboring countries due to outbreak of FMD. Thus, source of heifer was strictly confined to domestic market only. In this procurement process, RARDA was responsible organ to confirm pedigree diagnosis and presence of disease diagnosis. JICA Team visited Rwangingo farm located in Nyagatare twice on November 8 and 30, 2006 with RARDA staff and purchased 18 heifers-in-calf. In this mission, RARDA took responsibility to issue an authorized letter by taking blood sample for test and diagnosis of crossbred visually including pregnancy diagnosis(See Annex V.5.5.6). Based on diagnosis result, RARDA issued an authorized letter to the JICA team for purchase.

(7) Briefing Workshop prior to Heifer Distribution

RARDA-JICA joint team held a workshop on December 5, 2006 at Mandera Woman Promotion Center in Ntarama Sector. This workshop aimed at making sure of this QP to launch smoothly in collaboration with stakeholders consisting of the 18 model farmers, District Office, Sector Office, Cell Office, vet-technicians, RARDA and JICA Team(See Annex V.5.5.7 and V.5.5.8).

(8) Cow Distribution

RARDA-JICA joint team delivered 18 heifers in calf to the 18 model farmers on December 7, 2006. The heifers were transported from Rwangingo to Ntarama Sector over three hours and spent another 2 hours for delivery to each model farmer.



(9) Monitoring of Animal Health and Guidance

1) Employment of vet-technician

After delivery of heifers, three vet-technicians were just recruited to each Cell for monitoring animal health condition of the heifers in each command area. They made a biweekly monitoring report and submitted to the agronomist in Ntarama Sector Office. The Sector agronomist compiled the report based on the monitoring report and submitted to District Office(See Annex V.5.5.9).

2) Symptom caused by stress

Because of long distance transportation with drastic change of their living environment, most of the heifers were more or less stressed by showing some symptoms like decrease of appetite and drinking water or skin leg injury by kicking cowshed poles, and abortion. Among the factors caused stresses, major factor was assuming a drastic change of living condition from grazing system to zero grazing system including ignorance of taste for heifers. Therefore, heifers showing severe symptom were mainly diagnosed by RARDA-JICA joint team and advised as below.

Table 5.5.2 Major symptoms caused by Stress

Major Symptoms	Guidance to Model Farmers
Decrease of Appetite	Mixing penissetum with other palatable grass species and changing a mixing ratio by increasing penissetum portion to other species gradually so as to make heifer adjust herself in a new feeding diet.
Leg injury	Due to drastic change of living condition from open place to zero-grazing, heifer was stressed and got injury by kicking cowshed. So advice the model farmer to give antibiotic tab via vet-technician so as to avoid infection.
Miscarriage	One of heifers got abortion on December 14, one week after delivery and this appeared to be caused by interaction between long transportation and change of living environment. So advice the model farmer to give antibiotics intensively via vet-technician.

3) Pregnancy test

In accordance with the Plan of Operation, heifer in calf was supposed to deliver. So diagnoses of pregnancy were carried out by RARDA-JICA team on December 15, 2006 Diagnosis on pregnancy was made via uterus manipulation. As result of it, 6 heifers out of the 16 heifers were found as heifers in calf. From this result on pregnancy diagnosis, the livestock supplier carried out artificial insemination (AI) in collaboration with RARDA.

(10) Claim Generated by Model Farmers

In accordance with the Plan of Operation, JICA team scheduled to deliver 75 % of crossbred between Friesian and Ankole. However, some of the model farmers complained the heifers delivered in terms of pedigree of crossbred because of some of the heifers less than that of 75 % based on their experiences. These complaints were submitted to District Office via Sector Office and the District Office decided to conclude a final decision by inviting a certain livestock expert from the Eastern Province who was supposed to diagnose the 18 heifers with the District Agronomist together on February 8, 2007. Further, this decision shall be submitted to RARDA-JICA joint team later to seek for reconsideration if necessary.

was focused on rearing of heifer as well as animal health condition.

2) Artificial insemination (AI) system

Artificial insemination is generally carried out under contract between RARDA and locally available qualified artificial inseminator. In this JICA QP, AI on non-pregnancy heifer is operated under financing of the heifer supplier based on the agreement with JICA team. The relevant stakeholders in this AI operation involve the four actors consisting of RARDA, heifer supplier, vet-technician and the model farmers who need AI. Furthermore, division of duties among the four actors should be shared well in order to function properly. Below figure shows a present AI system chart proposed by the heifer supplier. Each vet-technician reports libido symptom of his command heifers to the heifer supplier, and who contacts RARDA to secure the necessary semen and luteotrophic hormone for AI operation. At present, communication between vet-technicians and heifer supplier is not smoothly done because of no means to communicate such as mobile telephone by the vet-technicians.

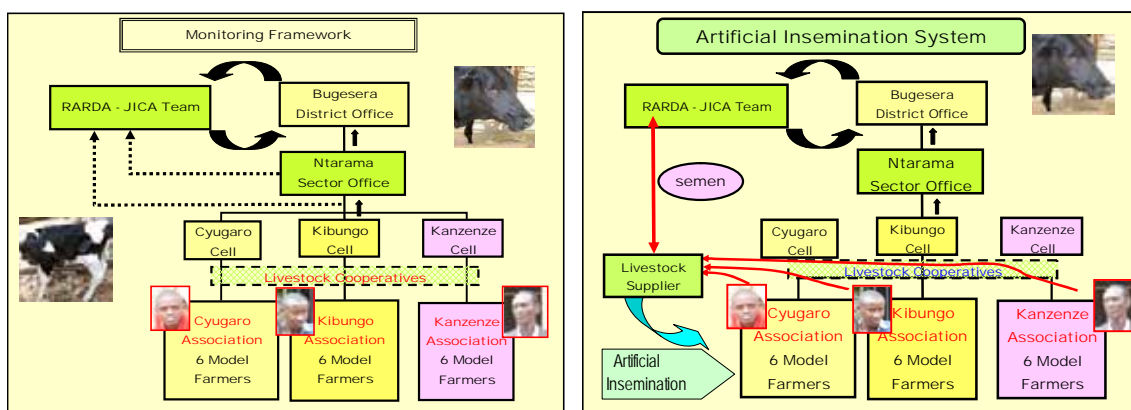


Figure 5.5.2 Monitoring Framework and AI Operation System

3) Absence of pedigree certificate to prove purity of crossbred

In case of purchasing crossbred in Rwanda, most of the livestock traders do not have the written certificate to prove a crossbred degree such as “Pedigree Index” and do business without the certificate. At that time to procure heifers, outbreak of FMD in the near border to Uganda restricted to import livestock and alternative option was only to find crossbred heifer domestically combined with a limited budget. Therefore, purchasing crossbred heifer was made from one of trustable cattle farm under attendance of RARDA expert to judge pedigree index by checking skin color, body frame, and presence of horn and so on. Then a permission authorized by RARDA DG was issued to the heifer supplier. However, some claim on pedigree index was generated from some of the model farmers and RARDA staff committed personally to admit this claim, suggesting that visual check was very difficult.

(3) Monitoring and evaluation result

It has passed one year since early December in 2006 when heifers were delivered to the 18 model farmers (MF). Since that time, the model farmers have been facing various problems in rearing modern cow. In order to grasp the model farmer's cow rearing condition, a monitoring survey to the 18 model farmers by using questionnaire sheet was conducted in late July, 2007 by recruiting the 3 vet-technicians. The monitoring survey items consists of the following eight categories.

- | | |
|----|---|
| 1) | General condition of Model Farmers |
| 2) | Rearing Condition |
| 3) | Animal Condition |
| 4) | Reproduction Aspect |
| 5) | Benefit generated by modern cow rearing |
| 6) | Association activity with Cell and Sector |
| 7) | Performance of vet-technician employed by JICA Team |
| 8) | Recommendation to RARDA-JICA by Vet-Technician |

1) Monitoring results

(a) Problems of the model farmers at hand

In accordance with the national policy of "One cow, one family project", the said project was aimed at income generation by selling surplus of milk under suitable animal husbandry via appropriate diet of feeding materials. However, various problems attributed to model farmer's low level of knowledge on dairy farming and animal health, and insufficient training provided by the supporting organ are generated as follows.

Table 5.5.4 Problems of Model Farmers

	Issues	Outlines
1	Animal health	disease (malnutrition due to insufficient intake of essential elements, parasite, bacterial infection, suppuration suffered from dehorning, swollen of knees, poor appetite, injury of legs caused by kicking cowshed due to stress, etc)
2	Animal reproduction	stillbirth, miscarriage, AI failure, etc
3	Animal husbandry	difficulty of rearing aggressive heifer, poor lactation performance due to imbalance of feeding materials
4	Supporting framework	there is no reciprocal help each other except for exchanging rearing condition., and no activity of formation of association without support from Cell, Sector and District Offices
5	Association Activity:	there is no reciprocal help each other except for exchanging rearing condition., and no activity on formation of association without support from Cell, Sector and District Offices
6	Recommendation to the supporting administration by the model farmers	Strong dependence on external supporting body were observed such as i) regular visiting and guidance to the model farmer, ii) request of extension and training service about cow rearing, iii) suggestion of the model farmer's participatory system to select high quality of crossbred, iv) supporting of supplying drug and vet-technician's regular visiting system, v) replacement of low quality-crossbred delivered by RARDA-JICA because of not contributing to poverty reduction, and etc.

(b) Issues on following up cow quick project

Below table summarized the issues to be followed up and its responsible body concerned based on the midterm monitoring results(See Annex V.5.5.10). The issues were categorized into the four comprising of animal nutrition, animal health, selection of high quality crossbred, institutional support. These issues are not only applicable to JICA cow QP but also most of the cow projects supported by the other donors in accordance with "One Cow, One Family Project".

Table 5.5.5 Following up Issues

Subjects		Outline of following up	Main Actor	
			Local Government	MF
1	Animal nutrition	A. Giving information about general nutrients requirement related to lactation cycle and performance of crossbred.	ISAR RARDA	
		B. Feeding roughage by grass type available locally in relation to lactation performance by type of crossbred based on research data.	ISAR RARDA	
2	Animal health	A. Giving specific information and solution about major disease, stillbirth, miscarriage, death of calves after born, character of aggressive heifer so far faced by MF via Q & A	RARDA	
		B. Establishment of following up system to the MF's regularly by vet-technicians in order to guide MF for keeping cow in healthy condition.	Cell/Sector Office	Association
3	Selection of high quality crossbred	A. Establishment of definite way to select 75 % crossbred at present crossbred market in Rwanda.	RARDA	Association
		B. Offering an alternative option instead of replacing the crossbred delivered to MFs by RARDA-JICA. For example, 1st newborn female calf is given to the MFs and from 2nd female calf could be delivered to the 2nd generation.	RARDA Cell/Sector Office	
4	Institutional Aspect	A. Mobilization of the MF so as to form a livestock cooperative by giving lectures how to form and register cooperatives including division of duty as per each board member.	District Office, Sector office	
		B. Establishment of sustainable monitoring framework to the QP by involving local government level including selection and distribution of the 2nd generations.	Cell/Sector District office RARDA	Association
		C. In relation to the above 2-B, establishment of veterinary drug-supply system to the MFs in combination with cooperative formation	Cell/Sector, District Office	Association
		D. Capacity building for the local vet-technicians should be made. Increase of AI inseminator and their training should be done.	RARDA	

Source: JICA Study Team, December, 2007

(c) Discussion with RARDA

JICA Study Team submitted the midterm monitoring report to DG of RARDA, Representative of MASAKA RARDA Office and QP stakeholders concerned on December 17, 2007 and briefed the outline of the said report and discussed the countermeasures on quality of the delivered crossbred hereinafter. In the meeting, JICA Study Team proposed RARDA to deliver the 1st female calf to the model famer (1st generation) as mentioned in above No.3 issue and got consent of RARDA. At first, the first born female calf was planned to be given to the second generation. However, the quality of delivered heifer by RARDA-JICA still frustrated the model farmers and initiatives of the model farmers to improve cow management are difficult to be demonstrated positively.



(d) Follow-up activity

After completion of the mid-term WS on late December, 2007, JICA Study Team confirmed mid January 2008 the follow-up activities by RARDA with RARDA DG as below.

a) Poor lactation performance

RARDA will discuss ISAR Karama Station so as to support the model farmers in terms of leguminous fodder crop seeds.

b) Dispatchment of RARDA mission

RARDA will dispatch a mission to grasp on-going problems over the 18 model farmers of the RARDA-JICA Cow quick project in Ntarama Sector

c) Artificial insemination

RARDA will do synchronization of lipido again for AI operation due to low insemination rate resulted in the said quick project.

d) Management of two aggressive heifers

As heifer's nature is oriented based on past rearing condition, thus actual nature of the heifers are first carefully observed and diagnosed whether retraining is possible or not, and the model farmers' declining will to rear heifers are also discussed with them.

However, no follow-up activity was made by RARDA from mid-February 2008 to late May at the beginning of the 4th year field survey. Thus, monitoring survey was immediately carried out by JICA Study Team with RARDA vet-technician so as to grasp the QP progress during the absence of JICA Study Team. As a result, JICA Study Team decided that broadening a view of quality of the delivered crossbred cow by visiting other similar cow project and distribution of leguminous fodder crop seeds, which are necessary for improvement of lactation performance to the MF, should be important, and carried out the follow-up activity in the 4th year field survey as below.

1- Study Tour

The 13 MFs of QP visited to the Gahanga one cow, one family project, on August 29, 2008, located in Gahanga Sector, Kigali province initiated by RARDA. The project visiting has been done after passed more than one year since the delivery of 30 heads of 75 % crossbred heifer in calf on April, 2007. In the study tour, the MF party visited the three different farmers in terms of lactation performance such as high, medium and low level. After that, the MF group exchanged opinions about feeding, animal health and formation of cooperative with the cow association group members.

2- Distribution of leguminous fodder crop seeds

JICA Study Team requested RARDA to support leguminous fodder crop seeds adaptable to Bugesera agro-ecology so as to improve lactation performance. RARDA provided 150 kg of mucuna and Lablab grass, respectively. The seeds were delivered to the 14 MFs, 8kg/each species with crop guideline (leaflet) on September 5th, 2008.

(e) Cost estimation of the project

Breakdown of the cost estimation for the QP consists of the six expenditure categories (a. materials for cowshed, b. construction cost for cowshed, c. drug and equipment for animal health, d. procurement cost for the 18 crossbred, e. training of the 18 model farmers, and f. cost for following up activities). Total cost amounted to 2,310,000 yen, equivalent to 19,890 USD (1.0 USD = 116 ¥). Thus a unit cost of heifer amounted to 128,000 ¥, equivalent to 1,105 USD.

5.5.4 Fact Findings through Implementation

(1) Internal Evaluation

The final evaluation workshop was held so as to evaluate the QP internally based on the monitoring results up to the QP progress in the end of July of 2008(See Annex V.5.5.11). The evaluation result is summarized as follows.

Table 5.5.6 Final Monitoring Results of Modern Cow Introduction

No	Monitoring Items	Outline of Survey Results		Cause and Future Issues to be tackled
1	Latest situation about JICA Cow Keeping by Model Farmers (MF)	Sold out	The 3 MFs have sold out their cow or heifers by July 2008 due to sterility, frequent abortion, or with aggressive temper.	1. caused by poor breeding and distribution systems.
		Still Keeping	14 MFs have still kept the JICA cow but poor productivity.	2. Most of the MFs have complaints against poor lactation of the delivered cow except for few MFs.
		Moved to other area	1 MF moved to Nyamata Sector on Oct., 2007	3. Institutional Weakness of Cell/Sector Offices
2	Pregnancy and Delivery Conditions	Male calf	10 calves born and 2 of them died a few months after delivery.	4.No system to follow up the MFs regularly and MFs could not cope with animal health issue.
		Female calf	5 calves born and one of them died one year later	
		Stillbirth, abortion	4 cows were concerned	5. There is a doubt about infection but similarly no quick action to coop with the problem is taken like above No.4.
		Sterility	4 cows were concerned	
3	Water supply situation	Swamp & river	2 MF	6. Water supply to cow is very burden work in zero-grazing system in Bugesera District. More than 70 % of MFs purchase water, thus JICA study team supported all MFs by installing rainwater storage facility so as to cope with the issue.
		Rainwater storage	17 MF	
		Tap water	12 MF	
		Purchasing of water by jerry can)	12 MF(900~6000Rwf/Month)	
4	AI/Natural Mating and its cycle	-Success rate of AI is around 25 % -Natural mating by Friesian Bull become popular among the MFs. -Cow possible to get pregnancy 3 month after delivery but long dry period is observed.		7. AI implementation properly is difficult due to poor accessibility 8. No bull is available near MFs living area and difficult to do natural mating on time. 9. MF does not understand properly a life cycle of milking cow.
5	Cow keeping situation by MF	1.JICA Cow	14 heads/14MF	10. Cell/Sector offices do not grasp by recording
		2.Crossbred Calf	12 heads/10MF	
		3.Ankole-Calf	3 head/2MF	
		4.Crossbred Cow	5 heads/4MF	
		5.Pure Bull (Friesian)	2 heads/2MF	
		6.Pure Friesian cow	1 head/1MF	
		7. Pure Friesian heifer	1 head/MF	
		8.Ankole Cow	5 heads/4MF	

		Total	43 heads/17MF		
6	Labor force to keep cow	Enough labor	14MFs	11. Checking system of MF's precondition is not sufficient.	
		Insufficient labor	3MFs		
7	Feeding materials	Napir grass, wild weed, leaves of sweet potato, skin of banana fruit and others	16MF	12. Protein source for improvement of lactation is essential but most of the MFs are confined to only Napir grass and weeds. Also some MF face lack of fodder crops during the dry season. 13. Cow with low lactation performance is expected to increase <u>one liter more by feeding leguminous fodder crops</u> . 14. Concentrate is expensive and not available locally.	
		Leguminous fodder crops	4MF		
		Concentrate	1MF		
8	Presence of cowshed Expansion by MF	Expansion/renovation MF	5MF (2 ~ 6 free stool expansion)	15. Guidance of cowshed sanitation should be necessary in expansion of cowshed associated with cow dung pit/manure pit.	
		Keeping Original cowshed MF	11MF		
9	Benefit	Milk	No lactation	4 MF	16. <u>4 MF have no lactation so far since commencement of the crossbred due to sterility, abortion.</u> 17. <u>Only 2 MF got 8 lits/day and majority of the MF ranged between 2 and 3 lits/day with poor lactation.</u> This is originated from "weakness framework of breeding and distributing system of high quality crossbred" which is pivot of "One Cow, One Family Project".
			Range of lactation performance	From 1 to 8 Lits/day Mean=2 - 3 Lits/day	
			Sale of Milk	6MF, 1 lit/150 Rwf	
		Manure	16 MFs applied their manure to fields and recognized improvement of soil fertility.		
		Family Health	Improvement of health is recognized by 3 MFs. Improvement of yield contributes to health improvement: 11 MFs		
		Sale of calf	Male calf	2 MF: 70,000~80,000Rwf/head	
Purchase of heifer	Heifer in-calf	1 MF purchased the 2nd heifer in-calf by bank loan based on benefit of milk sale generated by JICA crossbred(@120,000 Rwf)			
10	Presence of recording keeping	No recording	8MF	18. Getting MF recording lactation, libido cycle, date of natural mating and artificial insemination makes efficient practice of AI and natural mating possible, and efficient reproduction possible.	
		Natural mating/AI date	7MF		
		Lactation amount	8MF		
		Libido cycle	1MF		
11	Animal health management	Spraying of Acaricide against tickborn disease	- Once a week: 8 MF - Twice a week: 8 MF - Three times a week: 1 MF All MF have practiced.	19. Regular training of overall animal husbandry practice is essential for the MF who keep crossbred less tolerant than local breed like Ankole in disease.	
		Giving deworm tablet	• Nil: 3MF • Every 3months: 7 MF • Every 6months: 6 MF • Irregular: 1 MF		
12	About formation of livestock cooperative, support by administration, and selection of the 2nd generation (Association leader only)	(1) Activity about formation of cooperative - Nothing	20. RADA leaves the MF to form cooperative but a measure to strengthen organization is essential by training a key MF. 21. There is no support made by local governments like Cell/Sector office so as to make the MF form cooperatives, thus local administration should examine a supporting method the MF to form cooperatives.		
		(2) Supporting of formation of cooperatives from Cell/Sector Office - Nothing			
		(3) Request to Cell/Sector Office - Advices about formation of cooperatives - Support of livestock drug, leguminous fodder crop seeds and construction of milk center by RARDA			
		(4) Selection of the 2nd generation - Training of the 2nd generation is vital prior to distribution - The 2nd generation should work together with			

		<p>the 1st generation so as to develop his/her capacity prior to distribution of heifer-in-calf</p> <ul style="list-style-type: none"> - Candidate of the 2nd generation should be relative or brother. - 9 - 10 months age of heifer is proper for delivery. 	
13	Negative Impact or Problems on Cow keeping	<p>Awareness of MF on this QP in negative impact is as follow;</p> <ol style="list-style-type: none"> (1) It cost too much about animal health treatment with labor intensive work but very low return due to poor lactation. (2) Keeping the heifer for the 2nd generation needs long period with heavy load. (3) It is very difficult to access AI inseminator when it necessary because of no AI inseminator closed to their living area. (4) Diagnosis and treatment on livestock is very difficult and unable to coop with a problem at once. (5) The delivered crossbred cost too much but poor return caused by poor lactation performance. (6) Securing fodder crop is difficult during the dry season. (7) So far no return from the QP for 19 months since distribution of the crossbred. 	<p>22. These comments indicated that a big difference between concept of One cow, one family project which contributes to poverty reduction by distributing high productive crossbred and actual observation.</p> <p><u>An essential review on One cow, one family project should be necessary.</u></p>

Remark: MF refers to Model Farmer.

The future issues to be tackled over the 22 items were extracted based on the result of internal evaluation, and one of the MFs practiced to purchase the 2nd heifer-in calf based on profit by selling milk generated by the first delivered cow. This success story indicates a vital lesson learnt in “One cow, one family project”. It is essential for the project to deliver a high lactation performance of crossbred so as to bring MF in profit (income of milk sale) and to boost the motivation of the MFs. However, poor productive cow was actually delivered, thus the said project does not contribute to income generation of poor family as combined with weakness of livestock service to the MFs. The below table shows requests to RARDA made by the MFs based on the 19 month-implementation of the QP. In the request, some dependence on RARDA appears to be seen but it includes a point of vital importance to the QP which has been implemented as a part of “One cow, one family project”. This indicates a weakness of operation framework governed by RARDA as a key authority of the said project.

Table 5.5.7 Request to RARDA from the 18 Model Farmers for Discussion

No	Issues	Outlines
1	Animal Health	(1) <u>Requesting a public service to station vet-technicians closed to living area of the model farmers for visiting regularly</u>
2	Animal Reproduction	(1) <u>Establishment of efficient AI implementing framework based on accessible allocation of AI inseminator for MF when MF needs AI for his/her cow or heifer libido at any time.</u> (2) Establishment of natural mating system based on accessible allocation of pure breed of Friesian bull.
3	Training program for the Model Farmers	(1) <u>Establishment of regular technical training program for the model farmers about general knowledge of cow keeping until MF could stand by him/herself.</u> (2) Conducting of study tour for the model farmers to advanced dairy farming area.

4	Selection and Distribution of high quality crossbred cow	(1) Establishment of a participatory selecting system of crossbred by the candidate recipient of crossbred cow/heifer in-calf. (2) Establishment of breeding system and selecting method of high quality crossbred cow (3) Establishment of distributing high quality heifer in-calf to the model farmers
5	Supporting framework to the Model Farmers	(1) Establishment of the MF supporting framework by allocating vet-technicians properly in the project command area. (2) Establishment of supporting MF with animal health drugs and tools (3) Establishment of animal drug pharmacy in the project command area
6	About One cow, one family project	(1) Lesson learnt via similar project should be incorporated into "One cow, one family project". (2) So far nothing has been materialized although the MF have been questioned with various requests, and this modern cow project imposes burden work with poor benefit, and are weighed down with various expenses. (3) Poor productive cow or heifer (sterility, frequency of abortion) should be replaced by putting MF's name on RARDA cow recipient list with high priority.

Remark: MF refers to Model Farmer.

The remark of the JICA Study Team to the key authority is below as an external donor implemented the QP in collaboration with RARDA including MINAGRI.

Table 5.5.8 Recommendation to the key administrative authority about Modern Cow Distribution from the JICA Study Team

No	Issue	Outline
1	Livestock breeding administration	- As long as observing crossbreds delivered via "One cow, one family project", there was great gap by individual crossbred in terms of lactation performance. Breeding policy should be properly formulated about breeding high productive crossbred and distributing to MF. - In proceeding "One Cow, One Family Project", formulation of some remedy should be necessary for the farmers who received low productive cow.
2	Selection of MF	- Dairy farming is labor-intensive livestock farming with much cost. Moreover, a zero-grazing system requires more labor forces such as security of fodder crop and water, supply of feeding and water, treatment of excreta, cleaning of cowshed, milking, spraying of chemical to protect cow from disease and giving tablet of dew arm. Meanwhile, a candidate farmer should be selected by considering livestock keeping expertise, enough land, financial resource, motivation, and access to market. A candidate farmer meeting these pre conditions is a farmer class which is far from an image of poor family.
3	Supporting framework of MF	Dairy farming is requires the highest and various systematic combination of practical elements. Achieving outcome certainly by implementing "One cow, one family project", it is essential for a key authority to establish countermeasures against disease and framework to direct proper livestock husbandry practice for dissemination of practice on feeding/management of livestock.
4	Measure of Income Generation by keeping livestock	Cow distribution project via present One Cow, One Family Project" is risky because of requiring long period to recover return, management capital and sophisticated practice of dairy farming, thus rural poor family class is difficult to be benefited. On the other hand, a turnover by small livestock such as goat and rabbit is quick with low initial cost associated with low requirement of management practice, thus it is preferred for income generation of rural poor class.
5	Preparation and distribution of Practical guideline for One Cow, One Family Project	Eight years have passed since "One Cow, One Family Project" has commenced in 2000. It was July 2007 when the JICA Study Team started the QP in collaboration with RARDA. However, no guideline is existed in terms of the project implementation. Thus, RARDA should plan by formulating a project guideline based on lesson learnt so far and distributing it to the stakeholders concerned in order to improve the said project quality.

The JICA Study Team reported the monitoring results as of the end of July 2008 to the MF, Sector and Cell staff concerned, and RARDA at the final evaluation workshop held on September 5th, 2008. Then, overall discussion about the matter in hand of the MF was consulted with RARDA staff based on the

recommendation from the MF to RARDA. As an outlook of future follow-up activity, RARDA did not reply any clear commitment except for the following opinions.

- 1- The matter in hand of the MF shall be reported to RARDA DG.
- 2- Replacement of the delivered heifer/cow with low productive quality is difficult unless specific defect observed.
- 3- Only the way to improve purity of crossbred is to operate AI on female offspring by using semen of Friesian.
- 4- One vet-technician financed by RARDA has been stationed to Ntarama Sector Office recently in accordance with one sector, one vet-technician policy initiated by RARDA, and he is able to operate AI when he is trained and given an AI Kit in near future.

(2) Fundamental Information and Lessons Learnt through Implementation of QP

“One cow, one family” policy has been launched since 2000 driven by MINAGRI, and by RARDA later. In accordance with this policy, JICA QP has been launched in collaboration with RARDA by incorporating participatory approach based on a view of JICA development study. So far the following points should be paid with enough attention when launching similar project.

1) Role of RADA in “One Cow, One Family” policy

“One cow, one family” policy has been initiated by MINAGRI since the year of 2000 and at present, RARDA is exclusively the sole governmental agency to superintend the stakeholders involved in launching the said policy. Thus, an implementing body is fundamentally the beneficiary, and RARDA is positioned to be advisable body including technical support. It implies that RARDA itself could not be a main actor to manage the said policy project directly and be exclusively a technical information/materials provider including animal health service nationwide (There are some exception). Therefore, from the point of view of securing sustainability of the project after phasing out of donor’s project implementing body, the project should be implemented in collaboration with promising local NGO.

2) Criteria of model farmer and “One Cow, One Family” policy

In accordance with the preconditions stipulated by MINAGRI for the said policy, JICA QP has also been launched in collaboration with RARDA. Selection of the eligible candidates was made by Cell and Sector staff concerned after kick-off workshop of briefing the scope of work for JICA QP to the participants. Some of the first selected candidates were claimed by RARDA because of ineligibility on the precondition stipulated in the said policy. Then Sector Office together with Cell Office concerned reselected some of the candidates who were pointed out in terms of land holding size and numbers rearing local cattle. However, the following facts were appeared via QP implementation stage.

- Sufficient check by Sector officer to eligible candidate is unable to make due to lack of transportation means.

- Local administrative office has no system to follow up the selected candidate by interviewing in details.
- The selected candidate is unable to prepare for reception of heifer so as to clear precondition due to poverty. In other word, poor family has no margin to manage dairy farming which requires the highest and various systematic combinations of practical elements with enough labor force.
- Thus, eligible candidate farmer is obliged to select a fair class as model farmer.

3) Needs of crossbred/modern cow in the community

Demand of crossbred or modern cow among the rural population appears to be quite high. This is supported by the fact that several farmers in Ntarama Sector dreamed of receiving modern cow some day with planting fodder crop, and building a cowshed in some case. Another fact is that the participants denied the first JICA QP proposal of modern cow distribution based on below two options. Moreover, the participants wanted to cope with reproduction through AI operation to the delivered crossbred cow.

Proposal 1: Delivery of Ankole cows with one pure bull of Friesian produce crossbred in future.

Proposal 2: Delivery of crossbred heifers with one pure bull of Friesian produce crossbred in future.

4) High motivation of modern cow interviewee

The selected model farmers showed their motivation more than expectation. Model Farmer paid some part of the construction cost including labor and prepared necessary construction materials. Their high ownership suggested their strong motivation intending to achieve objectives compared to other QPs such as Installation of rainwater storage, roadside irrigation and shallow well irrigation.

5) Livestock administration and "One Cow, One Family Project" implementation

As long as observing other similar "One Cow, One Family Project", it was observed that weakness of animal disease prevention, weakness of AI operation framework for reproduction, weakness of training MF without any regular program, and great gap among lactation performance of the delivered cows. The most vital factor to create model farmer's motivation is to deliver high quality (high lactation performance) of crossbred cow and bring the MF in benefit (sale of milk). As long as observing crossbreds delivered via "One cow, one family project", there was great gap by individual crossbred in terms of lactation performance. Breeding policy should be properly formulated about breeding high productive crossbred and distributing to MF.

In order to make it possible, it is essential for the key authority to formulate clear principle about breeding of homogeneity with high quality cow of lactation performance, distribution system and supporting framework.

5.6 Rainwater Storage Installation

5.6.1 Background and Purpose of the Project

(1) Background

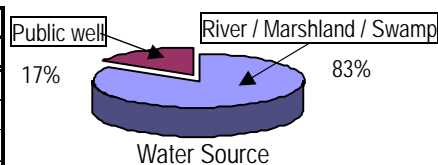
The issue of securing water is not confined to the population of Ntarama Sector, the site where a series of activities of the QP have been implemented. Although it is basic human needs to have access to the clean and safe water, almost all the population in rural area of Bugesera District have been against to get it. The results of monitoring survey targeting the model farmers who are participating in this QP component show their current situation over water availability as well as needs for water in Ntarama Sector as follows:

1) Water sources

The water sources of such area are mainly river, marshland, swamp, pond, etc., for home consumption including for livestock. Even in Ntarama Sector, according to the survey targeted to the model farmers of the rainwater storage installation, 83 % of the residents are using such kind of water in a sort of direct or and through the well.

Table 5.6.1 Water Source in Study Area

Water source	Cell	Cyugaro (persons)	Kanzenze (persons)	kibungo (persons)	Total	
					(persons)	%
River/Marshland/Swam		19	26	30	75	83%
Public well		10	4	0	14	16%
Public tap		0	0	0	0	0%
Others		0	0	0	0	0%



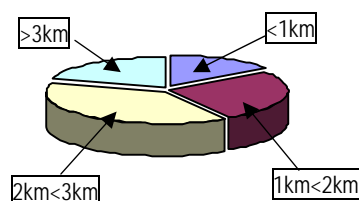
Remark: The number of samples for survey is 89. (Cyugaro: 29, Kanzenze: 30, Kibungo: 30)

2) Distance and hours to water point

On average, the residents of Ntarama Sector spend 4.9 hours to fetch water with 2.9 trips a day. The distance to a water source from their housing area (Umudugudu) mainly ranges from 1 km to 3 km, which accounts for 65 percent of all answers.

Table 5.6.2 Distance to Watering Point

Distance	Cell	Cyugaro (persons)	Kanzenze (persons)	kibungo (persons)	Total	
					(persons)	%
Less than 1 km		8	1	4	13	14%
between 1 km and 2 km		3	10	11	24	27%
between 2 km and 3 km		7	12	15	34	38%
More than 3 km		11	7	0	18	20%



Fetching Water	Cell	Cyugaro (persons)	Kanzenze (persons)	kibungo (persons)	Average
					(persons)
Hours a trip (hours)		1.8	2.1	1.5	1.8
Trip a day (times)		2.7	3.2	2.7	2.9
Hours needed a day (hours)		4.6	6.2	3.8	4.9

Remark: The number of samples for survey is 89. (Cyugaro: 29, Kanzenze: 30, Kibungo: 30)

3) Quantity of water consumed per day

In Ntarama Sector, the average number of family members per a household is estimated at 5.4, consisting of 2.6 adults and 2.8 children respectively. Under this situation, 82 percent of the households consume more than 3 jerricans a day for home use. In addition, households who keep livestock need some more water. The amount of water required for keeping livestock depends on the number of livestock which he/she owns but normally is at least 2 to 3 jerricans. Generally speaking, it is said that the daily per capita requirement of domestic water is estimated at 20 liters in African countries. Applying this number to the case of Ntarama, 108 liters of water a day ($=5.4 \times 20$) will be needed for a general household there. This situation would give inconvenience to the daily life of the people in Ntarama sector. The designed capacity of rainwater storage introduced at this time through the QP is about 1 m³, which is equivalent to 50 jerricans (=1,000 liters). If the storage is full of water at its maximum capacity, this means that the capacity holds out for 2 weeks under the present condition of water consumption. Even the period to consume the water of storage, another opportunity of rainfall would be expected to replenish the capacity of water tank.

4) Cost of water

Some of the model farmers ask water vendors to transport water from marshland. This cost ranges from 50 Rwf to 200 Rwf per one jerrican, depending on distance or season. Especially, households with elder family members tend to take this way to get water. As another way to get water for the people in Ntarama sector, there are some public wells with hand pump devices nearby marshland, which were constructed by some NGOs in the past. In most cases it costs the population 100 Rwf per month to access such public wells.

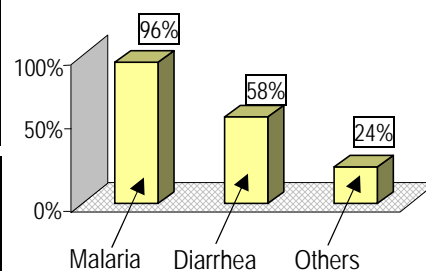
5) Disease possibly caused by water

According to the results of monitoring survey carried out in December 2006, almost all the model farmers suffered with malaria, diarrhea, and other disease such as fever during the preceding six months. The infection rates of each disease are 96 %, 58 %, and 24 % respectively. In connection with these figures, more than half (59 %) of people who suffered with diarrhea in the preceding six months had drunk non-boiled water. It is hard to say that this situation has been undoubtedly linked to low quality of water they fetch from river, marshland or swamp but it seems that there is a certain extent of relation between diarrhea and drinking non-boiled water.

Table 5.6.3 Disease Possibly Caused by Water

Disease	Cell	Cyugaro (persons)	Kanzenze (persons)	kibungo (persons)	Total	
					(persons)	%
Malaria		28	29	29	86	96%
Diarrhea		14	18	20	52	58%
Others		13	6	3	22	24%

Boil or not	Cell	Cyugaro (persons)	Kanzenze (persons)	kibungo (persons)	Total	
					(persons)	%
With boil		22	21	15	58	64%
Without boil		8	9	15	32	36%
Suffered from Diarrhea		4	6	9	19	59%



Remark:

- The number of samples for survey is 89. (Cyugaro: 29, Kanzenze: 30, Kibungo: 30)
- The samples are allowed to answer plural kinds of disease.

6) Role of water fetching

In most households, water fetching is a role of a housewife and children. As mentioned above, the people who are living in Ntarama Sector are obliged to spend about 5 hours a day for a round-trip to get water. Under such circumstances, installation of household rainwater storage would greatly reduce their burden for water fetching.



Role on water fetching

7) Expectation to the household rainwater storage

In terms of clean and safe water as mentioned above, it can be said that installation of household rainwater storage meets the basic demands in the rural life. According to the monitoring survey conducted by JICA Study Team, the model farmers express their expectation to the storage as follows:

- Expectation to Rainwater Storage
- Saving time to fetch water,
 - Saving labor to fetch water,
 - Saving money to get water, and
 - Being healthy (No special order is observed.)

The current situations over water indicate that it is quite essential to secure clean and safe water for the population who are living in rural area as well as Ntarama Sector. With regard to this point the three Cell officers and Cell people gave higher priority to the rainwater storage construction.

(2) Purpose

According to the background as mentioned above, the purposes of project were set up as follows:

- Make sure to get clean and safe water and reduction of expenditure of livelihood for purchasing water,
- Reduction of labor for fetching water, and
- Improvement of sanitary situation (reduction of disease caused by unclean water)

5.6.2 Process and Results of the Project

(1) Process

1) Main project (Period: from May 2006 to February 2007)

The project process consist of two phases, namely, the main project for 10 months from May 2006 to February 2007 and the follow-up project for another 10 months from May 2007 to February 2008 respectively.

Table 5.6.4 Implementation Process of Rainwater Storage Installation

Activity Item	Y2006							Y2007							Y2008						
	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F
Pattern of rainfall																					
1- Explanation W/S	▲																				
2- Selection of model households	■																				
3- Provision of material		▲	▲	▲	▲	▲	▲								▲						
4- Demonstration		▲																			
5- Implementation (Construction of R.S)		■	■	■	■	■	■														
6- Monitoring by Study Team		■	■			■	■							■			■	■	■		
7- Mid-term W/S						▲															
8- Mid-term evaluation with stakeholders							▲		▲	▲											
9- Implementation of Follow-up Project																■	■	■	■		
10- Mid-tearml evaluation with stakeholders																			▲		

2) Follow-up project (Period: from May 2007 to February 2008)

Based on the monitoring survey, it was judged that strengthening the structure of rainwater storage is essential to secure durability of the storage which has been passed for about 10 months since its construction. The follow-up plan consists of 3 components as follows:

- Component-1: Reinforcement of the main body of rainwater storage
- Component-2: Provision of material for fixing the gutter
- Component-3: Provision of material for assembling the cover

The follow-up plans were formulated by the Cell officers in collaboration with JICA Study Team. The contents of each component are summarized as follows respectively.

(a) Component-1

- Project purpose: Reinforcement of the structure of storage (Increasing durability)
- Project activity: Plastering joints in the outside wall (between brick to brick)
- Project period: From the middle of September to the middle of December 2007
- Site, Model Farmers targeted
- Material shared by both parties of JICA Study Team and Model Farmers / Cells

Table 5.6.5 Contents of Component-1 for Follow-up (Rainwater Storage Installation)

Cell	Nos. of Model Farmers		
	Original members	Cow recipients	Total
Cyugaro	24	4	28
Kanzenze	29	5	34

Kibungo	25	2	27
Total	79	11	89
Item	JICA Study Team	Model Farmers	Each Cell Office
Material	For 1 site	<ul style="list-style-type: none"> ▪ Water ▪ Small tools ▪ Labor 	<ul style="list-style-type: none"> ▪ None
	<ul style="list-style-type: none"> ▪ 1 bag of cement with 1 bag of water proof ▪ 3 wheelbarrow of fine sand 		
Material	In total		
	<ul style="list-style-type: none"> ▪ 89 bags of cement with 89 bags of water proof ▪ 267 wheelbarrows of fine sand ▪ Cyugaro:84(=28*3), Kanzenze:102(=34*3), Kibungo:81 (=27*3) 		
Personnel	<ul style="list-style-type: none"> ▪ Supervisor 	<ul style="list-style-type: none"> ▪ None 	<ul style="list-style-type: none"> ▪ Masonry, Helper

(b) Component-2 and 3

- Project purpose: Establishment of the system for collection of rainwater
- Project activity: Provision of materials and fixing
- Project period: November 2007
- Site, Model Farmers targeted
- Material shared by both parties of JICA Study Team and Model Farmers / Cells

Table 5.6.6 Contents of Component-1 as Follow-up (Rainwater Storage Installation)

Item	JICA Study Team	Cow recipients
Material	<ul style="list-style-type: none"> ▪ 2 Iron sheet for gutter and cover for a site ▪ 22 Iron sheet for gutter and cover in total 	<ul style="list-style-type: none"> ▪ Fixing gutter and cover with iron sheets ▪ Cyugaro:4, Kanzenze:5, Kibungo:2

With instruction of The Study Team, the follow-up activities are to be managed and monitored by officers of each Cell who involved in formulating the follow-up plan.

(2) Results

During the project period, rainwater storages were installed at 103 sites as the table below:

Table 5.6.7 Results on Rainwater Storage Installation

Kinds of Model Farmers	Conventional type	Brick type	Wooden type	Total
Model farmers as original plan	2	77	11	90
Model farmers as recipients of Cow Distribution Project		11	0	11
Ngenda Vocational Training Center		2	0	2
Total	2	90	11	103

Remark: 11 rainwater storages were additionally constructed for model farmers of the cow distribution project, one of the QP components, upon the request by MINAGRI at the hand-over ceremony on 28th December 2006.

5.6.3 Monitoring and Evaluation

(1) Process of Monitoring and Evaluation

Monitoring and evaluation on the QP was made from the second field survey, starting from October 2006 with regular monitoring activity by the Study Team. Concept of monitoring is primarily contemplated based on the objectives of this QP including monitoring period.

Table 5.6.8 Concept of Monitoring on Rainwater Storage Installation

Monitoring Period	Primary Monitoring Items
One year including the bimodal rainy seasons	<ul style="list-style-type: none"> - Reduction of Expenditure for getting water - Time consumption for fetching water - Spare time and the way to use it - Frequency of having diarrhea and any other disease - Durability of facility, and so forth

Table 5.6.9 Schedule of Monitoring and Evaluation

Monitoring & Evaluation Activity	2006						2007						2008									
	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
Installation of household rainwater storage																						
-Implementation of the Project & the Follow-up Project			■	■	■	■	■	■								■	■	■	■	■	■	■
-1st & 2nd Intensive monitoring							■								■							
-Mid-term workshop						▲																
-1st Mid-term evaluation with stakeholders								▲	▲													
-2nd Mid-term evaluation with stakeholders																				▲		

(2) Evaluation Method (Internal and External Evaluation)

The Study Team planned an external evaluation on the QP by the third person / agency in addition to the internal one by the participating Model farmers and the concerned administration officers, so the Team consulted with the Planning Unit of Bugesera District on the evaluators and methodology thereon. As the result, it was finally decided to do the evaluation by an officer in charge who has been recommended by the Director of the Unit considering the current situation of lacking relevant personnel outside the Project stakeholders to perform the evaluation except for the officers of the Unit.

The evaluation process of four QP consists of the following two phase:

- Phase 1: Internal evaluation by the model farmers and the officers in charge thereof, and
- Phase 2: External evaluation by the Planning Unit of Bugesera District.

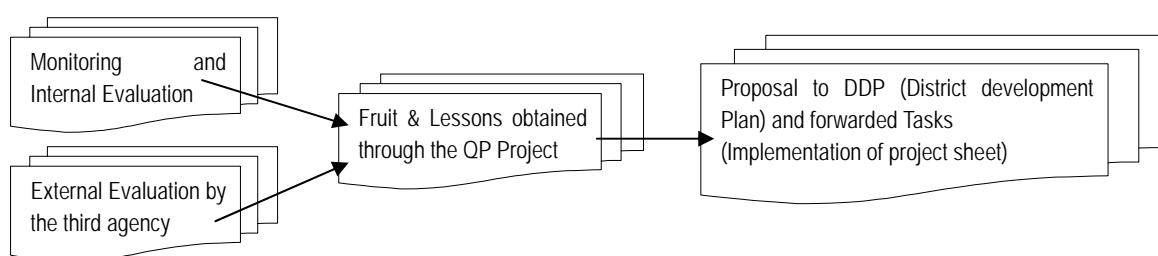


Figure 5.6.1 Flowchart of Evaluation for QP

Also, the objective and methodology of the external evaluation is decided as in the following:

- In the light of expected targets of each project, the extent of progress to the goals is to be evaluated and measured judging from the actual post-project status.
- Methodology of the evaluation should include five items, i.e., compatibility/feasibility, efficiency, effectiveness, effect/ impact and sustainability
- The Team presents a proposal for improving the Project in the future.

It has been decided that the external evaluating team comprises three members, namely, two Planning Unit officers of the Bugesera District (Planning officer in charge and agronomist) and the QP officer in Ntarama Sector.

The external evaluation has been carried out through the following process;

- An explanation on the results of the internal evaluation executed by the Study Team toward the external evaluation team and a consultation between internal and external evaluation teams on the methodology to be employed by the external evaluation.
- Further, site-inspection at the Project sites by the external evaluation team to collect detailed data.
- Compilation / provision of the draft evaluation report by the external evaluation team.
- Approval of the contents of draft evaluation report by the District Executive Committee, and
- Submission of the evaluation report to the Study Team.



(3) Project Evaluation

1) Internal evaluation-1 (evaluated by the model farmers and Umudugudu leaders)

An internal evaluation by the model farmers and Umudugudu leaders was carried out in December 2007. The following table summarizes the result of evaluation.

Table 5.6.10 Evaluation on Rainwater Storage Installation by the Model Farmers & Umudugudul Leaders

Evaluation Item	Evaluation / Comments
Project objective	<ul style="list-style-type: none"> ▪ Improving living environment
Efficiency	<ul style="list-style-type: none"> ▪ Highly efficient from the point of expenses versus benefits ▪ In order to create more efficient project output, self-help efforts by the inhabitants and external assistance in the form of useful input of human resources and locally available resources etc. are indispensable.
Effectiveness	<ul style="list-style-type: none"> ▪ The activities compatibly match with BHN and also show usefulness/ viability for improving living environment as aimed by the Project through the Project benefits such as reduction of household expenses to secure clean and safe water, alleviation of labor force and improvement on the rate of infection by water-borne diseases. ▪ Within the area where QP Project has been implemented, operation of tap-water system has been started since December 2007 though the beneficiary area is limited along the built pipeline. However, effective coverage of this Project will be enlarged if relevant support is dedicated for the residents living in remote area.
Positive Impact	<ul style="list-style-type: none"> ▪ The utmost impact that the participants appreciated is learning skill/ knowledge of how to construct box-type brick cisterns (tanks) proposed by L'equipe d'Etude. Some evaluators are of the opinion that thereafter it will be possible for the inhabitants themselves to build tanks and to transfer means of construction to their neighbors. ▪ Conspicuously greater effect was achieved through reduction of living costs for securing water. ▪ Saving labor force and working hours to fetch water: Notably for women and children, remarkable effect is brought about in saving to save laborious works and time to fetch water. ▪ Developing the Project from a spot to an area: A model cistern proposed by the Project has been constructed at a vocational training school within Ruhuha Sector, serving as a model to be disseminated to other areas. Likewise, some inhabitants in Ngeruka Sector asked how to

Evaluation Item	Evaluation / Comments
	<p>construct wooden framed water storage cistern, so they have keen interest thereon.</p> <div style="display: flex; align-items: center;">   <div style="margin-left: 20px;"> <p>← Rainwater storage in a vocational school in Ruhuha</p> </div> </div> <ul style="list-style-type: none"> ▪ Fostering creation of an atmosphere of mutual help-oriented concept: A creative action is emerging trying to establish a cordial relation with surrounding inhabitants by means of sharing stored water in the constructed cisterns. ▪ After the initiation of utilizing water stored in the rainwater cisterns, rates of incidence of water-borne sickness such as diarrhea/ dysentery has been diminished in most of the model farmers' families.
Negative Impact	<ul style="list-style-type: none"> ▪ Expensive construction cost: The construction cost of box-type brick cistern comes to 245 US\$, a bit costly to inhabitants living in the area (while a cistern made of wooden frame costs 150 US\$), so the construction thereof seems difficult by individual farmers judging from the average current annual income of model farmers ranging 180 US\$. ▪ Fostering disparity: As rainwater storage cistern is privately owned, some possibility still remains in the construction of cisterns that would widen currently observed disparity among local inhabitants.
Compatibility (accordance with inhabitants' needs or conformity with the actions in DDP and EDPRS etc.)	<ul style="list-style-type: none"> ▪ Since securing cleaner and safer water is a task/ BHN confronted by the local inhabitants, the proposed Project aiming at effective use of rainwater substituting use of standing water in wetland for which degradation of water quality is currently concerned is highly in compliance with human needs. ▪ In EDPRS, improvement in access to safer water for daily use is called for in its water and hygiene sector. Moreover, it reiterates labor saving for women in fetching water as one of the key measures to be realized in rural areas. ▪ According to District Development Plan (DDP) in Bugesera District, about 40% of the inhabitants presently uses unsanitary water from streams and lakes, while only 0.4% of them utilize rainwater. DDP will facilitate new construction or rehabilitation of water facilities as well as urge construction of facilities for storing rainwater. ▪ As such, the feasibility of implementing this Project is highly evaluated in the light of strategies taken by higher-ranked national plans and DDP.
Self-development and sustainability (issues / tasks etc in continuing the Project activities)	<ul style="list-style-type: none"> ▪ In the case of storage facility to be individually owned, the construction cost (around 245 US\$) is expensive for general inhabitants, and this in terms of cost limits sustainability and self-development momentum of the proposed Project. ▪ Participants in the Project commented in a way that "observing water storage tanks at closest quarter and participating in constructing works by themselves, they could learn how to build cisterns and acquired knowledge on water storage". Though expertise craftsmen (artisans) are required to complete construction works, there remains possibility of building it by local inhabitants with their own initiative. ▪ Notwithstanding, the construction requires such assistance as supply of materials/equipment by outsiders. ▪ For socially vulnerable strata, maintenance / management of tanks is an issue. ▪ It is not fully deniable that inhabitant's posture of external dependence still continues, and this possibly would serve as a major bottleneck in implementing the Project hereafter in a sustainable manner by the initiative of inhabitants. ▪ On the other hand, as to management / maintenance of cisterns, an opinion was posed attaching importance to keep keen management of handling keys of cisterns's inlet covers in an attempt to avoid unexpected accidents (for example infant's dropping/ drowning) during

Evaluation Item	Evaluation / Comments
	the time of cleaning inside the basin or during absence of other family members). This implies that inhabitants are already conscious of safety management of the facility.
Project benefits (such as expenses versus benefits)	<ol style="list-style-type: none"> 1. Benefit of saving costs for purchasing water for daily use <ul style="list-style-type: none"> ▪ As annual costs for purchasing water are maximally estimated at around 100 US\$ against the construction cost (about 245US\$), it follows that the initial investment cost can be amortized or depreciated in 3 - 4 years). 2. Time saving benefit for fetching water <ul style="list-style-type: none"> ▪ It is possible to save by 4.5 - 6 hours on average per day, and an indirect benefit can be brought to appropriate saved hours to other activities. 3. Benefit of securing sanitary water and keeping sound health / favorable hygiene <ul style="list-style-type: none"> ▪ Reduction of so far incurred expense for medical care / treatments owing to decline of infection rates by water-borne diseases by means of use of rainwater. ▪ No case has been reported as to breeding of vector mosquitoes that carry Malaria disease. 4. Benefit of Follow-up (FU) Project <ul style="list-style-type: none"> ▪ FU Project has been carried out aiming at sustaining/ improving durability and strength of cubic cisterns. As a result, benefit of minimizing dilapidation of outer wall by exposure to rain/ wind has been identified. It will be necessary to keep FU forward to sustain this benefit.
Desirable future development, improving points of the Project activities and feedback to DDP	<ul style="list-style-type: none"> ▪ It is obvious that this Project is effective in improving inhabitant's living environment. Further on, it will hereafter be necessary to examine possibility of constructing it as a public facility. Namely, instead of constructing it as a property of a household, it is proposed that the storage system is more useful by constructing one or more rainwater storage cisterns per a group of households under assistance from outsiders as an administrative service for social welfare within the currently pursuing policy for the creation of intensively living area.

2) Internal evaluation-2 (evaluated by administration officers)

Final evaluation WS was held by administration officers in charge of water related three Projects (June 25th 2008 at Mandela Village) where the following 13 officers participated.

- Ntarama Sector Office: Executive Secretary, Civil Request (Deputy ES), Agronomist,
- 3 Cell Offices: Executive Secretary, Coordinator, Secretary of Development & Economy

In this WS, evaluation was made from the viewpoint of administration by giving points (unsigned) to the above-described 3QP. In this forum, consultations were also made on how to participate by themselves in the project implementation, how to extend and develop the project from spot to facial dimension, risks, limiting factors and ways of solution in implementing sustainable projects, feasibility of implementing projects utilizing UBYDEHE fund, roles by themselves playable for rural development and evolution from now onward, current situations on use of micro-financing etc.

In this connection, 3 grades were given as evaluating points, namely “appreciating the project” or “good”, “moderately evaluated” or “fair” and “not appreciating the project” or “poor”. The following table summarizes the result of final evaluation by administration officers in charge of this Project.

Table 5.6.11 Evaluation on Rainwater Storage Installation by Administration Officers

Project Name	Introduction of rainwater storage system			
Sector / Cell	Project evaluation			Content of evaluation, comment thereon etc.
	Good	Fair	Poor	

Project Name	Introduction of rainwater storage system			
	Project evaluation			Content of evaluation, comment thereon etc.
Sector / Cell	Good	Fair	Poor	
Ntarama sector office	3/3	0/3	0	<ul style="list-style-type: none"> Both high importance and farmers' needs are attached to effective use of rainwater, while its storage system that allows to always secure water within living area during rainy season is exceedingly useful in daily life. Although water feeding to cattle is a heavy, burdensome work to cattle raising farmers, this system has mitigated their economic and labor burden. Participants succeeded in sharing stored water with households of neighborhood. It's imperative to always keep stored water in sanitary state, but some farmers are indifferent to hygiene, thus failing required maintenance and management. The adopted size of the tank is not sufficient for need, it should have been designed with larger volume.
Cyugaro cell office	3/4	1/4	0	
Kanzenze cell office	1/2	1/2	0	
Kibungo cell office	2/3	1/3	0	
Total	9/12 (75%)	3/12 (25%)	0	

Evaluators have given as a whole favorable evaluation, especially for “introduction of rainwater storage system” to which 75% of them has appreciated the Project. As regards the rate of “good” to “fair”, this storage Project has been compared to the evaluation result of other Projects for “shallow well irrigation” and for “irrigation utilizing rainwater collected in roadside drains” as stated in the following section. They give “75%:25%” for this project, “69%:31%” for shallow well and “75%: 25%” for “54%: 46%” for drain irrigation, respectively, implying that this Project has given the highest impact as a scheme directly influencing daily life of local inhabitants in terms of water security.

Also in the Project evaluation by the model farmers, it was pointed out that “the Project for introducing rainwater storage system” showed marked household expenditure saving benefit required for securing sanitary and safe water, benefits from saving time for water fetching and also from labor alleviation.

From these results of evaluation, it could be deduced that originally targeted goal of this QP (namely: access to clean water, saving hours of water fetching and keeping security of water for daily living activities) has successfully been fulfilled.

On the other hand, such assisting measures have to be taken for socially vulnerable households (in particular handicapped people) as shared work of maintenance works by neighborhood households. Also problems such as theft damage loss of galvanized iron sheet delivered to Cell office for material / equipment for manifold covers of cisterns has taken place, thus issues at the side of administration staff in charge of management of supplied resources are posed.

Approach by administration staff and self evaluation concerning other items

In addition to the evaluation on each Project, The Study Team discussed on approach by administration staff in charge of the QP and their self evaluation, measures for two-dimensional expansion of the Projects, risks and constraints affecting sustainability of the Projects and their

solutions etc.

As concern “self approach, role and action in the Project in charge”, attitudes of their approach may be visible in such a way that they realized their roles to play in the Project in charge, explanation of the content of the Project to model farmers and advice to them as well motivation for them to participate in the proposed Projects etc, as administration staff.

As to “measures and strategic ideas in terms of two-dimensional deployment of the (spot) projects”, the participants pointed out that it is imperative for administration staff in charge to be able to explain usefulness and effectiveness of the proposed projects to target farmers, and at the same time it is important for Sector agronomists to practice farming instruction activities. Also, as participants discussed, among 3 Projects, introduction of rainwater storage system has brought brilliant effect all right, but its construction cost is too expensive for local inhabitants to construct the facility, leading to difficulty in its diffusion. On the other hand, construction costs of shallow well irrigation and irrigation facility using rainwater collected in roadside drain ditches are so to speak “zero cost” or at negligible level, in addition maintenance and management of these facilities are easy for them, thus possibility of two-dimensional deployment can be expected.

As regards “risks and constraints affecting project sustainability”, participants reiterated lack or insufficiency of inhabitant’s understanding/ ownership towards the proposed Projects and also lack or poorness of leadership among Unudugudu leaders. Under such situations, it is visible that the stakeholders are struggling to find how to make inhabitants realize goals and expectable effects of the proposed Projects.

In the discussion of “availability of UBDEHE fund to the Projects”, opinions were posed in a way that it may be possible to examine its application to introduce rainwater storage system as well as to implement shallow well irrigation. This suggestion may be considered attributable to the keener participant’s interest to and high degree of benefits of these Projects that aim at securing clean water and improved farm income. Furthermore, some opinions focused on rearing of small livestock. This may stem from the effect of a pilot project “introduction of hares (rabbits) rearing”.

In this context, for mobilizing UBUDEHE fund, identification of inhabitants’ needs for fund and effort for exploiting latent needs among the inhabitants are important task of the administration staff in charge. In this connection, some of the participants were not yet acquainted with the details of the said fund, implying that currently this funding institution is not well known among the stakeholders.

With regard to “their own role towards area development”, the participants pointed out that what is important to the administrative authorities concerned is to envisage enhancing and urging local inhabitant’s consciousness towards area development through its enlightening/ popularizing campaigns. In concrete, illustrative examples were suggested in such manner that in order to try to elevate livelihood level of inhabitants by way of yield increase /income raising through improvement

of farming and cultivation techniques, they should instruct how to make use of micro-finance and the above-mentioned UBDEHE fund as means of procuring initial investment fund.

The following table summarizes comments and replies from administration staff in charge of the Project as to each of the discussed items.

Table 5.6.12 Approach by Administration Staff and Self Evaluation concerning Other Items

Item discussed	Evaluation / comment / reply
Way of own approach, role and actions in the Project	<ul style="list-style-type: none"> ▪ Calling/ advising & motivating model farmers so as to participate in WS. ▪ With Umudugudu leaders, recommending model farmers in shallow well irrigation sites and in irrigation sites using rainwater in roadside drains to make well use of these facilities. ▪ Explaining /instructing model farmers on the importance / usefulness of QP. ▪ Instructing model farmers how to construct shallow well irrigation facility and irrigation facility using rainwater in roadside drains. In addition, instructing them how to maintain and manage these facilities.
Measures and strategic ideas in terms of facial deployment	<ul style="list-style-type: none"> ▪ Administration staff delivered farmers information on the usefulness of the Projects, at the same time Sector agronomists instructed them farming techniques. ▪ Accelerating additional construction of farm-ponds and shallow wells as well as calling for water use towards beneficiary farmers (without relying on the support by the Study Team). ▪ Motivating / acting farmers to involve in Project activities, sensitizing them until they realize that the project activities are (not imputed to the Study Team but) directly reflected to the actors themselves. ▪ Initial input for rainwater storage system is expensive. On the contrary, shallow well irrigation and irrigation using rainwater collected in roadside drains do not require construction costs, and their maintenance/ management is easy, thus these two Projects retain possibility of horizontal or two-dimensional deployment.
Risks and constraints affecting stable holding of project sustainability	<ul style="list-style-type: none"> ▪ Owing to dear costs of farming input material (seed, fertilizers, pesticides etc) and farm implements, farmers can hardly afford to purchase these inputs. ▪ Many farmers do not realize that the Project outcome returns to them, in other words concept of ownership is too weak or deficient among inhabitants. ▪ Farmers are mostly feebly conscious of maintenance /management of facilities, thus their project activities remain inert. ▪ In the case of shallow well irrigation, available water quantity is less than expected, hence failing to procure planned rate of water to irrigate. ▪ Leadership of local community leaders lacks. ▪ To promote farmer's consciousness, administration is responsible for sufficiently explaining them importance and usefulness of the Projects to make them fully realize what is explained.
Availability of applying UBDEHE fund to the Projects	<ul style="list-style-type: none"> ▪ Beneficiaries solicit fund application to introduce rainwater storage system for all the Umudugudu. They also desire to make use of this fund as a fund to expand storage volume of already constructed tanks. ▪ Making use of the fund, introduction of shallow well irrigation is advised to farmers toward acceleration of vegetable cultivation. ▪ This fund is used for purchasing /rearing small livestock, wetland development (farming during dry season).
Own role to be played in the area progress/ development	<ul style="list-style-type: none"> ▪ By means of edification activities towards local inhabitants, improvement and promotion of their awareness of area development are sought. ▪ Instruction on farming, in particular that for vegetable culture is made envisaging income

Item discussed	Evaluation / comment / reply
	<p>expansion on one hand, access to small-scale credit institutions is assisted.</p> <ul style="list-style-type: none"> ▪ Farmers organizations are established / strengthened and project management is conducted by utilizing development projects as a catalyst, thereby urging farmer's motivation.

3) External evaluation

The following shows the result of evaluation and recommendations towards this Project by the external evaluation team.

(a) On the feasibility

- Under current situation where deterioration of standing water in wetland area that has so far been utilized by the inhabitants in the Study Area is being worried, introduction of rainwater storage system meets their needs of securing clean and safe water. In EDPRS, higher priority has also been given to improvement of hygiene water environment. Further, DDP also placed strengthened development of water supply facility as an exigent task, concluding that all these situations indicate high feasibility of this Project.

(b) On the efficiency

- High benefiting effect is expected in terms of initial investment amount (i.e., expense to construct facility concerned). However, the amount of input per cistern, 245 US\$ stays beyond the possible individual investment level by local inhabitants.
- During the process of facility construction, the model farmers in the Project have provided material/ equipment and labor, thus local resources in terms of human and substantial resources have been made use of. Such utilization of local resources should further been developed from now on to facilitate efficiency of the Project.

(c) On the usefulness

- This Project has proved its usefulness in coping with expensive water charge, heavy labor for fetching water, threatening water-borne diseases faced by local inhabitants. In the sites where QP has been implemented, public service for tap-water supply has already been started (from January 2008), but access to this tap-water supply is rather difficult for the inhabitants living away from the facility line. So, the extension of this Project is desirable for relief of the inhabitants in remote areas.
- This Project is also valid for saving expenditures in farm household accounting. As stated in the project benefit evaluated by the internal evaluation, the initially invested amount can be recovered within 3 ~ 4 years after the initial investment.
- The rainwater storage system constructed by this Project is rather inexpensive in comparison with indigenously available one. However, the initial investment level remains beyond the affordable amount as individual investment.

(d) On the effect, impact

- As a remarkable effect/ fruit of this Project, acquisition of knowledge and techniques by model farmers in the project on rainwater storage system through the participation in the project implementation can be counted on. (In future, participated farmers consider their ability of undertaking a part of construction process whenever similar project is started.)
- Ensuring clean and safe water is also deemed as a task in terms of BHN, therefore facility of this category should be arranged under an administrative assistance program.
- The Project has an effect of time and labor saving in fetching water. It saves approximately 4.5 - 6 hours per day, while the saved time can be spent for household chores and other daily activities.
- It has reduced cases of infection with water-borne disease such as diarrhea, through the use of rainwater.
- However, it could be pointed out that the implementation of this Project on the basis of individual beneficiary may have fostered development of disparity among inhabitants within a community. On the other hand, benefit or stored water has commonly been shared among the participants in the Project and neighborhood inhabitants (equitable distribution of the benefit), suggesting that the Project is proved useful in inducing /strengthening solidarity among inhabitants.

(e) On sustainability

- Since the construction cost for storage facility is rather expensive to local inhabitants, sustainability of the project is poor in so far as it is implemented on a basis of individual financing/ cost bearing.
- Though model farmers (local inhabitants) can manage to build the facility, assistance from surrounding community is essential in the form of material / equipment supply (brick, cement etc.). It seems difficult for socially vulnerable /handicapped people such as elderly /widow households, disabled people to manage and maintain the constructed facility.
- The water tank model proposed from the Study Team can be appreciated as basic prototype to which model farmers themselves can improve its design for enlarging storage capacity.
- This project has elucidated a heavy or excessive reliance of local inhabitants on others. Such concept or pattern of behavior may cause an issue, negatively acting as a bottleneck or a limiting factor in area development based on inhabitant's self-help efforts.
- It is considered relevant to characterize such facility as a commonly managed/ owned property
- Even though special skills were required for constructing some part of the facility such as plaster work, sustainable construction of the facility is possible by means of more effective use of voluntary labor and of natural resources supplied from the Project participants.

(f) Proposal and Recommendation

- Rain conduit pipes have not yet installed for some of the constructed cisterns. This is attributed to theft damages or appropriation of material /equipment supplied from the Study Team to other purpose. Thereafter, it is essential for Sector Office to retrieve lost /stolen material (galvanized metal sheets for processing into manifold covers of the tanks and rain conduit pipes), while it is also required for Cell Office to give thorough instruction for model farmers on proper management/ use of supplied material /equipment.

5.6.4 Fact Findings through Implementation

Through construction of the household rainwater storage, the following issues were pointed out (See Annex V.5.6.1 for detail).

- 1- Possibility of work (cost) sharing
- 2- What the model farmers can afford
- 3- Difficulty with organizing the model farmers and establishing their independence
- 4- Lack of communication between the Cell Office and the model farmers
- 5- Way of mutual aid
- 6- Hope to establish good relationship with neighbors through water sharing
- 7- Appropriate design of the rainwater storage taking account of sustainability in local population



Trial to find out appropriate way for construction of the rainwater storage
Left: Conventional method



Right: Improved model



Improved model proposed by
JICA Study Team

- 8- Reluctance to unfamiliarity
- 9- Equal opportunity among model farmers
- 10- Management capacity of Cell Offices
- 11- Way to select model farmers (Decision-making system and holding information in common)

5.7 Shallow Well Irrigation

5.7.1 Background and Purpose of the Project

(1) Background

Generally speaking in and around Ntarama Sector, farmers who have their own farm plots along a marshland cultivate vegetables such as tomato, sweet potato and carrot by using marshland water in dry season. The cropping pattern is categorized into the following three cropping seasons as below,

namely, Season A, B and C. On hillside, the cropping season starts from September and ends in next July, while in marshland area a cropping season ranges from June to next March depending on flood cycle of applicable area for cultivation. The figure below shows the cropping pattern in the Study Area. Vegetables are cultivated in the marshland and its boundary zone in the hillside from July to next March until next flooding cycle. Fluctuation of water level along the boundary from hillside to marshland varies from site to site, and practice of recession cultivation is observed in Kibungo Cell of Ntarama Sector. That is, vegetable cultivation on marshland is extended along to recession of flooded water and vice versa.

In accordance with fluctuation of groundwater level, farmers practice vegetable farming beside the marshland and rivers. From July groundwater level becomes lower from day to day and farmland is extended toward marshland / river. On the contrary, from October groundwater level rises, farmland becomes shrunk toward hilly area. In general farmers use watering cans to irrigate vegetables but distance from water source and farmland is 20m-40m, which is very inefficient. During the season with low water level of marshland, farmers struggle with fetching water from marshland due to the long distance from water point. Under such condition, there are some places where farmers use potable pumps paying high rental fee to irrigate their crops.

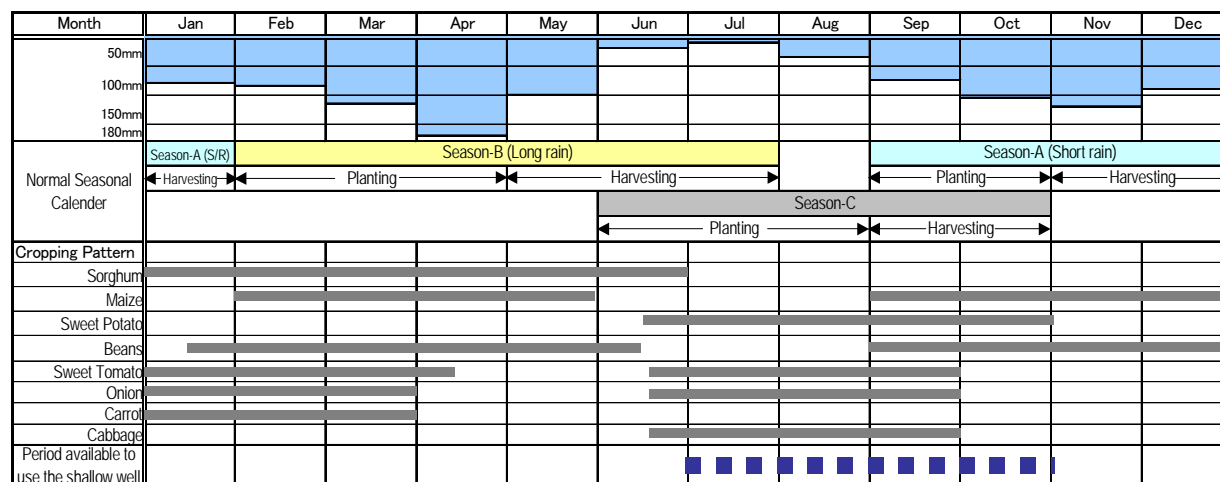


Figure 5.7.1 Normal Seasonal Calendar and Cropping Pattern in Ntarama Sector

(2) Purpose

Based on the background mentioned above, the purposes of project were set up as follows:

- Improvement of agricultural income in dry season (Season C)
- Reduction of labor for fetching water for irrigation use

5.7.2 Process and Results of the Project

(1) Process

1) The main project (Period: from May 2006 to February 2007)

The project process consist of two phases, namely, the main project for 10 months from May 2006 to

February 2007 and the follow-up project for another 10 months from May 2007 to February 2008 respectively.

Table 5.7.1 Implementation Process of Shallow Well Irrigation

Activity Item	Y2006							Y2007							Y2008						
	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F
Pattern of rainfall																					
1- Explanation W/S	▲																				
2- Selection of model sites & participants	■																				
3- Identification of candidate sites			■	■	■	■	■														
4- Provision of tools, material		▲																			
5- Demonstration		▲	▲	▲																	
6- Implementation (Construction of S.W.I.S)			■	■	■	■	■														
7- Monitoring by Study Team			■	■	■	■	■														
8- Mid-term evaluation with stakeholders								▲	▲												
9- Study tour																					
10- Implementation of Follow-up Project																					
11- Mid-term evaluation with stakeholders																					

Site selection process is a) Explanation of the aims of the project by the Study Team, b) Selection of candidate sites by Cells, c) Field survey by both the Study Team and Cell representatives, d) Determination of sites and identification of model farmers by the both parties. Considering the seasonal variation of groundwater levels, topographical condition of the farmland and currently inefficient irrigation methods, following three methods of improved irrigation were given through the site survey as well as actual construction cases. With shorter construction period and lower construction cost, they are considered as more adequate ways to introduce shallow well.

Table 5.7.2 Types of Facility on Shallow Well Irrigation System

Type	facility Type	Suitable Condition of Site
Type I	Shallow well	Groundwater level in dry season becomes more than 3m lowering then shallow well around 4m below from ground is being dug
Type II	Small scale canal	Groundwater level in dry season become 1m -2m lowering then about 20m from marshland to farmland of canal is constructed
Type III	Small-scale pond with canal	Groundwater level in dry season become 2m-3m lowering then 9m ³ (3m x 3m, 3m in depth) of pond is constructed with canal

2) Follow-up project (Period: from September 2007 to February 2008)

Based on the monitoring survey, it was judged that extension services should be secured to let farmers know proper farming technology together with introducing shallow well irrigation system. In order to expand the shallow well irrigation system in the area of Ntarama Sector, the follow-up plan which consist of 2 components was formulated as follows:

- Component-1: Conduct of mutual study tour
- Component-2: Putting into practice lessons learnt from the said study tour

The follow-up plans mentioned above were formulated by the Cell officers in collaboration with JICA Study Team. The contents of each component and its progress are summarized as follows respectively.

(a) Component-1

- Project purpose: Extension of introducing shallow well irrigation system
- Project activity: Understand present situation of the sites where the shallow well irrigation system was introduced in last season
- Project period: 22nd August 2007
- Site, Model Farmers targeted

Model farmers (participants of the study tour) invited from possible sites of shallow well irrigation practice.

(b) Component-2

- Project purpose: Extension of cashable crop cultivation with introducing shallow well irrigation system
- Project activity: Construction of shallow well and experimental farming by using shallow well water
- Project period: From September 2007 to February 2008
- Site, Model Farmers targeted
- Material shared by both parties of JICA Study Team and Model Farmers

Table 5.7.3 Contents of Component-2 as Follow-up (Shallow Well Irrigation)

Item	JICA Study Team	Model Farmers
Farming inputs	<p>For 1 site</p> <ul style="list-style-type: none"> ▪ 3 kinds of vegetable seed (Onion, Cabbage, Carrot) each 25gms ▪ Pesticides (Dethane) of 2.4 kg <p>In total</p> <ul style="list-style-type: none"> ▪ Vegetable seed of 1,200gms, ▪ Pesticides (Dethane) of 38.4 kg 	<ul style="list-style-type: none"> ▪ Construction of shallow well ▪ Preparation of experimental plots ▪ Practice of vegetable farming using shallow well
Tools (for Umudugudu)	<ul style="list-style-type: none"> ▪ 1 Sprayer for 1 Umudugudu, in total, 22 sprayers 	<ul style="list-style-type: none"> ▪ Tools farmer's own

a) Follow-up component-1: Mutual study tour

The mutual study tour was held on 22 Aug 2007 to understand what the shallow well irrigation is and know the present situation of farming in the area. The participant was 32 model farmers and a counter part from Bugesera district respectively. The participants of the study tour met the farmers of the existing sites of shallow well irrigation system and then they exchanged their opinions.



Mutual Study Tour in Shallow Well Irrigation

b) Follow-up Component-2: Putting into practice lessons learnt from the study tour

After conducting the study tour, depending on the construction plan of shallow well which was scheduled by each Cell Officer, it has been caring out since the beginning of September 2007. The

farming practice was commenced during the period from September to October 2007. Crops introduced were tomatoes, cabbage, onion, carrot, eggplant, and so on.

Table 5.7.4 Progress of Introducing Shallow Well Irrigation System

Cell	Site (Umudugudu)	Date of Construction	Nos. of Farmers	Site condition
Cyugaro	Ruwankeri (Kayenzi)	Sep.07'	22	
	Gasave (Kidudu)	Sep.07'	12	
	Bwunyu (Rugunga)	Sep.07'	22	
	Gakurazo (Kingabo)	Sep.07'	12	
Kanzene	Kurugenge (Kurugenge)	3,Sep.07'	12	Canal type to lead water from marshland
	Byimana (Ruwangara)	5,Sep.07'	8	Well type, it is expected to store underground water through a year
	Karumuna (Karumuna)	7,Sep.07'	11	Well type, excavation 1.0m in depth
	Kabeza (Kabeza)		10	
Kibungo	Ntaburiba (Nganwa)	7,Sep.07'	12	Well type
	Ryarutanga (Ruhengeri)	Sep.07'	14	

(2) Results

During project period, shallow well irrigation were introduced at 19 sites as the table below:

Table 5.7.5 Results on Shallow Well Irrigation

Cyugaro Cell		Kanzenze Cell		Kibungo Cell	
Site (Umudugudu)	Participants	Site (Umudugudu)	Participants	Site (Umudugudu)	Participants
Cyato (Gatoro)	12	Kinyana (Kabeza)	12	Kagoma II (Kagoma II)	12
Kirera (Kayenzi)	15	Karumuna (Karumuna)	11	Gashamagariro (Kagoma II)	5
Gakurazo (Kingabo)	22	Kurugenge (Kurugenge)	12	Rujyabaguwe (Kagoma II)	26
Gasava (Kidudu)	12	Byimana (Ruwangara)	8	Nyaburiba (Nganwa)	14
Bwunyu (Rugunga)	22	Gasagara (Gasagara)		Ryarutanga (Ruhengeri)	
Ruwangeri (Kayenzi)	10			<i>Kagoma (Kagoma I)</i>	
Rubomborana	10			<i>Kiganwa (Kiganwa)</i>	
Total 7 sites	103	Total 5 sites	43	Total 7 sites	57
Site 19, Participants 203					

- Bold letters indicate shallow wells that are still managed as of June 2008
- Italic bold letters indicate the sites where farmers themselves constructed shallow-well irrigation system without particular instruction by the Study Team

5.7.3 Monitoring and Evaluation

(1) Process of Monitoring and Evaluation

As mentioned already, monitoring and evaluation were made from the second field survey, starting from October 2006 with regular monitoring activity by the Study Team. Concept of monitoring is ,in principle, contemplated based on the objectives of this QP including monitoring period.

Table 5.7.6 Concept of Monitoring on Shallow Well Irrigation

Monitoring Period	Primary Monitoring Items
Up to the end of JICA Study	<ul style="list-style-type: none"> - Improvement of farming condition by using shallow well - Expansion of cropping area - Type of crops with amount of inputs to cultivate, - Self consumption and sale amount of the crops

Table 5.7.7 Schedule of Monitoring and Evaluation

Monitoring & Evaluation Activity	2006												2007												2008	
	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2					
Introduction of shallow well irrigation system																										
-Implementation of the Project & the Follow-up Project																										
-1st & 2nd Intensive monitoring																										
-1st Mid-term evaluation with stakeholders																										
-Study tour																										
-2nd Mid-term evaluation with stakeholders																										

(2) Evaluation Method (Internal and External Evaluation)

The project was evaluated by same method with other project (refer to 5.6.3(2)).

(3) Project Evaluation

1) Internal evaluation-1 (evaluated by model farmer, leader of Umudugudu)

Following WS for intermediate project appraisal carried out in December 2007, WS for the final evaluation was held by model farmers, Umudugudu leader and general farmers (on 17th ~ 20th June 2008 at Kanzenze Cell: 34 attendants, Cyugaro Cell: 37 attendants and Kibungo Cell: 43 attendants). In this WS, participants has identified recent situation on the use of shallow well irrigation and evaluated impact to livelihood improvement of the model farmers.

(a)The number of project sites

As mentioned above, road side irrigation was introduced at 19 sites in total.

(b)Content of discussions in WS

In WS, participants discussed on the impact on farm income and common livelihood of the model farmers who introduced shallow well irrigation during dry season in 2007 (Season C, or June ~ October) and their attitude of approach toward vegetable cultivation. Major vegetable species they cultivated were onions, carrot, cabbage, tomato and eggplant. In this connection, vegetable seed was distributed to the sites of shallow well irrigation Project in September 2007 as a component of Follow-up Project (FU). However, the farm income evaluated in the WS covers the result obtained prior to the implementation of this FU.

(c) Results of evaluation by Cell

a) Case of Kanzenze Cell

As of 2008, 4 sites have been irrigated from shallow wells where Byimana site has shown better result than other 3 sites for vegetable cultivation. Income from shallow well irrigation during dry season in

2007 (Season C, or June - October) was estimated at 6,300Rwf per person (net income) as an average of all 4 sites, use of which and obtained secondary effect to livelihood is tabulated as follows:

Table 5.7.8 Results on Farming in Season C by Shallow Well Irrigation (Kanzenze Cell)

Site	Umudugudu	No. of users of shallow-well	Gross income (Rwf) 2007 dry season	Input material expense (Rwf)	Net income (Rwf)	Net income per capita (Rwf)
Kinyana	Kabeza	12	36,000	6,000	30,000	2,500
Karumuna	Karumuna	n.a.	-	-	-	-
Kurugenge	Kurugenge	6	43,000	1000	42,000	7,000
Byimana	Ruwangawa, Kabaha	8	96,000	16,000	80,000	2,000
	Mean	26	58,300	7,600	50,700	6,300

Table 5.7.9 Purpose on Use of Income from Shallow Well Irrigation (Kanzenze Cell)

Breakdown use of income	Changes in livelihood (in particular labor status etc.)	Future prospect
<ul style="list-style-type: none"> ▪ Purchasing seed ▪ Purchasing manure ▪ Purchasing consumer goods (cloth etc) ▪ Preparation for next cropping ▪ Paying for school fee ▪ Purchasing livestock ▪ Merit: Farmer can open his bank account that allows him individual credit borrowing 	<ul style="list-style-type: none"> ▪ Because shallow well is available near farmland, labor for irrigation was saved. ▪ Clean water was obtained ▪ Shallow well irrigation can be operated even if lifting pump gets disordered. ▪ Labor by women was eased through shortened time to fetch water and they acquired spare time to spend for other activities than irrigation ▪ More water is available for irrigation 	<ul style="list-style-type: none"> ▪ Further improvement in crop yields can be expected ▪ Income betterment to higher level is expectable. ▪ Further livelihood improvement can be longed for (ex: at the dimension of nutrition and health etc.)

Besides, various opinions have been issued from the model farmers including 1) no instruction of cultivation techniques has provided by Sector agronomist officers, 2) farmers concern on whether assistance from the Study Team is further available or not, 3) they do not exactly know how to utilize micro-finance (as the measures for post-JICA Study) and 4) some anxiety remains as to how they manage shallow wells.

b) Case of Cyugaro Cell

The following gives the state of shallow well irrigation at Cyugaro Cell.

- Harvests during the Study period in 2007 (C cropping season C, or June - October) have only been consumed at home, thus no cash income has been brought from irrigation.
- Only cabbage was harvested but farmers failed harvest of all other crops including tomato and eggplant.
- Assuming that these harvested crop is sold, about 10,000 Rwf would have been earned by 12 users of shallow well irrigation (calculation base: about 50 heads of harvested cabbage at a rate 175Rwf/ head).
- For this year, cultivation would be difficult because the Model farmers feel difficulty in procuring input material by themselves.

Further, many of WS participants appealed to continue assistance in the form of input material / equipment supply. According to their comments, they would not be able to utilize shallow wells because of lack of further assistance in the form of material / equipment supply despite that vegetable seed was already distributed through FU Project.

c) Case of Kibungo Cell

Income gained from shallow well irrigation during dry season in 2007 (Season C, or June - October) was averaged at 15,700Rwf per farmer over all the sites (on net income basis), the usage and chain effect on livelihood is summarized as follows:

Table 5.7.10 Results on Farming in Season C by Shallow Well Irrigation (Kibungo Cell)

Site	No. of users of shallow wells	Gross income (A) Rwf	Income prior to shallow well irrigation (B) Rwf	Balance (A) – (B) Rwf	Input material cost (C) Rwf	Net Income (A) – (C) Rwf
Kagoma	1	16,000	24,000	(-)8,000	9,000	7,000
Gashamagarirro	3	3,000	2,000	1,000	0	3,000
		39,000	14,000	25,000	16,500	22,500
		40,000	40,000	0	9,000	31,000
Nyaburiba	2	22,000		22,000	9,500	12,500
		20,000	10,000	10,000	7,000	13,000
Kiganwa	1	25,000	10,000	15,000	5,000	20,000
Average/Total	7	23,571	16,667	9,286	8,000	15,571

- Kagoma I: Negative balance in Kagoma I is a result of decline in cultivation area.
- Kagoma II: The reason why no difference is observed is found in the fact that the model farmers failed their farming in 2007.
- At 3 sites, namely Kagoma I, Nganwa and Kiganwa, shallow-well irrigation was practiced on the farmer's own initiative.

Table 5.7.11 Purpose on Use of Income from Shallow Well Irrigation (Kibungo Cell)

Breakdown of use of income	Changes in livelihood (in particular labor status etc.)
<ul style="list-style-type: none"> ▪ Purchasing consumer goods ▪ Payment for school fee ▪ 2 fowls of chicken (2,400Rwf) ▪ 1 head of goat (6,000~10,000Rwf) ▪ 1 head of cattle (80,000~90,000Rwf) ▪ Pharmacy drug ▪ Favorites such as spirit ▪ Opening fund of grocery shop 	<ul style="list-style-type: none"> ▪ Heavy labor has been alleviated, getting healthier life. ▪ Livelihood is ameliorated. ▪ Irrigation works are felt less toilsome as experienced previously. ▪ Payment to employees has got smoother.

Further, the following indicates the replies to the below four question items.

Question item	Reply to the item from the participants
On the way of administrative intervention (Cell, Sector)	<ul style="list-style-type: none"> ▪ Administration side recommends shallow well project in such forum as meetings, but no concrete assistance is proposed. ▪ Agricultural officers are always absent, without any instructive service.
On the public services allocated to Cell Secretary	<ul style="list-style-type: none"> ▪ Cell secretary advises shallow well management practices including weeding, cleaning, retrenching preferably to be practiced in early morning or evening. ▪ Cell Secretary makes it a habit to patrol 3 times a week per Umudugudu, while model farmers appreciate this itinerant service.
On the outlet markets	<ul style="list-style-type: none"> ▪ Kicyukiro Market : carrying ca. 100kg of vegetables by bicycle, taking five hours. ▪ Nyamata Market : carrying ca. 100kg of vegetables by bicycle, taking two hours.
On the future evolution of the Project	<ul style="list-style-type: none"> ▪ The respondents expect future evolution of the shallow well irrigation. ▪ Lack of such material/ equipment as sprayers, watering tins and pesticides poses a serious problem.

The model farmers keep their aggressive attitude towards shallow well irrigation project. It is found that some of them drilled shallow well on their own initiatives, proving their strong willingness toward the project development. Some requests were posed for input material /equipment supply during

discussion, however, they composed minor opinions as compared with other two Cells. Since their income level has been improved comparing with previous one recorded before implementing shallow well irrigation project, it is expectable that in coming years the project can be sustained by participants farmers themselves through their voluntary project management.

d) Final evaluation

The table shown below gives a summary of evaluation conducted by the model farmers related to this Project in three Cells as beneficiaries. In this context, evaluation standard was determined judging from content of discussion in WS, reaction of the model farmers to shallow well irrigation scheme and degree of positive attitude shown by the participants during WS. The mark (A) represents highly positive/affirmative attitude towards respective item, while (B) indicates fairly positive/affirmative attitude, (C) shows a difficult judgment on whether affirmative or negative, and (D) gives a negative attitude.

Table 5.7.12 Summary of Evaluation on Shallow Well Irrigation by Cell

Cell	Kanzenze	Cyugaro	Kibungo
Extent of understanding toward this Project	(A): Well understood	(C): Not fully understood	(A): Well understood
Degree of reaching Project goals	(B): Contributing to income improvement and labor saving for irrigation	(D): Income improvement has not been realized	(B): Contributing to income improvement and labor saving for irrigation
Farmers motivation towards the Project	(B): High. Also, not fully dependent on outsiders assistance for inputs	(D): Very low. Majority of farmers fully rely on outsider's assistance.	(B): High. But they fully depend on outsiders assistance for inputs.
Leadership / credibility of Cell staff, Umudugudu leader	(A): Exceedingly strong	(D): Lack of leadership, not well informed due to poor communication	(B): Instruction has given to some extent toward the model farmers
Sustainability and future expectations	(A): More aggressive extension activities by Cell staff are required.	(C): Currently very pessimistic, but Cell staff's attitude is changing.	(B): More aggressive extension activities by Cell staff are required.

Shallow well irrigation doesn't require huge initial investment, but it can mitigate labor for crop management including irrigation labor by utilizing well water lifted up from shallow wells dug in the vicinity of farm plots. Also, it can yield positive effect on livelihood improvement through cash crop cultivation during dry season, in addition to benefit from labor saving. With these benefits, the model farmers and those intending to introduce it from now onward show keen interest on this activity.

According to the result of rural community survey conducted by the Study Team (studied at pre-implementation stage in 2006), mean annual household balance of farmers participating in the Model Project of shallow well irrigation stood at 6,819 Rwf on average. On the other hand, income from dry season cropping by shallow well irrigation in 2007 (equal to post-implementation state) was 6,300Rwf per person (or household) (reference to Kanzenze Cell). It means that nearly the same amount of income earned as annual balance have been obtained from only one dry season cropping for four months, verifying the effect of this Project.

Apart from the effect, as pointed out by the participants in WS, there found many farmers who are not well acquainted with basic cultivation techniques on the production of cash crops for dry season like vegetables. From this fact, room for further manifestation of project effect still remain for adding more benefit to shallow well irrigation activity through simultaneous improvement in farmer's vegetable cultivation techniques with the diffusive extension of shallow well irrigation practices.

Referring to hitherto results obtained in the evaluation/ analyse, it can be deduced that activities and better understanding of Cell staff on the Project are the major element for making the Project more sustainable and putting it from spot activity into facial one because they live closest to local inhabitants. It has been observed that in Kanzenze Cell and also in Kibungo Cell, some farmers voluntarily created shallow well irrigation without intervention by the Study Team under relevant instruction of Cell Secretary. On the contrary, it has been observed that in Cyugaro Cell insufficient leadership of Cell staff and Umudugudu leader has resulted in the failure of information delivery on this Project to concerned model farmers.



Presently, the Government of Rwanda has placed a condition by which only the graduates from agricultural faculty can be appointed as Executive Secretary of a Cell, and it plans to give economic assistance for them to acquire Diploma so as to satisfy the appointment condition. Judging from such measures, relative importance and role of Cell office will be increased for the promotion of such category of projects.

In the course of this evaluation WS, many requests for the assistance of farm inputs/ equipment have been issued. Considering sustainability of the Project implementation on inhabitant's own initiative, the fact that easy-going provision of material/ equipment is rather nuisance against project development by inhabitants' own self-help efforts can be endorsed by hitherto experiences and verifications. For this reason, measures are sought to find alternatives, including use of micro-finance. Farmers are aware of the existence of micro financing activities, but still failed to make use of it because they are not fully acquainted with procedures for its application. In order for farmers to procure agricultural inputs by their own independent action, it is essential to be acquainted with such financing systems, backed up by the assistance from administration staff for information supply.

The below table summarizes the results of evaluation stated above and information obtained from hitherto monitoring to provide the evaluation for this project.

Table 5.7.13 Evaluation on Shallow Well Irrigation by MFs and Umudugudu Leaders

Evaluation Item	Evaluation / Comment
Project Objective	<ul style="list-style-type: none"> ▪ Income improvement, Labor saving for fetching water to irrigate for crops
Efficiency	<ul style="list-style-type: none"> ▪ Shallow well digging is easy/ simple for farmers, but it requires assistance of providing such hand tools as shovels and stone picks. ▪ Even meager input (input of vegetable seed etc) can trigger further linkages to farmer's nutritional improvement and livelihood amelioration (from the experiences of FU Project). ▪ Comments were issued from a part of model farmers on the supply of vegetable seed by the

Evaluation Item	Evaluation / Comment
	<p>Study Team in FU Project, appealing that supplied amount was too little and time of supply was too late.</p> <ul style="list-style-type: none"> As to amount of supplied seed, messages were not well informed to them though the Team had consulted with concerned Cells agreeing that seed was not planned to distribute to all the model farmers but supplied for the objective of verification only.
Effectiveness	<ul style="list-style-type: none"> The Project has contributed to income increase and saving labor for fetching water for irrigation as envisaged by the Project. A part of the project sites have not satisfied basic farming conditions due to deficiency of plant nutrition or lack of cultivation know-how etc, thus it is essential to improve farming environment through fortification of farm extension services. Depending on the timeliness of input (seed etc) provision, room for enhancing degree of fulfillment of project goals may still remains.
Positive Impact	<ul style="list-style-type: none"> Model farmers have become a nucleus from whom knowledge and techniques on shallow well irrigation are learned and transferred, also solidarity and concept of mutual cooperation are nurtured and inspired. Expanded possibility of cultivating vegetables during dry season has led to expansion of area under cultivation as well as improved yields of cultivated crops. <div style="display: flex; align-items: center;">   <div style="flex-grow: 1;"> <p>A model farmer expanded tomato plot by using well water.</p> </div> </div> <ul style="list-style-type: none"> Labor burden for fetching water to irrigate crops during dry season has been alleviated. Experiences of shallow well irrigation triggered/ fostered further well digging in a project site. Water in shallow wells is also useful as water for daily life at home.
Negative Impact	<ul style="list-style-type: none"> Limited beneficiary period (exerting as both positive and negative impact): Shallow wells are really useful for securing dry season farming in marshy area/ wetland, but their utilization period is limited in dry season, hence an issue arises on how to manage and maintain them during idling season.
Feasibility (accordance with inhabitants' needs, conformity with DDP and EDPRS etc.)	<ul style="list-style-type: none"> The project aims at income improvement and mitigation of labor for fetching irrigation water. Besides, it is applicable as measures coping with issues of food procurement and nutritional improvement. Thus, it really matches local needs. Surely it is difficult to find direct relation in a visible, concrete form between EDPRS or Bugesera District development Plan (DDP) and the proposed well irrigation project. However, the former positioned agricultural sector as a major player of national economy in Rwanda to steadily develop under Vision 2020, while the latter gave higher priority rank to agricultural sector development by deeming various issues in the agricultural sector as main constraint for economic development of Bugesera District. In "Land-husbandry, Water harvesting and Hillside-irrigation (LWH) Project" formulated by MINAGRI, promotion of irrigated farming during dry season has been called for. As stated above, this Project is concluded significant in the light of direction of development given to the agricultural sector by higher positioned national plans and DDP.
Possibility of self-development, Sustainability (such as issues in sustaining project)	<ul style="list-style-type: none"> Sustainable project evolution is expected through farmers' self-help efforts from the viewpoints of strong needs for facility, effectiveness, simple and easy construction skills that even farmers can practice, low level construction cost (almost zero cost) etc. Assistance from outside of the community is indispensable that includes initial investment at minimal scale in the form of farming material/ equipment, extension services such as farming and cultivation techniques as well as streamlining of markets etc.

Evaluation Item	Evaluation / Comment
activities)	<ul style="list-style-type: none"> ▪ Furthermore, it is required to build extension system through "Farmer-to-Farmer" network. ▪ Issues to be addressed include commuting cultivation from remote area to farm plots in wetland, natural damages by birds and beasts as well as theft damages before the harvest. ▪ One of the comparative advantages that Bugesera District takes is that it is located at only 30km away from the capital Kigali. The construction of a trunk road connecting Bugesera District and Kigali City has completed, thus radical improvement in cargo-transport condition for farm product delivery is expected in nearest future. Backed by such amelioration of farming outlet, there find ample possibility of further expansion of vegetable production in wetland during dry season through the diffusion of shallow well irrigation system.
Project Benefits (for instance, costs versus benefits)	<p>1. Project cost and benefits</p> <ul style="list-style-type: none"> ▪ Cost of shallow well digging is negligible, while facility construction can be met only by voluntary farmers' labor. ▪ In FU Project, large benefit was brought depending on the Project site. ▪ It is required to examine distribution of farming material (vegetable seed, fertilizers, pesticides) as initial input. <p>2. Mitigation of labor burden for irrigation water fetching</p> <ul style="list-style-type: none"> ▪ Since water source (shallow wells) is available nearest to farming area, use of well water is effective to save labor burden for carrying irrigation water during dry season during which water levels in wetland lowers (in other words water sources get remoter).
Aspect of Health	<ul style="list-style-type: none"> ▪ Because the Project enables vegetable cultivation during dry season, it can also contribute to nutritional amelioration by allowing farmers intake of diversified nutritional factors.
Environmental Influence	<ul style="list-style-type: none"> ▪ No environmental load affecting ambient (especially wetland) environment is identified from the construction of shallow wells.
Future Prospect, Items to improve in the project activities, Feedback to DDP etc.	<ul style="list-style-type: none"> ▪ Construction of the facility is extremely conventional, in addition, no economic burden on the farmers side takes place. Such advantages will lead to a self-propaganda for its high project benefits, possibly entailing in facial or two-dimensional diffusion of shallow well irrigation at farmers level. ▪ As farmers are not affordable in providing economic means to obtain initial investment on farming, assistance from outside is also necessary to sustain the Project. ▪ Earnest requests from farmer's side are made for the technical assistance on farm cultivation. Opinions are heard expecting liaison with Sector Office and Cell Office. Not only construction of facility (shallow well digging = hard portion), but assistance on cropping techniques (soft portion) is also essentially important for manifesting further project effect. ▪ Besides, exploitation and holding of marketing outlets as well as securing transport means are remaining to tackle from now onward. They can provide incentives for farmers.

2) Internal evaluation-2 (evaluated by administration officers)

Method of evaluation of this Project by the administration staff in charge is shown above, and the following gives the result of the evaluation.

Table 5.7.14 Evaluation on Shallow Well Irrigation by Administration Officers

Project name Sector /Cell	Shallow well irrigation			
	Project evaluation			Content of evaluation, comments etc.
	Good	Fair	Poor	
Ntarama Sector Office	3/4	1/4	0	<ul style="list-style-type: none"> • The Project is proved effective on vegetable cultivation during dry season, resulting in income improvement. Thus, it enhanced farmer's motivation of cultivating vegetables. • As irrigation water is available in the vicinity of field plots,
Cyugaro Cell Office	2/4	2/4	0	

Project name		Shallow well irrigation			
Sector / Cell		Project evaluation			
		Good	Fair	Poor	Content of evaluation, comments etc.
Kanzenze Office	Cell	1/2	1/2	0	farmers could save their labor for fetching water as compared to the previous irrigation labor. • Shallow well water was also used as water for households. • Participants acquired knowledge /techniques of irrigation by shallow well. • Size of the Project site was too narrow, and water quantity obtained from the well was less than expected. Number of the Project sites was not enough to meet demand.
Kibungo Office	Cell	3/3	0/3	0	
Total		9/13 (69%)	4/13 (31%)	0	

As mentioned above, Evaluation by the participants in WS gives the average annual household balance of the model farmers (without project basis) stood at 6,800Rwf, while they earned almost equivalent net income to this annual gain during one single crop in dry season. This might have enhanced their motivation to engage in dry season farming. Also, toilsome labor for water fetching has been eased.

On the other hand, the Project has some issues, for example, farmers failed to procure sufficient water to irrigate from their shallow wells in some sites, while in other sites basic farming conditions such as soil infertility in their farm plots or suffering lack of basic cultivation knowledge fail to meet their farming, thus they have failed to obtain expected result from their farm activities.

Such a situation may reflect in the fact that two-dimensional deployment of project expansion has not yet satisfactorily progressed. In spite of the fact that irrigation activities in some sites succeeded in bringing such benefits as stated above, number of implemented project sites remained at 19 in the whole Ntarama Sector. Hereafter, it is necessary to do technical examination for alteration of area for shallow well development, propaganda of benefits brought about from shallow well irrigation (in common, there are many farmers who do not follow other's success by their own initiatives even though others enjoy benefits from their activities), info-exchange among farmers, administratively oriented strengthening of farming extension services etc by administration staff, especially Cell staff and Sector agronomists, even by the model farmers and local leaders.

3) External evaluation

(a) On the feasibility

- The objectives of this Project, namely, livelihood amelioration and nutritional improvement through dry season wetland farming (cash crop cultivation) meet needs of local inhabitants.
- Because DDP formulated on the basis of the policies of EDPRS has launched a plan of reducing food deficit population to a half and of livelihood betterment by 2012, it can be concluded that this Project is politically and economically feasible.

(b) On the efficiency

- The project output versus input for project implementation was found efficient.
- Though shallow well irrigation can easily be constructed with simple work operation, it is

necessary to provide such initial input equipment as well drilling implements etc.

- Shallow well irrigation during dry season brings sizable effect on harvest (income) and nutritional improvement by negligibly meager input (such farming material as vegetable seed).
- In the meantime, while vegetable seed and pesticides were provided from the Study Team in FU Project started since September 2007, requests of improvement were issued against this provision on the supplied quantities and timing of provision. In particular on the period of seed supply, the requests suggested June ~ July, or the incipient month of C cropping period as a best and reasonable time for supplying seed. Thus, prior consideration on the timeliness of seed supply should have been examined.

(c) On the effectiveness

- The Project has achieved its goals to an extent. Nevertheless, some project sites fail to meet basic conditions on cultivation activities (soil fertility, lack of cultivation knowledge etc), to which farming extension service is essential.
- Shallow well irrigation is highly effective. Moreover, its effectiveness will further be secured by supplying inputs such as vegetable seed timely.
- Since shallow well irrigation can be provided by almost zero cost, and in addition, it brings about sizable project effect (in the form of income generation by cultivation of dry season crops), it is highly effective to farm economy.

(d) On the benefit and impact

- Along with learning / acquiring knowledge and techniques on shallow well irrigation, the Project has brought beneficial effect on the creation of solidarity among farmers and on the awareness of mutual collaboration.
- Shallow wells have not only an effect on alleviation of labor for water fetching in small scale vegetable irrigation, it also has a merit of multi-purposed utilization of a facility, for example it is used as a water source for living of inhabitants who live near the site during dry season, so it can be used for wider usage.
- The fact that there is a site where more shallow wells were dug by the participant's own initiative without needing instructions and assistance of the Study Team is considered as a result of farmer's perception on the beneficial effect of shallow well irrigation.

(e) On the sustainability

- Since the Project can conventionally be implemented with low cost input, it has ample possibility of being sustained with farmers' self-help efforts. In this context, promotion of such an activity requires firm establishment of farmers assisting system through expansion and fortification of farming extension services, development of marketing outlets etc.
- Because crop damages caused by wild animals (bird etc) may serve as disincentive/

discouraging factor for farmers concerned, it is necessary to take measures to cope with such exogenous factors.

(f) Proposal and Recommendation

- Sector Office and Cell Office are requested to make public merits of shallow well irrigation among local inhabitants.

5.7.4 Fact Findings through Implementation

Through implementation of the shallow well irrigation construction, followings have been revealed (See Annex V.5.7.1 for detail).

1- Type of shallow well

During implementation of the project, three different type of shallow well were introduced based on the site condition.

1) Type I: Shallow well type

Type I : Shallow well type
 Dimension:
 Size: 2m*2m
 Depth: 1.8m
 Height of embankment: 0.5m



Left: 9 Participants digging well for 2.5 hours
 Right: Embankment work around well mouth

Shallow Well Construction at Muzi-Cyeru Site in Kanzenze Cell

2) Type II: Small scale canal type

Type II: Small-Scale Canal Type
 Dimension of canal:
 Width : 1.5m
 Depth : 1.3-1.5m
 Length : 20m



Left: 9 farmers participated
 Right: Completion of digging work, Marshland water is led to plots

Construction of small-scale canal (Gashagamariro, Kibungo Cell)

3) Type III: Small scale pond with canal type

Type III: Combined type with Small-Scale Farm pond and Canal
 Dimension:
 Pond: Size 3m*4m, Depth 3m
 Canal: Width 3m, depth 1.5m, Length 15m



Left: Existing pond

Right: Under construction of canal

Combined type with Small-Scale Farm pond and Canal (Rutovu, Cyugaro Cell)

- 2- Simple construction with zero-cost
- 3- Domestic consumption of the shallow well water

- 4- Gap between intention and practice
- 5- Fruitful results by a little input

In order to secure safety of the users of the shallow well in the field, prompt measures should be taken soon after the construction of shallow well facilities. On the pilot project sites, the participants surrounded the shallow well with a vinyl tape around the opening of the well so that the tape could indicate the place of the well, thus called the users' attention.

5.8 Roadside Irrigation

5.8.1 Background and Purpose of the Project

(1) Background

In the Study Area, short matured crops like haricot bean and sweet potato are usually cultivated twice a year as double cropping in the hillside, while long matured crops like sorghum and cassava are cultivated once a year as single cropping, planted at the beginning of either A or B season in the hillside. Banana plantation also occupies large area somehow in the hillside. For better production of those crops, the roadside irrigation system has been tried to introduce more effective use of rainfall and to protect road and cultivating land on the hillside from soil erosion.

(2) Purpose

According to the background of the study area, the project aimed to achieve the following purposes.

- Improvement of farming activity during the bimodal rainy season through increase of agricultural productivity through effective use of rainfall
- Soil conservation and underground water cultivation
- Income generation

5.8.2 Process and Results of the Project

(1) Process

Since September 2006, the project was progressed on the schedule as shown in the table below.

Table 5.8.1 Implementation Process of Roadside Irrigation

Activity Item	Y2006							Y2007							Y2008						
	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F
Pattern of rainfall																					
1- Explanation W/S	▲																				
2- Selection of model sites & participants		■	■	■	■	■	■														
3- Identification of candidate sites				■	■	■	■														
4- Provision of tools		▲																			
5- Demonstration				▲																	
6- Implementation (Construction of R.I.S)					■	■	■													■	■
7- Study tour							▲														
8- Monitoring by Study Team			■	■				■	■	■	■				■	■					
9- Mid-term evaluation with stakeholders										▲	▲										
10- Mid-term evaluation with stakeholders																					▲

(2) Results

During project period, roadside irrigation was implemented at 18 sites as the table below:

Table 5.8.2 Results on Roadside Irrigation

Cyugaro		Kanzenze		Kibungo	
Nos. of Site implemented	Nos. of Persons concerned	Nos. of Site implemented	Nos. of Persons concerned	Nos. of Site implemented	Nos. of Persons concerned
5	7	2	5	11	11
G. Total of implemented sites and persons concerned of the Roadside irrigation project: 18 Sites, 23 Farmers					

5.8.3 Monitoring and Evaluation

(1) Process of Monitoring and Evaluation

Monitoring and evaluation of roadside irrigation was done with the schedule as shown below.

Table 5.8.3 Concept of Monitoring

Monitoring Period	Primary Monitoring Items
Up to the end of JICA Study	<ul style="list-style-type: none"> - Cropping area expanded - Type of crops with amount of inputs to cultivate - Self consumption and sale amount of the crops by road side irrigation

Table 5.8.4 Schedule of Monitoring and Evaluation

Monitoring & Evaluation Activity	2006												2007												2008	
	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2					
Introduction of road side irrigation system																										
-Implementation of the Project & the Follow-up Project																										
-Study tour																										
-Intensive monitoring																										
-1st Mid-term evaluation with stakeholders																										
-2nd Mid-term evaluation with stakeholders																										

(2) Evaluation Method (Internal and External Evaluation)

The project was evaluated by same method with other project (refer to 5.6.3(2)).





(3) Project Evaluation

1) Internal evaluation-1 (evaluated by the model farmers and Umudugudu leaders)

An internal evaluation by the model farmers and Umudugudu leaders was carried out in December 2007. The following table summarizes the result of evaluation.

Table 5.8.5 Evaluation on Roadside Irrigation by the Model Farmers & Umudugudul Leaders

Evaluation item	Evaluation/ Current status
Project goals	<ul style="list-style-type: none"> ▪ Income improvement, Environment conservation (prevention of soil erosion), acceleration of groundwater recharge
Efficiency	<ul style="list-style-type: none"> ▪ The facility can be created using only labor contribution by farmers and the construction works are also simple /conventional. Moreover, no cost is to be borne by farmers in the construction. ▪ From the aspect of crop cultivation, such measures as soil improvement and application of fertilizer would be necessary provided that field plot has poor fertility. ▪ For all the cases of this project system banana planting has been applied, and output response to input is highly evaluated.
Effectiveness	<ul style="list-style-type: none"> ▪ The project is effective for valid use of rainwater, to prevent soil erosion and for recharging groundwater.

<p>Positive Impact</p>	<ul style="list-style-type: none"> ▪ Many of project participants marked learning of knowledge concerning rainwater harvesting. <div style="display: flex; justify-content: space-around; align-items: center;">   <div style="margin-left: 20px;"> <p>← Runoff goes into Banana plots.</p> </div> </div> <ul style="list-style-type: none"> ▪ As to the result of introducing this system into banana plantation farm, farmers appreciated it because they sold a bunch at 500Rwf before introducing the system, but later they could sell it at 2,500Rwf owing to improvement in both yield and quality, thus leading to a great income increase. <div style="display: flex; justify-content: space-around; align-items: center;">   <div style="margin-left: 20px;"> <p>← The system shows good effects for banana cultivation (Kibingo)</p> </div> </div>
<p>Feasibility (accordance with inhabitants' needs, conformity with DDP and EDPRS etc.)</p>	<ul style="list-style-type: none"> ▪ This Project aiming at income expansion and prevention of soil erosion in hillside farming is considered responding local inhabitants' needs who are facing to issues on livelihood and farming constraints giving them measures to cope with these issues. ▪ In the Bugesera District Development Plan (DDP) importance is also attached to water harvesting, this Project pursuing effective utilization of rainwater and subsequent income increase is considered having high feasibility. ▪ In "Land-husbandry, Water harvesting and Hillside-irrigation (LWH) Project" formulated by MINAGRI calls for a comprehensive approach for introducing and promoting proper techniques including water harvesting and other methods for hillside irrigation farming and thereby resulting enhancement of agricultural productivity as well as sustainable growth, also market-oriented diversification of agro-products. These policy frameworks suggest that this Project completely matches what is envisaged in these guidelines. ▪ Concluding from above-cited aspects, this Project is based on the same direction of Bugesera District DDP and agricultural policy, hence it is exceedingly feasible from policy aspect.
<p>Possibility of self-development, Sustainability (such as issues in sustaining project activities)</p>	<ul style="list-style-type: none"> ▪ From the aspects of farmers' needs for project, usefulness, nature of conventional works that even farmers can manage to construct, low construction cost (negligibly zero cost) etc, a sustainable evolution can be expected with farmers' own self-help efforts. ▪ The model farmers earnestly request extension services covering farming and cultivation techniques, market development etc, so it is indispensable to continue to provide external assistance.
<p>Project Benefits (for instance, costs versus benefits)</p>	<ul style="list-style-type: none"> ▪ Cost for procuring construction material is free, while the construction of the system can be managed by labor force supplied from farmers.
<p>Environmental Influence</p>	<ul style="list-style-type: none"> ▪ The Project is effective in minimizing soil erosion loss from the crop field, also in fostering groundwater recharge.
<p>Future Prospect, Items to improve in the project activities, Feedback to DDP etc.</p>	<ul style="list-style-type: none"> ▪ Because of zero cost and earlier fruition of its effect, it is expected that two-dimensional development at farmers level can be expected (making use of newsletter is also conceived). ▪ Strong requests are issued from the model farmers for the assistance on farming/ cultivation techniques. Development and holding of market outlets are also issues to be tackled hereafter. These items of assistance can serve as incentives towards farmers.

2) Internal evaluation-2 (evaluated by administration officers)

The following gives the result of the evaluation by administration officers.

Table 5.8.6 Evaluation on Roadside Irrigation by Administration Officers

Project name		Roadside Irrigation			
Sector / Cell		Project evaluation			
		Good	Fair	Poor	Contents of evaluation, comment etc.
Ntarama Sector Office		3/4	1/4	0	<ul style="list-style-type: none"> The Project resulted in yield increase of banana. Effect of checking soil erosion was brought. A comment says that this is an effective method amidst recent years tendency of unstable, precarious rainfall (in declining trend) pattern in Bugesera District. Because there are many farmers who don't own their farm plots along roads, number of project sites (and number of participants) suitable for this Project is limited. It is essential to inform the beneficial effect among farmers at large for further diffusion.
Cyugaro Cell Office		2/4	2/4	0	
Kanzenze Cell Office		0/2	2/2	0	
Kibungo Cell Office		2/3	1/3	0	
Total		7/13 (54%)	6/13 (46%)	0	

The evaluation on this Project by administration staff gave a mixed result where 50% the evaluators marked “good” and the rest 50% gave “fair” mark. Though no evaluator gave “poor” mark, the judgment for “good” remained a half as compared with previously stated two projects.

The objectives envisaged by this Project lies in “income amelioration for rainy season farming” and “environment conservation (effect on soil erosion prevention and on groundwater recharging)” and the evaluation recognized actual effect respectively as targeted/ anticipated. However, evaluators also pointed out that number of project implementation is still few, hence many farmers concerned have not recognized effectiveness of the techniques employed in this Project. Such viewpoints have led to the above-tabulated (somewhat under-estimated) result of evaluation.

Similar to the above-mentioned shallow well irrigation, the issue confronted by this Project lies in how to diffuse and develop it over the target area. To this end, as evaluators pointed out, it is requested that first of all administration staff do realize the effect of this technique to maximize use of rainwater amidst Bugesera District where rainfall follows a declining trend, then they propagate the effect towards farmers.

3) External evaluation

(a) On the objective of implementing project

- This Project has been introduced with the objectives of crop yield improvement through effective use of rainwater, minimization of soil erosion over road surface and acceleration of groundwater recharge.

(b) On the feasibility

- DDP envisages introduction of water harvesting techniques with a view to facilitating effective use of rainwater for farming in the district. Also, LWH project by MINAGRI plans to realize

diversification of agricultural production and sustainable farm production by means of introducing and promoting comprehensive relevant techniques. With such background, feasibility of implementing this Project in the Study Area is proved to be high.

(c) On the efficiency

- Because the construction of this facility is highly conventional with nearly zero-cost, the project efficiency is also high.

(d) On the effect

- As a result, since the application of irrigation has incidentally been concentrated on banana plants, effect of the Project on banana cultivation has been verified. However, the effect on other crops is not yet made clear.

(e) On the benefits and impact

- The benefit of the Project has been identified in the model farmers who introduced irrigation to banana cultivation. They could ameliorate both yield and quality of harvested bunches the unit price of which was raised five times as much as hitherto price level, thus they enjoyed the project benefit.
- Against erosion at the road surface and runoff from soil surface in the farm plots during intense rainfall, the facility provided by this Project could retain washed earth material inside the plots and its effect was also observed in the retention of soil moisture.



Runoff flows into banana plots

(f) On the sustainability

- As implementation of this Project is simple as well as inexpensive, there is a possibility for farmers to sustain the project by their own self-help efforts. In this connection, in order to promote this project under the above-cited conditions, it is indispensable to establish such assistance system for farmers as expansion and strengthening of farm extension services and stabilization of markets etc.

(g) Proposal and Recommendations

- Since this Project fulfills its function only during rainy season, creation of a linkage with farm ponds that have been constructed by the hillside agricultural development project should be pursued.

5.8.4 Fact Findings through Implementation

Same as other water related components, some tangible facts have been found out through implementation of the roadside irrigation construction (See Annex V.5.8.1 for detail).

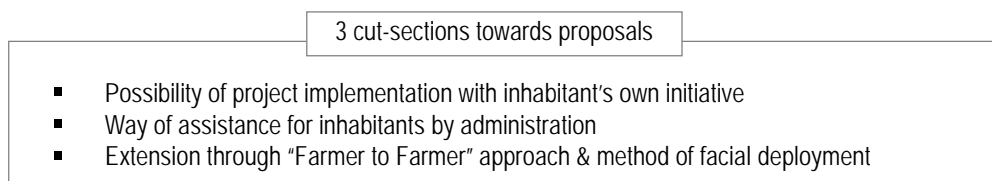
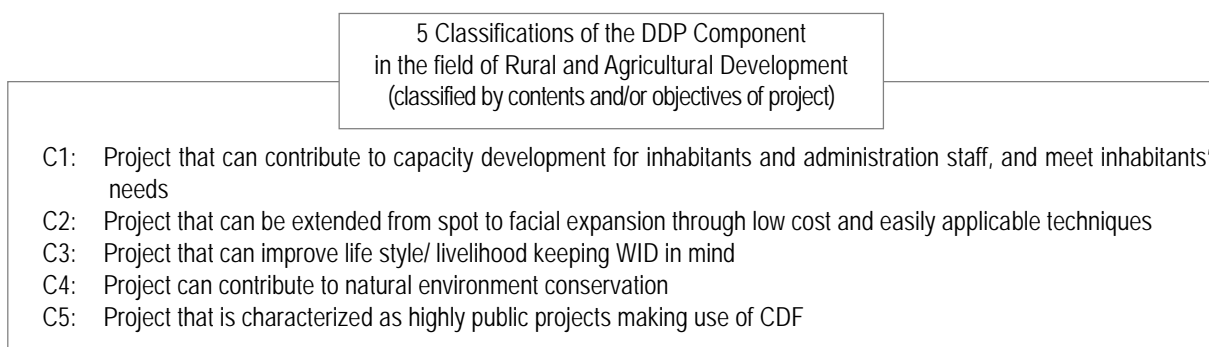
- 1- Simple construction with zero-cost same as shallow well
- 2- Leadership as a driving force
- 3- Eagerness for getting knowledge of advanced farming technique
- 4- Gap between intention and practice



The participants are delivered with a lecture

5.9 Proposal to Bugesera District Development Plan (DDP)

The QP has the objective of reflecting fruit and lessons obtained through the implementation of the Project components into Bugesera District Development Plan (DDP). To this end, taking into due account of the above mentioned items, the Study proposes to classify rural and agricultural development project components of 67 numbers in DDP into 5 categories (C1 - C5 in the below table) according to project contents or by objectives so as to check the probability of implementation by local population and help planner concerned review DDP in future. In addition, based on the fruit/lessons learnt in the course of the project implementation, as well as on the result of project evaluation made by model farmers, administration officers concerned and that by the third person (external evaluation), a project sheet is provided through grouping these data into 3 sections (illustrated in next to below table) to be provided as proposal to DDP thereby offering as a guideline to hereafter review DDP. The said project sheet is indicated in section 7.3.5 of Chapter 7.



5.10 Environmental Evaluation for Quick Project

(1) Introduction of Modern Cow

Cowsheds are constructed in farm gardens, and fodder crop is produced at small plots (0.2ha per farm)

in existing farmlands. A cowshed is small-sized and constructed using locally obtainable materials (woods, cement, sand, nail, iron sheet, etc). The cost for constructing a cowshed is approximately US\$200. Construction period is about 5 days.

Crossbred cows are purchased by the Study Team and provided to farmers. A question regarding the percentage of European blood was raised by farmers. Fodder produced at farmlands is being provided to cows. In order to maintain cattle and to have larger milk production, forage produced at larger lands (larger than 0.2 ha) is required. Therefore, sufficient amount of forage may not be given to cattle or the fodder production from farmlands may occupy the place where other crops are produced. Concerning this point, the model farmers selected for the Cow QP afford to manage cow keeping in his/her farmland via monitoring result made by JICA Study Team.

In order to maintain animal health, veterinary services (i.e. vaccination against diseases, disinfections) are needed. The cost of veterinaries is rather high for local farmers, and therefore it may not be able to continue without financial support by the project. Artificial insemination will be provided with support by the project. Cowshed is designed to collect excrement from cows in order to use them as manure for crop production and no impact from excrement is predicted. Construction of cowsheds requires certain amount of woods, which are collected from neighboring forests. It is required to get permission from Sector office through Cell office prior to cutting trees and illegal cutting is fined under watch system at Cell level. However, it is necessary to follow up actual operation of this rule via monitoring general condition of community forest.

(2) Rainwater Storage Installation

Rainwater storages have been constructed beside farmhouses. The size of storage is small (1m³), and constructed using locally available materials (brick, cement, iron sheet, etc.), so that there is no land clearing and compaction are conducted since storage is placed in backyard of each farmhouse.

Rainwater is collected mainly during rainy season. Maintenance to clean the storage is required in order to water inside clean. The maintenance can be conducted at the beginning of the wet season by using rainwater that contains the dirt of the roof. The outbreak of malaria mosquito is avoided since the mouth of storage tank is completely covered by lids. By using rainwater storage, positive impacts on human health are expected since rainwater is relatively clean compared with the water from swamp/lake that farmers drink. No negative impacts on the environment are predicted.

At the beginning stage of the project, it was worried that Malaria mosquitoes will breed in the storage. According to the monitoring result in this stage, breeding of mosquitoes in/around the storage was found few. Only a mosquito was found at the storage without cover. It could be assumed the relation between putting the cover and breeding of malaria mosquitoes, and the cover of the storage is effective to prevent breeding of mosquitoes.

(3) Shallow Well Irrigation

Shallow wells are constructed at the bottom of hills. The well size is small (circle 2 meters in diameters, 1.5 meters in depth), and constructed without using any materials. Therefore, no negative impacts are predicted at the construction.

Water from shallow well, which is collected naturally, is used for vegetable production. The amount of water collected in the well is small; therefore no negative impact to existing water system is predicted. Although annual maintenance to remove soil accumulated in the well is required at the end of the wet season after submersion, no additional cost is needed except for labor work which can be voluntarily provided by local farmers. Four sticks connected by rope indicating the location of a well are placed at the corners of the well in order to avoid accidents. The distance from residential area is long enough to avoid the outbreak of vermin, especially malaria mosquitoes.

(4) Roadside Irrigation

The irrigation channel is constructed at roadside. The size of the canal is small (30cmx30cm) and the length is short (approximately 100m). The construction materials are limited. Construction period is short (2 - 3 days per site). Therefore, no negative impacts are predicted during the construction.

The existing farmlands are benefited by irrigated water from these canals. Rainwater flows by gravity from roadside to farmland without any cost for operation. Maintenance to remove soil accumulated in the canal is needed, but the removed soil can be utilized in crop fields. Since excessive runoff water by intensive rainfall may damage the cropping fields, monitoring is required. Drainages controlled by gravity and water control devices are expected to solve the problems. On contrary, if eroded soil along the roads is effectively collected through the irrigation, nutrient contained in the soil will be utilized for crop cultivation.

It was anticipated damage caused by excessive runoff by heavy rainfall flows into the farm plots through the roadside irrigation system. According to the monitoring, such damage was not reported because the systems were introduced to the banana plantation mainly that equips depletions around the banana trunk to tap the runoff temporally.

CHAPTER 6 THE PILOT PROJECT (PP)

6.1 Objectives of the Pilot Project

The objectives of the Pilot Project (PP) is to verify effectiveness, feasibility of the project components in Bugesera District Development Plan (DDP) as well as methodology and effect of “from a spot to an area” (from a spot trial, then spreading over a wider area) deployment of the components, thereby feeding back. Therefore, components of PP were selected among candidate projects corresponding to priority sector in Bugesera District. In this concern, approaches have been made attaching priority on the following four key points.

- Capacity development of inhabitants, agricultural officers in charge in Districts and Sectors as well as Cell staff is enhanced through PP and coordination as well as strengthening collaboration with RADA, RARDA and ISAR are pursued.
- Paying respect to indigenous (self) development in communities, self-help oriented project management techniques for Umudugudu in particular are examined/ exploited.
- Methodology and effect of “from spot to an area” deployment of the project is verified.
- Fruit and lessons learnt through the implementation of PP is reflected in DDP.

PP has been implemented for about one and a half years targeting three Cells in Ntarama Sector and paddy cropping area of Nyaburiba marshland in Ruhuha Sector. Inhabitants in the project area can participate in various levels, such as association (hereinafter referred to as AS), Umudugudu/ Cell/ Sector etc, while such organizations as Umudugudu/ Cell/ Sector can be fully used as information center for sensitization / extension like QP. Likewise, CD can cover not only target inhabitants and extension staff concerned, but also staff of Sectors who play role of coordinators in project implementing stage as well as of ISAR, RADA, RARDA etc who provide monitoring and technical support, thus having given precious opportunity of OJT to these staff.

Through the implementation of the QP, it was found that Umudugudu functions as the smallest administrative unit under the Cell and its organization needs to be strengthened in line with the national policy. In order to promote grass root community development, this organ is essential and it will be necessary to involve Umudugudu in making plan and implementing PP as a core and driving force of community development. At present there are 22 Umudugudu in Ntarama Sector.

6.2 Processes of Selecting the Project Sites and Components

(1) Selection of the Project Sites

In selecting the sites of the PP, possibility of exercising further effect by continuously implementing the development project in the targeted Ntarama Sector including follow-up (FU) of QP project and promotion of paddy crop to contribute for food security are considered attaching priority. From these points of view, Ntarama Sector (Nyaburiba marshland) and Ruhuha Sector have been selected for this

PP. (See Annex VI.6.2.1 for details.)

(2) Components of PP

PP implemented in this Study consists of the following five components.

Table 6.2.1 Components of the Pilot Project

Name of Project	Summary of the project contents	Applied site
(1) Improved Rice Seed Multiplication and Dissemination Project	To introduce improved paddy cropping techniques mainly based on seed multiplication of selected paddy varieties, thus envisaging strengthening extension system for improved seed	Ruhuha Sector, Nyaburiba marshland
(2) Marshland Agricultural Development Project	To establish paddy production trial plots where possibility of marshland agricultural development is examined through test trial cropping of selected paddy varieties.	3 Cells in Ntarama Sector
(3) Hilly Terrain Agricultural Development Project	To construct small-scale farm pond to secure irrigation water both for supplement irrigation during rainy season and small-scale irrigation during onset period of dry season, thus stabilized growth of crop is pursued.	Ditto
(4) Livelihood Improvement Project	To implement project by combining a few components like livelihood improvement through arboriculture of edible fruit trees, rearing of small livestock etc, living status amelioration through use of solar energy	Ditto
(5) Follow up project for QP	Monitoring of QP4 project is sustained and Follow Up project is designed and implemented as necessity arises	Ditto

(3) Process of Selecting Project Components of PP

The four components of the PP in Ntarama Sector were selected through the following process.

Table 6.2.2 Process of Selecting Project Components of PP

Period	Consultation / Activities	Contents / identified items								
January 2007	Consultation with Mayor of Bugesera District	<ul style="list-style-type: none"> Components of (1)~(4) in the above table were proposed from the Study Team (roughly estimated cost of 280,000US\$) to the chief, and reached basic agreement. 								
D.O.	Execution of a study tour for project training	<ul style="list-style-type: none"> To visit and study the existing examples of above listed component, representatives of Ntarama Sector, 3 Cells, 22 Umudugudu chiefs etc conducted a study tour. They visited study sites of Nyaburiba marshland and Murama hilly terrain watershed management project (inhabitant's participatory project by ISAR) . 								
D.O.	Holding WS (at Ntarama Sector)	<ul style="list-style-type: none"> With a view to extracting issues and needs faced by each Cell concerned, clearly grasping available natural resources, state of organizations /activities of Umudugudu etc, WS was held contributing formulation of project components of PP. At the same time, taking account of the process of the above-cited consultation with Bugesera District chief, original draft of conceivable project components were explained in WS. 								
February 2007	Holding joint meeting with Sector and Cells concerned (at Ntarama)	<ul style="list-style-type: none"> Based on the results of the above-cited WS, Project components of PP (draft) were formulated. At the period, the following were included as (requested) tentatively chosen, candidate components. <ol style="list-style-type: none"> Marshland Agricultural Development Project: a site per each Cell, the implementation was scheduled in total 3 sites Hilly Terrain Agricultural Development Project. 2 sites per Cell, the implementation was scheduled in total 44 sites Livelihood Improvement Project: listed in the below frame QP Follow Up Project: continued monitoring and implementation of follow-up 								
Livelihood Improvement Project (draft)										
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Cell</th> <th>Cyugaro</th> <th>Kanzenze</th> <th>Kibungo</th> </tr> </thead> <tbody> <tr> <td>Proposed by inhabitants (Order by</td> <td>1) Improved goat rearing 2) Egg layer's rearing</td> <td>1) Maize milling 2) Egg layer's rearing 3) Bee keeping 4) Improved goat rearing</td> <td>1) Introduction of vegetable cultivation (tomato,</td> </tr> </tbody> </table>			Cell	Cyugaro	Kanzenze	Kibungo	Proposed by inhabitants (Order by	1) Improved goat rearing 2) Egg layer's rearing	1) Maize milling 2) Egg layer's rearing 3) Bee keeping 4) Improved goat rearing	1) Introduction of vegetable cultivation (tomato,
Cell	Cyugaro	Kanzenze	Kibungo							
Proposed by inhabitants (Order by	1) Improved goat rearing 2) Egg layer's rearing	1) Maize milling 2) Egg layer's rearing 3) Bee keeping 4) Improved goat rearing	1) Introduction of vegetable cultivation (tomato,							

Period	Consultation / Activities	Contents / identified items			
		relative priority)	3) Fruit banana cultivation 4) Vegetable cultivation (tomatoes, cabbage, onion, eggplant)	5) Fruit tree cultivation 6) Vegetable cultivation 7) Rabbit rearing 8) Pineapple cultivation 9) Sweet water fish culture 10) Cultivation of manioc and maize	carrot, cabbage) 2) Pineapple cultivation 3) Bee keeping 4) Improved goat rearing
		<p>Proposed by the Study Team: Introduction of simple treatment of marshland water, solar cooker, introduction of biogas system, Construction of publicly managed rainwater storage installation etc.</p> <p>Note: Layers rearing suffers from the issue of bird influenza. Maize millers have been run on a commercial basis and needs of avoiding competition. No hatching pond is available in neighborhood for sweet water fish culture and a project by another donor already introduced cassava and maize cropping promotion. Hence, these components are not dealt with in this Project.</p>			
March 2007	Explanation to and consultation with the domestic supporting committee	<ul style="list-style-type: none"> The Study Team explained to and consulted with the domestic supporting committee on the proposed project components as a result of consultation made in the field study with the above-mentioned stakeholders and the committee agreed on what the Team had proposed. 			
May to June 2007	Explanation to / consultation with Sectors and Cells concerned, reaching final decision (at Ntarama Sector)	<ul style="list-style-type: none"> The Study Team explained project components as agreed on the above-cited committee to Ntarama Sector and consulted with these components, finally reaching an agreement. In this consultation, the following items underwent alteration as follows: <ul style="list-style-type: none"> <u>Marshland Agricultural Development Project</u> Out of the scheduled 3 sites, Nyirabahanga marshland (located in Kibungo Cell) and Cyato-Gatoro marshland (in Cyugaro Cell) were excluded from the view points of soil and environment, and finally only Muzi-Cyeru (Kanzenze Cell) was selected. <u>Hilly Terrain Agricultural Development Project</u> Out of the planned 44 sites for project implementation, 22 sites were chosen as the project sites taking their topography, engineering soil property, state of hinterland watershed (one site per each Umutugudu). <u>Livelihoods Improvement Project</u> An ardent request was made from Ntarama Sector to deal with (introduction of fruits and cooking banana cultivation from food security point of view in place of (introducing fruit cultivation) and (introducing improved goat variety). The Team consulted on this request with the related Cell and Umutugudu, and agreed on this request. 			

6.3 Implementation Plan

(1) Size of the Project and Expected Effects

Size of the project and expected effects of the decided PP are given in the following table. The scale of the facilities accompanying with the construction works such as trial plots for paddy testing and farm ponds was determined making the design of their facility structures as simple as possible so that the inhabitants themselves can construct, maintain and manage them even after the termination of PP. Also, as mentioned in 6.1, a study tour to the sites of PP was programmed covering Sectors where PPs were not implemented, taking into account of exceeding importance of acquiring capacity of self effort-oriented project management system as well of “from spot to an area” deployment of the project for agricultural and rural community development in Bugesera District.

Table 6.3.1 Quantities of components of PP

Project component	Scale/ Quantity of the component	Expected effects/ concerned organizations
1- Improved Rice Seed Multiplication and Dissemination Project	Multiplication and dissemination of improved rice seed in 3 ha of existing paddy field	Increased food production, soil conservation, improved farming/ improved post-harvest techniques
2- Marshland Agricultural Development Project	Reclamation of 1ha (1 site) of new paddy land	Introducing farming/ improved post-harvest techniques, Increased food production
3- Hilly Terrain Agricultural Development Project	Construction of farm ponds in sites (1 pond/Umudugudu)	Improved livelihood, promoting better living, soil conservation, collaborated practices by Umuganda
4- Livelihood Improvement Project <ul style="list-style-type: none"> ▪ Vegetable cultivation ▪ Rabbit rearing ▪ Bee keeping ▪ Pineapple cultivation ▪ Fruits & cooking banana cultivation ▪ Simple treatment of marshland water ▪ Solar Cooker 	1,000m ² per Cell, total area 3,000m ² 48 rabbits in Kanzenze Cell in Cyugaro and Kibungo Cells (3AS) Each 1 ha for Kanzenze & Kibungo Cells, total: 2 ha 1ha for each Cell, total area: 3ha 3 sites for each Cell, total sites: 9 4 villagers per Umudugudu, total: 88villagers	Promoting improved livelihood, better living Making use of ISAR Karama experiment station
5- Follow-up project for QP <ul style="list-style-type: none"> ▪ Monitoring/ evaluation ▪ Repairing established facilities 	One set	Promoting improved livelihood, better living
6- Study tour	<ul style="list-style-type: none"> ▪ Visit to project sites in QP and PP by the representatives of the former 3 Districts ▪ Mutual study tour within PP project sites 	Enlightenment/ extension

(2) Project Cost

Project cost was roughly estimated for six project components as shown in the above table separating into three categories, i.e., i) hardware component, ii) software component and iii) provision of equipment supply. The construction cost was estimated at about 223,000US\$.

(3) Implementation System

Many Umudugudu inhabitants participated as working staff of people’s construction in the construction of paddy test plots for marshland agricultural development project and the works of hilly terrain agricultural development project. Similarly, cooperative staff of Corinyaburiba took part in

improved rice seed multiplication and dissemination project. The representatives of Ntarama Sector and three Cells as well as those of Corinyaburiba Cooperative mainly managed the plan of mobilizing these working staff and cooperative members. (System framework of implementing the above-cited three component projects is attached in the Annex VI.6.3.1.)

(4) Implementation Schedule

The implementation of PP started since May 2007, after formulating project implementation plan and completed in October 2008, 1.5 years after the initiation thereof (refer to the following table) .

Table 6.3.2 Plan of Operation of PP

Content	Year/Month	Phase II																								
		2007												2008										2009		
		5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2			
4th to 5th Fieldwork																										
(1)	Explanation/discussion on IIR(2)																									
(2)	Implementation & Monitoring of PP																									
a)	Improved Rice Seed Multiplication & Dissemination																									
b)	Marshland Agricultural Development Project including NERICA																									
c)	Hilly Terrain Agricultural Development Project																									
d)	Livelihood Improvement Project																									
i)	Vegetable cultivation 1,000m ² /Cell																									
ii)	Rabbit rearing 16 Beneficiaries																									
iii)	Bee keeping 33 Beneficiaries (3 AS)																									
iv)	Pineapple cultivation 200 Beneficiaries (160																									
v)	Fruit & cooking banana cultivation 10 Beneficiaries																									
vi)	Simple treatment of marshland water 5sets/Cell																									
vii)	Solar cooker 71sets at 3 Cells																									
(3)	Study tour																									
(4)	Monitoring & follow-up of QP																									
i)	Modern cow distribution (18 model farmers)																									
ii)	Rainwater storage installation (103 nos.)																									
iii)	Shallow well irrigation (19 places)																									
iv)	Road side irrigation (23 places)																									
(5)	Dissemination & Publication Activity																									
(6)	Technology Transfer Seminar																									
(7)	Study on CDF Activities																									
(8)	Final Evaluation on QP & PP																									
(9)	Preparation/discussion on PR(3)																									
3rd Homework																										
(10)	Preparation on Draft Final Report (DfR)																									
(11)	Review/revise on DfR																									
6th Fieldwork																										
(12)	Explanation/discussion on DfR																									
(13)	Submission of Final Report																									

▽ Workshop, Meeting, etc ▩ Preparation ■ Civil Work Ongoing

6.4 Improved Rice Seed Production and Dissemination Project

6.4.1 Background and Objectives of the Project

(1) Background of the Project

The Nyaburiba marshland is located in the ex-Ngenda district, one of the six major rice production marshlands comprising of Ruvubu, Gatere, Kirufura, Nyaburiba, Kibaza and Rwabikwano, and where is accounted for around 418 ha paddy fields. The said marshland was selected based on relatively stable condition of irrigation water source through the year with active farmer's group organized into

Corinyaburiba cooperative comprising of 524 members, and cultivated with 52 ha of paddy fields including of non-reclaimed 10 ha.

The farming system in the Nyaburiba marshland consists of the hilly terrain and the lowland farming throughout the year. In the lowland, rice double cropping system is managed by using spring water as irrigation source throughout the year. On the other hand, crop diversification on the both side hilly terrains is well developed including cereal, tuber, vegetables and some fruit crops throughout the year. A typical cropping pattern in the Nyaburiba Marshland is shown the figure.

In the hilly terrain farming, the short matured crops like haricot bean, sweet potato and maize are double cropped based on bimodal rainy season (A and B seasons), while long matured crop such as sorghum and cassava are planted once a year.

The farming in the hilly terrain where sandy soils are well expanded causes soil erosion during the rainy season, and which affects the irrigation canal and the paddy fields through siltation. On the other hand, rice farming in the marshland faces chronic issues like degeneration of rice variety because of no supply channel of improved rice varieties from out side, and a poor quality of rice has loosened competition combined with improper farming practice. In order to regenerate rice farming system in Nyaburiba Marshland, an introduction of new varieties combined with seed multiplication scheme is indispensable.

(2) Objectives

The pilot project is aimed at multiplying the improved rice seeds of the three promising varieties combined with improved farming practice focused on seed production in order to disseminate not only Nyaburiba but also other rice farming area of the marshlands existing in the ex-Ngenda District.

6.4.2 Plan of Operations and Results

(1) Schedule of the Project Implementation

The implementation schedule of the Project is shown as below figure, and the field survey was phased out by completing the two rice cropping and undertaking of the 3rd rice crop.

2007 -08 FY IP Schedule of Improved Rice Seed Multiplication and Dissemination PP

Activity	2007 FY												2008 FY											
	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12			
1 Kick off workshop			■																					
2 1st Seed multiplication				■	■	■	■	■	■	■	■	■												
3 2nd Seed multiplication							1				■	■	■	■	■	■	■	■	■	■	■			
4 Mid-term evaluation WS											■		2											
5 3rd Seed multiplication																	■	■	■	■	■			
6 Study Tour							■									■								
7 Monitoring and Evaluation				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■			
8 Final Evaluation Workshop																			■	3				

Below is a summary of the progress of project activities over the three paddy rice cropping. (See Annex VI.6.4.1-4 for details.)

(2) Results

1) Implementation Framework and the Beneficiary Farmers

In accordance with the resolution made at the kick-off workshop held on June 25-6, 2007, JICA study team hired the two full-time local agronomists (hereinafter refers to Agronomists) from early July, 2007. The two agronomists play a role of technical assistants for the JICA Study Team and play an important role as an interface between JICA team and the 60 beneficiary farmers headed by the president of Corinyaburiba cooperative as well as between the said president and the said beneficiaries.

On the other hand, plot size of the beneficiary farms ranged from 370 m² to 870 m², totally amounted to 3.18 ha.

Table 6.4.1 Cadastre Data of Seed Production Plots

Site location		Sub total (m ²)	No of Beneficiaries
1	Upper	10,379	20
2	Middle	11,522	20
3	Lower	9,722	20
Total		31,773	60



Leveling operation by using T-shape tool

2) Preparation of Paddy Nursery Beds

Around 400 - 500 m² plot was provided by rice variety, and which was equipped with 1 m - width rectangular beds for nursery. Each rectangular bed was made by hoe and T-shape leveling tools which was newly introduced in this pilot project.

3) Variety selection, Seed Treatment, Sowing on nursery and Roguing Operation

(a) Variety Selection

The three promising rice varieties supplied by ISAR are all late maturing variety with 160 days and explained as tolerant to blast disease. These three varieties were allocated to the upper, middle and lower site for sowing on nursery in the first rice cropping. In the 2nd rice cropping, the beneficiary farmers selected Gakire and Intisinze by making a point of its yielding ability. Meanwhile in the 3rd rice cropping, the most tolerant variety against disease, Insindagirabigega was selected among the three over the 3 sites beneficiaries (see below Table).

Table 6.4.2 Change of Variety Selection over the 3 Cropping Seasons

Variety		1st crop (7-12/07)			2nd crop(1-6/08)			3rd crop(7-12/08)		
		upper	middle	Lower	Upper	middle	Lower	Upper	Middle	Lower
1	Gakire					●	●			
2	Insindagirabigega		●					●	●	●
3	Intsinzi	●			●					

Source: JICA Study Team, August, 2008.

(b) Seed Treatment

Sowing nursery bed in the first rice cropping was based on the lecture (seed treatment) given by RADA staff at the kick off workshop as below table. However, insufficient moisture during the

incubating seeds process resulted in poor pregermination and delayed emergence after sowing.

Table 6.4.3 Seed Treatment Process prior to Sowing on Nursery Beds

Date	Treatment	Outline
July 4th, 2007	Seed Dressing	Seeds bag was soaked in Kitazine solution for 24 hours. Kitazine solution was made with 300 ml Kitazine in 30 liters water.
July 5th, 2007	Seed soaking /Incubation	Seeds bag was incubated by splashing water every 3 hours from outside after removed from the solution for 24 hours.

Source: JICA Study Team, July 2007.

In the 2nd rice cropping, the seeds which were harvested 3 weeks before were used and appeared not to be broken with dormancy period, thus seed treatment of 24 hour-soaking with 72 days incubation resulted in 10 - 70 % of pregermination rate. Meanwhile, two day- seed treatment with 3 days incubation by the local farmers resulted in 100 % pregermination. Thus breaking seed dormancy for the seeds just after harvest is possible to break for this method. For the 3rd rice cropping season, sowing on nursery was done with seed treatment of 48 hours seed treatment and 2-5 days incubation by observing progress of incubation.

(c) Roguing Operation

The first roguing operation (elimination of off-type) was done over the three nursery plots on July 25th in combination with weeding, and the 2nd roguing operation was applied only to the middle and upper site plots on July 31 except for the lower site because of negligible contamination. The roguing operation was easily applied to the upper and lower nursery plots because of clear morphological differences between introduced varieties and off-type in terms of leaf sheath color. However, the middle site nursery met some difficulties because of no typical morphological differences amongst off-type and the variety. The second operation was carried out during the second half of August in combination with weeding together after transplanting.

Roguing operation was practiced twice over the 3 rice cropping during the nursery period together with weeding. Roguing operation was easily applied to Gakire and Intisinzi varieties because of leaf sheath color differences between off-type and two varieties, but Insindabiragigega met some difficulty because of no typical difference about morphology with off-type. However, this rouging operation is practiced by different growth stage such as tillering, heading, flowering and ripening stages, thus it is possible to manage.

4) Transplanting Ceremony

The proposed farming practice for transplanting by the JICA Study Team was summarized as below.

- | |
|--|
| <ul style="list-style-type: none"> - One seedling/hill - Planting Distance : 30 cm between lines and 15 cm between hills - Well leveled paddy plots by using hoe and T-shape leveling tools |
|--|

The transplanting ceremony was held on August 1, 2007 at the 4 demonstration plots of the middle and lower sites with having around 100 participation including the beneficiary farmers, NGO, mass media, JICA Rwanda office staff and etc. This transplanting ceremony was on air on the same day

countrywide. Following to the demonstration of transplanting ceremony, each beneficiary farmer embarked on its operation and completed by August 13 over the 3 ha of the seed production plots.

5) Basal dressing, water management, weeding and rooting condition

Basal dressing was applied just after transplanting at rate of NPK elements, 39.4 kg/ha each with whole amount of PK as surface application method. Water management was directed to keep a certain water depth for a week just after transplanting. However, many plots were observed in drained condition. Many reasons were brought such as waterfowl landing on plots and damaging seedlings or deep water killing seedlings, etc. The beneficiaries seemed to have some prejudice of water management. Thus it is necessary for them to formulate an optimum water management method even though a plot to plot irrigation method is limited to water management system.

Lack of irrigation water occurs every year during the July - August in the dry season caused by severe water competition between vegetable growers in the hilly side and rice farmer. To solve this problem, Corinyaburiba Coop decided to introduce a rotational irrigation method at the general assembly meeting. In this irrigation method, seed production plots were scheduled to be irrigated for two days in the morning and non-seed plot for two days in the afternoon under scarce water regime. If water is available freely, no rotational irrigation method is applied except for morning and afternoon rotation (see below Table).

Table 6.4.4 Water Management Plan

No	Site	Time	User	
1	Upper	2 days	AM	A
			PM	B
2	Middle	2 days	AM	A
			PM	B
3	Lower	2 days	AM	A
			PM	B

Note: A refers to PP beneficiary farmers. B refers to non PP beneficiary farmers.



Weeding operation by using rotary weeder



Uneven growth condition

The first weeding operation was done by 60 units of the rotary weeder (see the above left photo), manufactured by KIST workshop and delivered to the 60 beneficiary farmers in the 3 associations. The participants appreciated its efficiency. Progress of rooting after transplanting showed uneven growth clearly such as vigorous plant and poor plant within a plot, and which was assumed to be caused by transplanting injury, improper transplanting depth, uneven leveling and imbalance of soil nutrients (see the above right photo).

6) Progress of Official Formalities of Registration of Seed Grower

In order to involve the pilot project in official seed production channel, JICA Study Team discussed an official formality with Director of the Seed Unit in RADA late June, 2007. As a result, it proved no one was allowed as an official seed grower unless he/she registered itself to RADA seed grower list by submitting application letter. A flow of official formalities to RADA is as below. Based on

the official process, Corinyaburiba coop proceeded the application formality and was registered as the 2nd seed growing cooperative on July 23, 2007 in the country.

- Submission of application letter from Corinyaburiba to RADA
- RADA inspector checks the seed multiplication plots based on its requirement.
- Registration officially is done if the seed production plots meet the requirements by RADA.
- Declaration of multiplying seeds about variety, acreage, fundamental farming practices for seed production to RADA.
- At least RADA inspector visits and examines the seed multiplication plots more than three times in terms of isolation of the seed plots from other variety, contamination of off-type, and outbreak of disease and insect damage during the growing stage.
- Declaration of seed production after harvesting and submission of seed samples to RADA.
- In the seed test, RADA shall check moisture content, purity of seeds, germination rate and infection of disease
- RADA shall issue the certificate to the produced seeds if meeting the requirements

7) Study Tour

Study tour was carried out one time per each 3rd year and 4th year during the project implementation. Each study tour was summarized as follow. (See Annex VI.6.4.5 for details.)

(a) CODERVAM Rice Cooperative in Nyagatare, Eastern Province

On September 6th, 2007, around 80 participants including the 60 beneficiaries of JICA PP, Ruhuha/Nyarugenge Sector, relevant Cell officers and JICA Study Team visited CODERVAM. Program of the study tour consisted of briefing of CODERVAM, discussion of key issues including institutional aspect of cooperative organization, and site visiting including rice mill, and paddy fields. The study tour brought them fruitful results via active discussion.

(b) Bugarama Rice Cooperative, Rusinzi District in Western Province

Corinyaburiba coop 16 members headed by Ruhuha Sector head carried out a study tour to Bugarama Rice Cooperative (CPRB) on July 28-29, 2008. In this study tour, the Coop party collected necessary information about sophisticated rice milling machine and local rice farming system in Bugarama.

Table 6.4.5 Profile of Bugarama Rice Cooperative

Survey Item	Outline
CPRB	<ul style="list-style-type: none"> • The Coop command area consists of 3 Sectors (Bugarama, Muganza, Nyakabuye), and rice cultivated area amounted to 1,405ha. • Rice farming began since 1940 and 7 agronomists are engaged in the Coop at present, and reached to 7 t/ha in paddy yield. • The Coop activity consists of rice cultivation, rice milling and sale of Bugarama rice. • Rice varieties for cultivation: <ul style="list-style-type: none"> ▪ Insindabiragigega: 80% of total rice production (25*25cmPlanting space), yield: 8t/ha, Selling price of polished rice:580Rwf/kg ▪ Siffara (6 months maturity), Yield: 4.5t/ha, Selling price of polished rice :650Rwf/kg ▪ Basmati (3months maturity), Yield: 4-5t/ha, Selling price of polished rice:1,100Rwf/kg ▪ NERICA No.9 (3months maturity), Yield:6t/ha, Selling price of polished rice:1,000 Rwf/kg
Rice Milling Factory	<ul style="list-style-type: none"> • Rice milling machine:Zacckariya Zx25, 1,200 kg/hour milling capacity • Price: 3,600 Rwf, installed in 2005 under finance support by MINAGRI • Separator function is equipped such as stone, and 4 different grain size like 100, 75, 50, 25% of Full Grain. • 7 full-time staff are engaged in the factory for O&M work.

Survey Item	Outline
	<ul style="list-style-type: none"> Storage capacity is 200 t for accommodation of paddy, seeds and agro-chemicals, while stock management with input procurement are handled by Caritas NGO.

8) Construction of Concrete Drying Yard and Storage

Construction site for drying yard and storage was finalized by Corinyaburiba Coop at left side of slope in the South access road to the marshland, and 1,400 m² for construction site was purchased by the Corinyaburiba Cooperatives via negotiation. Construction work was divided into two phases and 540 m² of drying yard was constructed in 2007FY, and the rest 270 m² was in 2008 FY. (See Annex VI.6.4.6 for details.) Meanwhile, the Corinyaburiba Cooperatives requested a 30 m² floor of the storage but due to JICA budget constraints, the JICA Study Team requested their cost sharing and got agreement with the Coop by sharing 241,000 Rwf from JICA and the rest shared by the Coop. However, the construction work was disturbed by a lack of funds shared by the Corinyaburiba Coop, thus the rest of construction work was born by the JICA Study Team.



9) Yield Survey and Yield Component Analysis

The seed multiplication plots in the 1st rice crop were fallen into ripening stage from around December 20. Gakire variety appeared to be shattering type and showed high shattering habitat when panicle was drawn through hand. The beneficiary farmers considered harvesting operation would start from early January 2008 till all panicles reached to ripening. However, JICA Study Team instructed them to initiate harvest operation at once because of ongoing shattering habitat, and then the beneficiary farmers began to harvest paddy from December 24, 2007. Meanwhile, quadrant sampling survey was practiced prior to harvesting operation by selecting 3 representative plots over the upper, middle and lower sites.

This yield survey was conducted by analyzing both yield and yield components. The 2nd rice crop was analyzed on July 7, 2008 with the same method of the 1st rice crop. The result of analysis is as follows.

Table 6.4.6 The Result of Yield and Yield Component Analysis

Variety	Site	Culm Length		Panicle Wt (gm)	Yield Components/3 panicles					Yield/ha (kg) 21 hills	Total harvested Yield/ each site (kg)	NO OF Panicles / m ²	Area (m ²)	
		Cm	±SD		No of Hills/m ²	No of Panicles /hill	No of Spikelets /panicle	1000 Grains Wt (gm)	% of Ripened Grains					Yield/ha (kg)
Intsinzi/SB	Upper	50.7	5.9	4.3	18.4	13.1	192.0	23.8	68.4	5,860.2	7,530	8,150	290.8	10,379
Intsinzi/SA	Upper	47.4	4.7	3.3	17.3	12.6	166.3	24.0	70.4	5,514.0	6,395	5,740	218.0	
Insindagi ragigega/SA	Middle	85.4	13.7	6.2	17.7	8.3	218.3	30.0	83.1	3,650.0	6,237	6,200	184.3	11,522
Gakire/SB	Middle	46.2	7.9	3.9	19.6	14.2	181.3	23.4	74.8	7,394.5	7,297	8,800	315.2	11,522
Gakire/SB	Lower	55.1	5.7	3.4	17.8	13.2	174.7	21.7	75.0	5,942.7	8,142	9,300	293.0	9,872
Gakire/SA	Lower	50.5	1.6	3.9	19.5	12.0	207.0	22.8	83.5	5,756.0	6,181	8,755	234.0	31,773

Source: JICA Study Team, Jul., 2008, Remark: SA refers to Season A (July-Dec/2007), SB refers to Season B (Jan-Jun/2008)

Paddy yield increased from the 1st crop to the 2nd crop in terms of the quadrant sampling as well as the total harvest of each seed multiplication plots. The paddy weight of the total harvest in the 1st crop ranged from 5.7 t/ha to 8.7 t/ha, however, the 2nd crop resulted in 8.1 - 9.3 t/ha. Percentage of ripening grain decreased 2-8 % compared with the 1st one but the number of panicles per hill slightly increased together with 25 -30 % increase of number of panicles per m². However, maturity of rice plants appears not to reach uniformly thus harvesting work operated till early August.

10) Harvesting Operation and Post Harvest Practice

Harvesting operation was practiced from December 24 to January 8, 2008. Sun-drying practice was conducted on the newly constructed concrete drying yard (540m²) and required around two days in order to decrease grain moisture content (GMC) from 20-25 % just after reaping condition to suitable GMC of 14 % by measuring GMC with a grain moisture meter.

To avoid uneven dryness of grains, the beneficiaries were guided to spread paddy grains on concrete drying yard with 3 cm thickness and turn over them every one hour.



Threshing Operation



Winnowing operation



Spreading paddy on concrete drying yard with around 3 cm thicknesses and is turned over every one hour to dry up uniformly up to 13 % GMC.

11) Midterm and Final Evaluation Workshop

The mid-term workshop was held on February 4th, 2008 under 77 participants followed by completion of the 1st rice crop harvest. The WS aimed at feeding the 1st rice crop result including monitoring of beneficiary's farming practice back into them in order to plan further improvement of beneficiary's farming practice. The final evaluation workshop was held on September 4th, 2008 to discuss the several topics as below. (See Annex VI.6.4.7-10 for details.)

- Feed back of beneficiary's performance about seed on the 1st and 2nd multiplication farming based on the "technical guideline of improved rice seed production/final version".
- Lecture on seed multiplication practice and discussion by AFSR staff
- Prospect of post-development study
- Evaluation of the seed multiplication project by the participants

12) Soil Survey

Soil survey in both Nyaburiba and Muzi Cyeru was carried out on late June, 2007 and which

included 12 soil samplings and 4 soil-pits observation (Nyaburiba: 3 pits, Muzi Cyeru: 1 site).

Soil samples were submitted to the soil lab of ISAR, Butare on early July, 2007.

The diagnosis results based on the analysis norm (Methodes selectionnees pour l'analyse du sol en appinational'ISAR 2001) indicated that Nyaburiba soils were generally extremely low level of P and K level. P and K play important roles on rice plant growth in terms of tillering, root development, grain weight, percentage of full grains, lodging, poor resistance of disease/insect attack, and so on. Thus fertilizer program should be reconsidered so as to balance deficient elements like P and K by incorporating rice straw or alternative materials. On the other hand, Muzi Cyeru soils were generally no specific problem except for low available P level, and need to consider rice straw incorporation to soil so as to build P level. (See Annex VI.6.4.11 for details.)

13) Traditional Rice Farming Practice by the Existing Associations

The baseline survey was conducted to collect basic information. (See Annex VI.6.4.12 for details.)

The sample surveyed households consist of the three associations from upper, middle and lower stream in the Nyaburiba marshland. Each association comprises 42 - 75 members established during 1995 to 1998. An entrance fee for the association ranges from 21,500 to 35,000 Rwf. As for farmland, farm plot in the hilly terrain is borrowed from various land owners but usufruct of Nyaburiba marshland is permitted by the Sector Office for rice cultivation. Lease period usually ranges from 1 to 3 years. As for revenue of association, there is no regular income except for crop sharing among the members. On the other hand, activity cost for the association is based on annual membership fee, which could be used for procurement of agricultural tools, seeds, agro chemicals and parcel rent. Rice farming practice by Association is summarized as below table.

Table 6.4.7 Traditional Rice Farming Practice

No.	Outline of Rice Farming	Results
1	<i>Rice varieties</i>	<ul style="list-style-type: none"> - Yun keng 136 and Mutara are the two rice varieties commonly cultivated. Those varieties have been introduced by the MINAGRI. - The first annual rice season begins from January up to June, while the second covers the period of July-December. - Sowing period covers two months, and is respectively December-January for the first annual rice season and June-July for the second annual rice season
2	<i>Plot Size</i>	Plot size varies among the farmers from 1 to 20 ares, on average of 7 ares per household. It was very difficult to grasp an accurate data because of no metrology concept among the rural community. That weakness noted about metrology concept among the farmers is not only common in Ruhuha Sector, but also in the whole Rwandan rural area. Thus, some of the interviewed household heads replied rough estimation about their land size
3	<i>Nursery bed</i>	<ul style="list-style-type: none"> -All nursery beds are practically established at paddy. Their average area was about 50 m². - Seeds were soaked so as to get pre-germinated seeds. - No chemicals were dressed just after transplanting
4	<i>Land preparation</i>	<ul style="list-style-type: none"> -This activity is done with hoes - Interviewed farmers declared that during land preparation, there is enough water
5	<i>Transplanting</i>	Transplanting was done during January-February for the first annual rice season, while it was in July-August for the second annual rice season on space of 20 cm x (10-20) cm, with over than seven seedlings per hill.

No.	Outline of Rice Farming	Results
6	<i>Fertilizers</i>	<ul style="list-style-type: none"> - Manure was not applied. - NPK (17/17/17) was dressed just after transplanting, in a rate of 7 to 36 kg per household per year, on average of 18 kg per household per year. It means that farmers apply an average rate of 129 kg/ha per season. This rate is lower than that of MINAGRI which recommends 250 kg/ha per season. - Urea was dressed 30 to 60 days after transplanting, in a rate of 3 to 24 kg per household per year, on average of 10 kg per household per year. It means that farmers apply 72 kg/ha per season on average. This rate is lightly less than that of the MINAGRI recommendation of 100 kg/ha/season.
7	<i>Water management</i>	<ul style="list-style-type: none"> - 50% of farmers declared no problem in water management. - 36% declared water management some times problem. - 14% declared problem of water management.
8	<i>Weeding</i>	Weeding is done 3 times (30 th , 60 th and 90 th days)
9	<i>Harvesting</i>	<ul style="list-style-type: none"> - Harvest operation is done when the grains color at the tip of the panicles are hard and golden yellow. - 57% of farmers used sickles in rice reaping. - 43% of farmers used other methods (such as saws) in rice reaping
10	<i>Threshing & drying</i>	<ul style="list-style-type: none"> - Farmers used conventional method in rice threshing by carefully beating rice bundles with a stick and drying under sunlight on mats - Drying time was ranged from 2 to 5 days, on average of 3 days. - Farmers dried paddy rice on sheet
11	<i>Transporting</i>	<ul style="list-style-type: none"> - 93% of farmers transported rice on their head. - While only 7% of farmers transported rice by bicycle
12	<i>Yield/producti on</i>	<ul style="list-style-type: none"> - In the first annual rice season (A season), production was ranged from 200 to 1,000 kg, on average of 468 kg per household. By using production and plot size given, an average yield was estimated to 3,343 kg/ha per season, a reasonable yield according to the MINAGRI reports. - In the second annual rice season (B season), yield was ranged from 270 to 1,150 kg, on average of 527 kg. By using production and plot size given, an average yield was 3,764 kg/ha per season, a reasonable yield according to the MINAGRI reports. <p>The 2nd cropping was higher than the first, mainly because of long rainy season.</p>
13	<i>Pest & disease</i>	<ul style="list-style-type: none"> -100% of the farmers perceived significant pest, disease and bird damages, but they could not quantify its extent of damages. -58% of the farmers sprayed pesticide while 42% of them did not spray any.
14	<i>Marketing of Paddy</i>	<ul style="list-style-type: none"> - The place of selling paddy is Abahujumugambi Cooperatives, - The selling price is made by the Cooperative.

Source: Interview Survey Results by JICA Study Team, 2007

6.4.3 Monitoring and Evaluation

Improved rice seed multiplication and dissemination project has been launched in Nyaburiba Marshland in Ruhuha Sector since July 2007 as targeting of the Corinyaburiba Coop. The first cropping (A season) was made from July, 2007 to January 2008, and the 2nd cropping (B season) started from late January 2008 and completed late July 2008. Meanwhile, the baseline survey conducted on August, 2007 was aimed at analyzing of production constraints on rice production in Nyaburiba Marshland and extracting necessary parameter to evaluate project effect as well as some basic information. This monitoring survey to evaluate project effect was focused on rice farming and institutional aspect of Corinyaburiba Coop. The monitoring result was fed back to the all beneficiary farmers and Cell/Sector's personnel concerned, and contents of overall discussion on the final evaluation workshop was summarized as below.

(1) Objectives

Following to the baseline survey on the pilot project, this survey is aimed at evaluating a project effect as of completion of two rice cropping season by focusing on rice farming.

(2) Method

The survey on project effect evaluation consists of the five survey items.

Table 6.4.8 Survey Outline

	Survey Items	Contents
1	General	Family aspect, decision making, meal, staple food
2	Income	Income (July-07 to June-08) by Rice and by Season,
3	Expenditure	Expenditure (July-07 to June-08) by agricultural input and hired labor for rice
4	Recommended Rice Farming Practice in Nyaburiba Marshland	Seed quality, Seed rate, seed treatment, nursery bed, land preparation, planting density, No of seedlings per hill, fertilizer, pest & disease, rouging, weeding, threshing, winnowing, drying paddy, yield, sale amount of paddy
5	Others	Soil erosion, Flood damage

The sampling farm households and its numbers are same as the last baseline survey. In this time, one of the sampling farmers in the lower site was delineated due to violation of the Coop internal law, thus total interview farm household amounted to 14. Interview survey was made by a local consultant and agronomist employed by JICA Study Team under guidance of the said Team, and summarized by JICA Study Team.

Table 6.4.9 No of Sampling Beneficiary Farmers

	Association site	No of households	Sampling Households	Ratio
1	Upper	20	5	25%
2	Middle	20	5	25%
3	Lower	20	4	20 %
	Total	60	14	23.3%

(3) Results

1) Target Beneficiaries

In this survey, the same question was studied so as to grasp some change of family composition from the baseline survey. Table below shows a situation of the target beneficiary.

(a) Family

Target beneficiary ranges from 26 to 59 years olds, and average age of 40.5 year old. An average family size is 5.4 members, and 2.4 members of household are engaged in agricultural activity. Among the 14 households, half of them were grown up indigenously and the remainder immigrated from outside from sixties to early eighties of the nineteenth century.

(b) Decision making of economic activity in household

64 % of decision making on farming activity is made by council system of couple, and 14 % was either husband or wife alone. 43 % of decision making of family food mater is dominantly

controlled by wife solely and 50 % by council system of couple.

(c) Ingesting of meal per day

Frequency of meal intake per day is 2.3 times and not different from the result of the baseline survey. Breakdown of this habitat consists of dominantly two times per day such as lunch and dinner without taking breakfast. Two interviewees replied three times per day by season. Change by season appears to be generally linked with harvesting season of cassava, maize and rice

(d) Staple food crop

Generally indigested grain and tuber crops in the Nyaburiba marshland area consists of the seven crops such as sorghum, maize, haricot bean, banana, cassava, sweet potato, rice and vegetables (tomato, eggplant, cabbage and onion) cultivated in the dry season. Vegetables are included in the Cell No.8 Others in the above Table. The most ingested food crops through a year is rice, 83 %, haricot bean 81 %, sweet potato 55%, banana and cassava 48%, maize 29 %, and sorghum 5 % respectively. Thus, rice and haricot bean are staple food crops in Nyaburiba through a year.

2) Income

Below table shows a compiled data about harvest and gross income by rice production with and without the project. The survey result was compiled based on the beneficiary's memory, and as well as influenced by techniques of enumerator's interview, thus the result is not always consistent. Therefore, the following operation and interpretation were imposed as precondition.

- Concerning yield increment, paddy yield of the B season by local method is used as a index of without project
- Only the B season of sale amount of paddy by local method was available and used as index without project.
- Plot area by each target farmer is not even, thus amount of harvest was used for index of comparison.

(a) Yield Increment

The paddy yield with project in the season A uniformly has increased by 120 % - 201.7 % compared with that of local method. On the other hand, only one beneficiary in the B season decreased in paddy yield but the remainder 13 beneficiaries has increased by 113.5 % - 227.8%. There were some farmers who replied to interview by including paddy yield in the non JICA seed plots. Excepting these farmers' case, yield increment ranged from 50 kg to 350 kg per household. (See Annex VI.6.4.13 for details.)

(b) Increase of Sale Amount

The beneficiary farmer generally sells the surplus paddy to Corinyaburiba Coop excepting own consumption and seeds for next year. Some farmer among the beneficiaries sold all harvest in the

seed plot. This is common when the beneficiary keeps other paddy fields with JICA seed plot or married couples belong to different association individually and hold usufruct in the marshland. Including beneficiaries who summed whole paddy yield including non JICA seed plots, an increment per household ranged from 230 kg to 950 kg in the A season, while harvest amount in the B season ranged from 292 kg to 1,200 kg per beneficiary farmer, which has increased by 60 to 700 kg per beneficiary compared with that of without project.

(c) Gross income

Below table shows a comparison of gross income between with project and without project (as of the baseline survey).

Table 6.4.10 Gross Income of Rice before and after JICA PP

6 Aug 08

Site	Name of the Household Head	Total (Rwf) in JICA Method				Total (Rwf) in Local method			Increase(%) (1)/(2) *100
		Season	Sale Price	Sale (Kg) (JICA)	Total (1) (Rwf)	Season A	Season B	Total (2)	
Upper Site	Nzeyimana André	A/JICA	220	640	252,300	140,000	75,000	215,000	117.3
		B/JICA	250	446					
	Simbikangwa J.Damasco	A/JICA	220	230	131,350	88,000	57,800	145,800	90.1
		B/JICA	250	323					
	Uwitonze Cécile	A/JICA	220	250	140,000	30,000	32,000	62,000	225.8
		B/JICA	250	340					
Kangabe Josée	A/JICA	220	263	130,860	22,500	28,800	51,300	255.1	
	B/JICA	250	292						
Mujyambere Mathias	A/JICA	220	600	232,000	126,000	80,000	206,000	112.6	
	B/JICA	250	400						
Middle Site	Dusabumuremyi Vianney	A/JICA	220	360	181,450	112,000	91,200	203,200	89.3
		B/JICA	250	409					
	Tuyisabe Valens	A/JICA	220	327	194,690	63,000	43,000	106,000	183.7
		B/JICA	250	491					
	Nzabonimana Pascal	A/JICA	220	336	185,420	60,000	48,000	108,000	171.7
		B/JICA	250	446					
Mukandutiye Odette	A/JICA	220	245	128,900	50,000	49,500	99,500	129.5	
	B/JICA	250	300						
Nyirakamana Betty	A/JICA	220	308	152,760	60,000	33,000	93,000	164.3	
	B/JICA	250	340						
Lower Site	Habimana Fidele	A/JICA	220	400	188,000	60,000	34,000	94,000	200.0
		B/JICA	250	400					
	Bimenyimana Elias	A/JICA	220	950	509,000	200,000	114,000	314,000	162.1
		B/JICA	250	1200					
	Mukanyarwaya Astérie	A/JICA	220	529	234,130	32,000	96,000	128,000	182.9
		B/JICA	250	471					
Ukwitegetse Josephine	A/JICA	220	330	160,100	60,000	45,000	105,000	152.5	
	B/JICA	250	350						
	Mean				201,497			137,914	146.1

Source: JICA Study Team, Aug., 2008

This gross income by paddy sale (A and B seasons) is not always consistent in terms of accuracy but a clear project effect is demonstrated. Compared a gross income in the baseline survey with the one with project, only two household decreased in gross income down to 0.9 but the all remainder has increased by 1.1 to 2.5 times. However, the two households are also confirmed to increase by 120 kg to 210 kg in paddy yield, thus an accuracy of the baseline survey might be questionable.

3) Expenditure

Production cost consists of seed, fertilizer, agro-chemicals, farming implements, transportation, and hired labor (plowing, leveling, transplanting, weeding, harvesting, water management, bird scarring, and water canal management). Below table summarized the paddy production cost of both A and B seasons from July 2007 to July 2008.

Accuracy is questioned due to the survey depending on the beneficiary's memory, but the input (seed, fertilizer, agro-chemicals) for the season A was supplied by JICA Study Team. Thus, the figure capitalized in the season A is the cost which the farmers spent for non-JICA seed plot.

Seed production plot is generally designed to 500 m²/beneficiary farmer but not equal size and ranges from 3 ares to 8 ares. Furthermore, there were some beneficiaries who had paddy plots out of the JICA seed plots. Thus some beneficiary appeared to reply to the question by including non JICA seed plots, and who capitalized cost in the Season A is the one. An average production cost per beneficiary farmer per year is around 65,000 Rwf. The production cost consists of hired labor cost 66%, and followed by fertilizer 24.4 %. For instance, hired labor charge is 500 Rwf per day.

Table 6.4.11 Production Cost of Rice Farming August 6, 2008

Site	Name of the Household Head	Season	Expenditure (A and B Season)						Grand Total
			Seed	Ferti	Chemical	Tool	Transp	Hired labor	
				G-total (Rwf)	Cypermeth (Rwf)	(Rwf)	(Rwf)	(Rwf)	
Upper Site	14 Nzeyimana André	A	0	10,360	320	2,500	3,900	31,750	88,540
		B	0	15,320	320			24,070	
	5 Simbikangwa J.Damascène	A	0			1,200	500	11,300	26,300
		B	0	3,050	300			9,950	
	7 Uwitonze Cécile	A	0			3,000	3,000	22,250	61,130
		B	510	6,280	440		1,700	23,950	
9 Kangabe Josée	A	0		200			14,250	35,325	
	B	525	5,600	200	0	300	14,250		
13 Mujoyambere Mathias	A		9,990	220	5,000	500	38,500	104,270	
	B	1,350	9,990	220			38,500		
Middle Site	1 Dusabumuremyi Vianney	A	0	6,200	510	6,500		33,650	101,870
		B	0	15,200	510			39,300	
	7 (Wife belongs to other associate)	A	2,450	21,200	220	9,100	500	48,080	151,020
		B		21,200	220			48,050	
	4 Nzabonimana Pascal	A		5,425	220		300	18,330	48,620
		B	400	5,425	220			18,300	
2 Mukandutiye Odette	A	0		550	2,400		2,800	25,900	
	B		11,200	550			6,000		
3 Nyirakamana Betty	A	0	7,200	200		300	15,130	50,180	
	B	1,050	7,200		4,000		15,100		
Lower Site	Gafaranga Gaspard	A							
		B							
	11 Habimana Fidèle	A	0				300	10,500	31,850
		B	800	7,510	440	1,800		10,500	
	10 Bimenyimana Elias	A	0	16,775	440		600	16,250	80,880
		B	1,050	16,775	440	12,300		16,250	
8 Mukanyarwaya Astérie	A	300	7,780	440		300	17,750	58,540	
	B	300	7,780	440	5,700		17,750		
6 Ukwitegetse Josephine	A				640	300	21,900	51,565	
	B	525	6,300				21,900		
Total			9,260	223,760	8,260	55,900	12,500	606,310	915,990
Mean									65,428
Percent (%)			1.0	24.4	0.9	6.1	1.4	66.2	100.0

Source: JICA Study Team, August 2008

4) Receptiveness of the introduced farming practice

In this pilot project, component of the farming technology for guidance in the paddy rice farming system is roughly classified into 14 components. Capacity of the beneficiaries to accept improved farming technology was monitored and evaluated by ranking two categories like a. to be continued and b. need to be improved. This monitoring result was fed back into the beneficiaries at the final evaluation workshop. (See Annex VI.6.4.14-15 for details.) Below table shows the monitoring results about receptiveness of each component technology and its reason.

Table 6.4.12 Receptiveness of the Introduced Farming Practice by the Beneficiary

No	Key practice	Local Method	Recommended practice	Receptiveness	Reason
1	Variety	4 varieties including short grain & long grain, regeneration is ongoing	ISAR supplied the 3 late matured varieties as basic seeds	1. Gakire 21.4 % 2. Intsinze: 42.9% 3. Insindagirabigega: 64.3 %	<ul style="list-style-type: none"> • High yielding variety • Tolerant to disease • Vigorous tillering • Long and big grain
2	Seed rate	300kg/ha for nursery	Sowing of 30kg seeds for ha	• 100% acceptance	<ul style="list-style-type: none"> • Economy, • High yielding • Vigorous tillering • Low outbreak of disease • Vigorous growth
3	Seed treatment	Only soaking	Treating of seeds with fungicide and soaking seed/hastening of germination	• 100% acceptance	<ul style="list-style-type: none"> • Prevention of disease • Even germination • Prevention of disease in nursery stage
4	Nursery	Nursery bed was made individually	Establishment of common nursery bed by variety, Application of NPK, Leveling bed by T-shape leveler	• 100% acceptance	<ul style="list-style-type: none"> • Synchronization of transplantation operation • Efficient management of nursery bed • Efficient use of Land/water
5	Plowing	Plowing and leveling by hoe	Plowing by hoe and leveling by T-shape leveler	• 100% acceptance	<ul style="list-style-type: none"> • Leveling operation is efficiently done by T-shape leveler. • Leveling is important so as to make water depth even
6	Planting density	20*20cm	• 30*15cm	• 100% acceptance	<ul style="list-style-type: none"> • Ample space for plant growth is available • Weeding is easy • Use of rotary weeder is easy • light-intercepting characteristic is proper. • Saving cost • Vigorous tillering • High yielding
7	No of seedlings/hill	7-10 seedling/hill	• One seedling/hill	• 100% acceptance	<ul style="list-style-type: none"> • Remarkable yield increase • Vigorous growing is possible • Saving of seeds • Vigorous tillering but increase of weeding work • Weeding with minimize cost

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No	Key practice	Local Method	Recommended practice	Receptiveness	Reason
8	Fertilizer application	<ul style="list-style-type: none"> Application of NPK 250 kg/ha 30 days after transplanting Application of Urea 200 kg/ha at booting stage 	<ul style="list-style-type: none"> Application of NPK240kg/ha at transplanting, Application of Urea 42 kg/ha 30 DAT Application of Urea42 kg/ha at meiosis stage 	<ul style="list-style-type: none"> 100% acceptance 	<ul style="list-style-type: none"> Vigorous growth and high yield Saving fertilizer dosage Vigorous tillering Decrease of empty grain Fertilizer application method is appropriate for rice growth (split application of basal and top dressing)
9	Pest and disease control	Nothing	<ul style="list-style-type: none"> Spraying of pesticide and fungicide on time 	<ul style="list-style-type: none"> 100% acceptance 	<ul style="list-style-type: none"> Mitigation of outbreak of pest/disease Yield increase
10	Roguing	Nothing	<ul style="list-style-type: none"> Roguing of 8 times made from nursery till ripening stage 	<ul style="list-style-type: none"> 100% acceptance 	<ul style="list-style-type: none"> Roguing is effective to keep pure variety Yield increase Improvement of quality Selling price was not seed price like food grain price and discouraged.
11	Weeding practice	Weeding 30, 60, and 90DAT	Weeding is done by rotary weeder and manual weeding by hand in combination with rouging operation	<ul style="list-style-type: none"> 100% acceptance 	<ul style="list-style-type: none"> Rotary weeder is very efficient. saving labor cost Vigorous tillering and yield increase Decrease of weed density <u>Increase of weeding cost</u>
12	Threshing	Beating rice bundle on log or banana stem on plastic sheet	<ul style="list-style-type: none"> Manual type thresher and plastic sheet 	<ul style="list-style-type: none"> 100% acceptance 	<ul style="list-style-type: none"> Very efficient Drastic decrease of labor force Very easy for old people Markedly efficient compared with local method Heavy and costing for transportation
13	Winnowing	Using "Urutaro"	<ul style="list-style-type: none"> Introduction of manual type winnowing machine 	<ul style="list-style-type: none"> 100% acceptance 	<ul style="list-style-type: none"> Very efficient Saving labor force Very efficient compared with local method Very heavy and costing for transportation Saving woman labor force
14	Drying paddy	Drying paddy on plastic sheet	Drying paddy on concrete drying yard with monitoring of grain moisture content by grain moisture meter (adjusting GMC to 13%)	<ul style="list-style-type: none"> 100% acceptance 	<ul style="list-style-type: none"> Mitigation of stone mixing with paddy Mitigation of alie matter mixture Drying efficiency is improved Very easy to manage Closed to paddy field and very convenient Saving transportation cost no Plastic sheets is necessary.

From the above table, farming system of rice seed production consisting of the 14 component technologies were clearly confirmed to be accepted by the beneficiary farmers. Countermeasure on the three comments with underline should be considered for future assignment.

- Component technology No.12 -Thresher: As it is very heavy and costly for transportation, it is difficult for elderly people.
- Component technology No.13- Winnower: -ditto-
- Component technology No.10 - Roguing:

There is no incentive imposed to selling price in spite of investing much labor force to produce paddy. That is to say, selling price is just for food grain and not seed price.

Comment about component technology No.10 is bottom line of the seed production project. Adding some value to the produce as seeds become seed grower's incentive, and consultation with Corinyaburiba Coop authority who purchase the produce from the seed grower is needed. Meanwhile, the Coop side have to clear the conditions stipulated by AFSR in order to sell certified seeds. For that purpose, control of seed production plot necessary for maintenance of varietal purity should be strictly practiced. In this regards, AFSR representative gave a lecture and discussion with the beneficiary at the final evaluation workshop on September 4th, 2008 and remarked the beneficiary farmer has reached a certain level of rice farming practice but they need an intensive training for seed production because of no clear understanding between cooking rice production and certified seed production. Furthermore, AFSR also remarked that she considered carrying out three-days-intensive training for them.

5) Multi-effect of Recommended Rice Farming Practice

After completion of the first rice cropping season on January 2008, the 121 additional rice farmers in the Corinyaburiba coop decided to introduce the recommended rice farming system by JICA Study Team for the 2nd rice cropping based on the association leader's meeting (See below Table shaded color cell).

Table 6.4.13 Extension of Introduced Rice Variety

	Site	Variety	No of FH	Seed Quantity
1	Upper	Intsinzi	20 FH	30 kg
			55 FH	75 kg
2	Middle	Gakire	20 FH	30 kg
		Insindabiragigega	26 FH	70 kg for 3 ha
3	Lower	Gakire	20 FH	30 kg
		Gakire	20 FH	30 kg
		Insindabiragigega	20 FH	20 kg
Total			181 FH	285 kg

With respect to variety selection for the 3rd rice cropping season starting from July 2008, the beneficiary farmers selected only one variety, Insindagirabigega, early mature and tolerant against disease among the three varieties in all seed plots from upper, middle and lower sites. On the other hand, seeds distributed to Nyaburiba marshland (42 ha) amounted to Insindagirabigega 606 kg and Garire 120 kg, respectively. This seed quantity almost covers a whole Nyaburiba Marshland.

6) Soil Erosion and Flood Damage

Interviewing beneficiary farmer followed by the baseline survey replied “Yes” to the question about inflow of earth and sand from the hillside, and siltation of canal causing flood damage to their plots as follow.

Damage caused by soil erosion

The six households faced damages to their plots caused by inflow of earth and sand from the hillside during the long rainy season (B cropping season). The remaining one household answered “damage in the A cropping season.

Flood damage

One household answered “Yes” by food damage. Non-seed rice farmers were also damaged by flood are generally owing their plots along to the central drainage canal. Countermeasure by them is to close inlet gate and open the outlet gate for draining excess water. However, central drainage canal overflows the neighboring paddy fields due to siltation which makes it unable to draining water. Therefore, flooding condition of 40-50 cm depth occurred 4 times from March to early April, 2008. Damaged paddy plots amounted to 4, 4 and 7 plots from the upper, middle and lower sites respectively. Therefore, plant growth of tillering stage was severely suppressed and some paddy plots were completely spoiled.

7) Institutional Change of the Corinyaburiba Cooperative

It was June 2006 that JICA Study Team launched the improved rice seed multiplication and dissemination project to Corinyaburiba Coop as a target stakeholder. Then, an amazing yield increment since transplanting at early August, 2007 was observed at harvesting period. This bumper crop was on air via TV, radio and news paper, thus the said coop has been remarkably changed based on concrete experience on improved rice farming practice of the beneficiary farmers including the Coop President via OJT. The change of the Coop as of August, 2008 after completion of the 1st and 2nd rice farming was summarized as below. (See Annex VI.6.4.16 for details.)

Table 6.4.14 Institutional Change of the Corinyaburiba Coop

Major Change		Outline
1	Association and coop members	12 Associations and 523coop members (as of August, 2008)
2	Legal registration of Coop	Corinyaburiba Coop was officially registered in July 2007.
3	Yield increment	Increasing of paddy yield from 3-4 t/ha to 6-9t/ha
4	Acquisition of improved paddy seeds	Acquisition of improved 3 rice varieties from local variety
5	Aggressiveness of rice farmer	The rice farmer in Nyaburiba appeared to be passive on rice farming but changed into aggressive as well as to be improved in rice farming practice.
6	Full time engaged extension worker	A full-time agriculture extension worker who was missing so far is permanently stationed to Corinyaburiba Coop supported by JICA Study Team.
7	Acquiring of improved rice farming practice	Seed rate on nursery conventionally amounted to around 300 kg/ha but decreased to 20-30 kg/ha in the improved method. Moreover, improved farming practice including quality and

Major Change		Outline
		yield improvement practices are acquired such as one seedling/hill , fertilizer application, pest and disease management, threshing, winnowing, drying and adjustment of grain moisture content.
8	Construction of concrete drying yard and introduction of advanced farming implements	Traditionally, sunlight drying paddy was managed on the grassland but quality improvement of paddy was fulfilled by using concrete drying yard constructed by JICA. Meanwhile, field operations were improved efficiently such as leveling, weeding, threshing, winnowing and drying paddy, and which contributes to quality improvement.
9	Employment of full-time accountant	A full-time accountant has been employed since October 2007 so as to strengthen accounting
10	Commencement of loan business to coop members	Loan to the coop member has been launched by borrowing loan from bank.
11	Commencement of rice milling business	Rice milling business has commenced by purchasing one pass type rice milling machine on March 2008. A storage house for storage and rice milling machine has been constructed.
12	Commencement of estate business	Corinyaburiba coop purchased a house in Ruhuha Center on late 2007 and established a coop office, and then the remainder is leased to tenant.
13	Recognition of outstanding Corinyaburiba Coop Activity	A letter of thanks with a gift of money was awarded to Corinyaburiba Coop by Ministry of Labor under the name of staff seconded to Bugesera District from MOL.
14	Acknowledge of Corinyaburiba Coop as seed producer	Corinyaburiba coop was recognized the 2nd seed produce coop in Rwanda by passing lab test of seed quality for certified seed and sold certified seeds to other 4 rice cooperatives in Ngenda Area, Bugesera.

Source: JICA Study Team, August, 2008

6.4.4 Recommendation to District Development Plan and Further Issues

The following lesson learnt was obtained through implementation of the project in terms of project sustainability and development from spot to area.

(1) Future Issues for Project Implementation

As a result of the project effect survey in terms of acceptance of the beneficiary farmer to the recommended farming practice, the comments below mentioned are extracted as issues for seed production project. Meanwhile, countermeasure to protect soil erosion from the hillside to paddy field, and flood damage is also vital factor so as to secure stable rice production in future in Nyaburiba marshland. These issues are summarized as below.

Table 6.4.15 Present Issues and Countermeasure

A. Issues to strengthen Coop organization		Outline	Result	Countermeasure
1	Capacity building of Accountant and improvement of accounting system	Recording items without classification by items on ledger	MINICOM pointed out to record by items with PC	• Training of Accountant about accounting with PC
2	Installation of PC	There is no progress to get PC from Bugesera District Office even though the district office promised to supply PC.	JICA Study Team donated an old PC and agronomist use it. Printing is made at net cafe when it is necessary.	• As Coop is under expansion, computerization of document and systemization is vital.
3	Employment of full time extension worker	The extension worker for the Coop is supported by JICA Study Team budget during the field survey.	Keeping the same extension worker in same condition by the Cooperative after JICA Study completion is difficult.	• It is necessary for the coop to strengthen a financial basis such as improvement of unit yield, quality improvement, continue of seed production project and reclamation of 10 ha for paddy fields.
4	Rice mill operation (employment of key staff)	Rice milling business started from March 2008 by One-Pass type milling machine (10Rwf/kg).	Milling capacity is 280 kg/hour but it generates many broken rice with limited milling function in terms of grain quality.	• Corinyaburiba coop has already applied loan for purchasing of sophisticated rice milling machine equipped with function of grain

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				separator. • Buying paddy and launching milling/selling of rice
5	Loan to the Coop members	A part of bank loan is used for lending money to the coop member with one time repayment by harvest.	• Defaulter came into existence due to crop damage caused by pest/disease/flood damage.	• Protection of nonperforming loan by setting security.
B. Agronomic issue		Outline	Result	Countermeasure
1	Introduction of early matured variety	No early matured rice variety as recommendation in Rwanda. Only late matured rice variety is disseminated at present.	<ul style="list-style-type: none"> • There is no much time between 1st and 2nd cropping in Nyaburiba marshland. So, delayed transplanting cause a problem to succeeding crop. • Much labor force are required. 	<ul style="list-style-type: none"> • Introduction of promising variety should be promoted from WARDA and other country. • By introducing high yielding early matured variety, soil improvement should be done in between rice double cropping.
2	Establishment of improved farming practice	Component technology from seed treatment to post harvest is compiled in the technical guideline and explained in the workshop. In the middle and final evaluation workshop, the monitoring results were fed back into the beneficiary farmers.	The packaged component technologies appeared to be roughly accepted, but still needs to improve them including a planting density and other components.	• It is very important that technical guidance should be made by demonstrating the difference (yield) between recommended practice and traditional practice.
C. Issue of seed production		Outline	Result	Countermeasure
1	Quality improvement and how to encourage the beneficiary farmers	Rouging operation was guided by plant growth stage in order to protect rice variety from degeneration by contamination.	<ul style="list-style-type: none"> • In the 1st cropping, rouging operation was strictly carried out under incentive of seed price but buying price offered by Coop was not differed from a price of cooking rice, and the beneficiary farmers were discouraged. For this reason, rouging operation was not strictly done in the 2nd rice cropping. • In the discussion between AFSR and the beneficiary farmers at the final evaluation workshop, the beneficiary farmers appeared not to be well understood a difference between certified seed production and cooking rice production. 	<ul style="list-style-type: none"> • Final decision of certified seed depends on lab test made by RADA/AFSR, thus Coop could not guarantee a high buying price. • The beneficiary farmers could not make an effort to operate rouging frequently under no incentive (no guarantee of high buying price). • Strengthening of the beneficiary farmer's capacity about seed production technology by training them intensively via AFSR initiative.
D. Issue of Civil Engineering		Outline	Result	Countermeasure
1	Renovation of division work and water gate	<ul style="list-style-type: none"> • Division work was constructed by using earth and wood under guidance of MINAGRI. • No data of water discharge is available. 	At present, no structures are functioned and the end users operate water distribution by raising soil on irrigation canal.	<ul style="list-style-type: none"> • Annual water discharge from sprigs should be observed. • Renovation of water division work • Construction of water gate at key points
2	Rihabilitation of water canal	There are 3 main irrigation and drainage canals, i.e, 2 irrigation canals located at both hill	Soil and sand eroded from hillside during the rainy season flowed into paddy plots and	• Strengthening of maintenance frame work for regular dredging

		bottoms and one canal existed in the central marshland.	water canals causing flood damage followed by siltation. The beneficiary farmers carry out dredging work from time to time via collective work.	operation
3	Plot to plot irrigation and water management	<ul style="list-style-type: none"> As a rule, block irrigation method (upper, middle and lower site) was applied. Water management by plot to plot is not systematically operated by each block. 	The plot beside hill-bottom where transplanting and basal dressing were just done first is drained toward the lower plot located in the central drainage canal. Thus applied fertilizer was washed away associated with drying of transplanted plot occurred.	<ul style="list-style-type: none"> Strengthening of guidance about optimum plot to plot irrigation method.
4	Reclamation of paddy field	Nyaburiba marshland consists of paddy field of 42 ha and non-reclaimed 10 ha upland.	The Coop member has an intention to reclaim paddy field from the upland but nothing is brought to fruition yet.	<ul style="list-style-type: none"> Reclamation of paddy plot should be considered by mobilizing the beneficiary via Food for Work approach.
E. Issue of soil conservation		Outline	Result	Countermeasure
1	Protection of soil erosion and flood damage	In the both escarpment of the marshland, farmer cultivates vegetables during the dry season and sorghum, maize, and cassava for the rainy season. Further countermeasure against soil erosion is scarcely taken so far.	Sandy soils are eroded especially during the long rainy season and flowed into water canal and paddy field causing damage.	<ul style="list-style-type: none"> Around 40 % of the farmers are cultivating both upland crop in hillside and paddy rice in marshland. The hillside farmers are not familiar with know-how of soil conservation, thus awareness creation about soil conservation should be promoted via workshop. Several countermeasures for soil conservation in the entire watershed area should be practiced such as contour ditch, tree-planting, contour ridge, and check dam.
F. Issue of facility and farming implements		Outline	Result	Countermeasure
1	Construction of drying yard	Concrete drying yard of 810m ² was constructed in the Pilot Project.	The constructed drying yard is not enough to cover the whole marshland rice area of 42 ha.	<ul style="list-style-type: none"> In order to cover the 42 ha, additional drying yard is necessary to be constructed in the upper one site, and lower two sites of same size with shade house.
2	Introduction of improved farming implements including rotary weeder	<ul style="list-style-type: none"> Rotary weeder was granted to the beneficiary farmers of 60 in the pilot project. 12 winnowing machines and 15 threshers were also granted to the beneficiary farmers. 	<ul style="list-style-type: none"> Rotary weeder is high demand among the rice farmers in Nyaburiba Marshland because of its efficiency. Thresher and winnowing machines are also high demand among the rice farmers but due to its heavy weight, decreasing of machine weight is requested by old age farmers. O&M framework of farming implements are not sufficient in the Corinyaburiba Coop. 	<ul style="list-style-type: none"> In this JICA PP, all farming implements were granted to the beneficiary but cost sharing system with the beneficiary should be considered in future. Further improvement of the introduced farming implements should be advanced in collaboration with KIST. O&M system about the supplied farming implements should be strengthened by stipulating an inner regulation within the Coop.

Source: JICA Study Team, August, 2008

(2) Outlook Hereinafter

The Pilot Project commenced from June 2007 and completion of the two rice framings over one year and four months is phased out on this October, 2008 prior to get the result of the 3rd rice farming. Amazing yield increment was observed through implementing the project but some future issues on seed production project also emerged; a. how to build beneficiary's capacity on seed production, and b. how to develop a seed market in further strengthening of project on production of certified seed. In order to establish the recommended rice farming practice among the beneficiary, it is essential for extension strategy to establish demonstration farm for displaying know-how of the recommended practice visually and disseminate them to rice farming area in the surrounding marshland. On the other hand, drastic change of the Corinyaburiba Coop within short period has received much attention in the rice sector. However, the Corinyaburiba Coop has just started a division of duties like accounting, agricultural extension, rice milling and loan to the coop member from a dictatorial management by the coop president before JICA study team intervened. Therefore an institutional strengthening focusing on coop management based on financial basis is an important subject from now. Furthermore, everyone agrees that the natural environment surrounding Nyaburiba Marshland holds a vital factor to protect soil erosion for stable rice production. Also, agriculture with livestock raising as major side line should be considered to supply compost by combining rice farming and livestock reciprocally in rice farming in Nyaburiba marshland.

These issues are unable to verify within a framework of this development study in terms of time as well as budget constraints. Marshland agricultural development is one of vital agricultural policy in Rwanda and Nyaburiba case should be guideline for future development of marshland. The lesson learnt from Nyaburiba Project is sufficiently applicable to other five marshlands managed by the five rice cooperatives. Therefore, these issues are preferred to be tackled through ODA scheme such as technical cooperation followed by the post development study.

6.5 Marshland Agricultural Development Project

6.5.1 Background and Objectives of the Project

(1) Background of the Project

During the workshops with the local people in each Cell, which were held in January 2007 to collect basic information for the planning of Pilot Project, following issues were revealed in terms of marshland agriculture.

- No reclamation works have been done for marshland development.
- Due to lack of knowledge and abilities, marshland is presently unutilized.
- River flooding often damages crop harvest.

Therefore it needs to improve agriculture in and around marshland and develop unutilized marshland.

On the other hand, rice production in the marshlands is included as a priority program in the NAP, the PSTA, the National Rice Production Program and the DDP of Bugesera District. Hence, the marshland agricultural development project accords with the national policies such as food security and poverty reduction.

(2) Objectives of the Project

According to the background of the Project as mentioned above, the PP aims at enhancing food security through rice production in marshland paddy fields newly reclaimed with labor force.

6.5.2 Plan of Operation

The overall implementation framework for the PP is divided into two stage as construction stage of paddy field and rice cultivation practice stage. The schedule was designed as follows:

Table 6.5.1 Plan of Operation of Marshland Agricultural Development Project

Year	2007							2008								
Month	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Kick Off W/S, Tools Procurement	■															
PF Construction		■	■	■	■											
Farming Practice				■	■	■	■	■	■	■			■	■	■	■
Monitoring & Evaluation		■	■	■	■	■		■	■	■	■	■	■	■	■	■

The details of progress on each stage, namely, implementation of paddy field construction and introduction of rice growing respectively are explained as follows:

6.5.3 Paddy Field Reclamation (construction of pilot farm for rice cultivation)

(1) Survey / Planning

1) Current Situation of the Project Site

Based on the discussions with Ntarama Sector and three Cells for planning of the pilot projects, the Muzi Cyeru marshland in Kanzenze Cell was selected as a site for marshland agricultural development project. The marshland is located on the right bank of the Akagera River and in a north-eastern part of Ntarama Sector. The shallow well irrigation



State of water level in Muzi Cyeru marshland in July 2007

project, which is one of quick projects, was also implemented there. Before the commencement of the pilot project, crops including tomato, sweet potato, chili and napiergrass were being planted.

Annual water level variations considerably affect rice production as well as marshland development. According to the local people, the maximum water level is observed in April or May (40 cm above the farmland surface). In June, the water depth decreases to 20 cm and the area is no more inundated in July. However, the groundwater level was 20-30 cm below the soil surface in the end of July 2007. Judging from these facts, the water level in the marshland considerably changes in accordance with seasons, and annual variations are quite remarkable.

In the Muzi-Cyeru marshland, many papyri grow. Some local people had concerns on

environmental degradation if these papyri were cut. However, it was judged that effects on environment was very little because (i) the area size of papyri cutting to store water was very small, 50 square meters, and (ii) paddy field construction was mostly done on the present upland field. After the completion of the pilot farm construction, no environmental degradation was observed.

In the past, about 30 farmers practiced farming on the former upland field, where the pilot farm was constructed, with permissions from the Kanzenze Cell Office. When the kick-off workshop was held, it was decided that the present cultivation rights (usufructs) of the stakeholders would be freely transferred to the Cell Office. However, some parts of the present upland fields were designated at outside the pilot farm considering layout of the farm.

2) Kick off Workshop

The first workshop to introduce the Project, held on 27th June 2007, brought together 44 stakeholders namely Kanzenze cell leaders, Umudugudu representatives, current farmers at the Project site, candidates of the Project. The WS gave a briefing on major activities of the PP including i) reclamation of the pilot farm, ii) farming of rice cultivation, iii) Operation and Maintenance (O&M) of the facilities, and iv) M&E activity and in the 2nd WS, the major activities of ii, iii and iv were scheduled to be discussed. To avoid delaying of activities, scheduling the 2nd WS will depend on the progress of the underway reclamation work started at the beginning of July and due to be completed in mid-September. Thus, the 2nd WS should be considered in accordance with the progress of the said work. Major contents of consultation and remarks identified in the WS are the following five items.

(a) Legislation for landownership of marshland and existing land right of the project site

Under the existing legislation, the marshland belongs to the Government (Sector/Cell) and Ntarama Sector has officially approved the project consisting of 1ha reclamation of paddy field in Muzi-Cyeru Marshland

It is indispensable to make existing cultivation right as well as landownership of the project site during implementation of the PP since farmland reclaimed by the 30 farmers living neighboring village can be damaged for a long time at the project site. In order to clarify the issue, the Study Team discussed with current farmers, Umudugudu leaders, Cell officers and it came out from the discussion as the following (Refer to Annex VI.6.5.1).

———— Detailed memorandum on existing land right ————

- The land ownership of the project site belongs to the Government (Bugesera District, Ntarama Sector, Kanzenze Cell).
- The existing usufruct for cultivation at the project site will be transferred to Kanzenze Cell Office from the Farmers without compensation during the Project.
- After completion of the Study, in case if the pilot farm is no more used for the rice cultivation purpose, etc., and all parties concerned agree on this matter after that the Farmers can take back his/her usufruct for cultivation.

(b) Cost / Work sharing

As one of objectives, the PP is seeking a way (i) to keep sustainability through the implementation of the project based on the local population's needs, (ii) to realize "Zero-Cost Project" as much as possible which could be managed by the local population themselves. The Study Team requested the participants in this Project sharing of costs and works.

During the workshop, the responsibilities among the beneficiaries and the Study Team in terms of materials and works for pilot paddy farm reclamation were preliminarily indicated to the attendants of the WS through discussion as shown below. However the contents are changeable according to the progress of construction works due to budget as well as the locally available materials. Apart from demarcation of cost/working between the beneficiaries and the Study Team, the casual labor required for construction works is selected by Cyeru Umudugudu among current farmers in the marshland.

During the preparation of the participatory activities for PP implementation by the Study Team and the Umudugudu/Cell representatives, they have at least deepened their awareness about the PP purpose.

Table 6.5.2 Preliminary Demarcation of Responsibilities for Paddy Field Reclamation

Item	Umudugudu/Beneficiaries	JICA Study Team	Remark
Tools/Material	Water, Hoe, Machete, Jerrycan, Rake, Gum boots	Shovel, Pick (Fork type), Wheelbarrow, Strings, Peg, Bucket, T-shape, Gum boots	Beneficiaries accepted to contribute ½ of the cost of gum boots.
Personal	Casual labor (30 people), Assistant Supervisors	Supervisors	

(c) Project implementation organization

Implementation system of PF construction was planned in a way that the supervisor of the construction works employed by the Study Team and the representatives of Cyeru Umudugudu jointly supervised works on the sites, thus transferring techniques of earthen work engineering to the participants thereof (Refer to Annex VI.6.5.1).

(d) Tools/Material management

As one of lessons learnt from Quick Project implemented last phase, lack of responsibility for management of tools/material was pointed out. The Study Team requested to the persons concerned to establish the system for tools/material management and the followings were agreed.

- Cyeru Umudugudu must take care of all the tools/material during construction period.
- The Cell office will be responsible for management of tools/material after completion of PF construction.

(e) Formulation of plan of operation

During the WS, participants formulated the plan of operation for PF reclamation. According to the table above, the construction work is expected to complete within 6 to 8 weeks with 30 to 40 casual labors. The working condition for casual labors is a 7-hour, five-day a week (Refer to Annex VI.6.5.1)

3) Pilot Farm Dimensions

It is extremely needed to properly design the elevation of facilities as well as the paddy fields level since rice cultivation requires appropriate water management based on growing stage of rice throughout the year. For that, it is essential to know the range of fluctuation of water level in the targeted marshland throughout the year. Muzi-Cyeru Marshland has been affected by the water level of Akagera River. There is, however, no hydrological data including the relation of water level between Muzi-Cyeru Marshland and Akagera River. The design of facilities therefore was set up based on the interview survey results from local farmer cultivating in the site for a long time.

Plan and dimensions of PF construction are shown as typical drawings (Refer to Annex VI.6.5.2).

(a) Design of experimental paddy plots

Based on the ISAR and RADA standards, a size of plot is decided as 500m² (=25m*20m).

(b) Design of roads and embankment

In order to smoothly transport agricultural inputs, products, and so on, the main and branch road are planned to be rehabilitated. Furthermore, embankment should be constructed around the PF area to prevent rice planted from flooding caused by Akagera River. The planned elevation (Crest height) of the facilities mentioned above is designed as EL. 1,500m based on the water level in Muzi-Cyeru Marshland estimated during 4 months from February to May which is the period of high water level.

(c) Design of canal

The marshland along the Akagera River is the only water source in Muzi-Cyeru for rice cultivation throughout the year. The water level of marshland goes down during the 3 months from July to September so that the elevation of canal bottom is designed as EL. 1498.5 to pump up water to paddy field from the canals. Based on the above, the dimensions of facilities for PF construction are summarized as follows:

Table 6.5.3 Dimension of PF Facilities

Area to be reclaimed	11,099.4m ² (Total area of experimental plot= 7,957.8m ²) (Total area of road, canal, embankment= 3,141.6 m ²)
Standard size of experimental rice plot	500 m ² (=25m×20m)
The number of plots	17 plots
Length of truck road	156.65m (Width of crest: 1.5m)
Length of branch road	435.00m (Width of crest: 1.0m)
Length of footpath	381.00m (Width of crest: 0.6m)
Length of embankment	172.00m (Width of crest: 0.6m)

Length of canals	184.00m (Width of canal bed: 1.0m, Width of canal top: 5.5m)
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(2) Construction of Pilot Farm for Rice cultivation

1) Progress of Construction

After completion of the preparation works, pilot farm construction in Muzi-Cyeru, Kanzenze Cell, was commenced at the beginning of July 2007. The works are expected to be carried out by labor force without any machinery. More than 60 inhabitants of Cyeru Umudugudu were involved in the paddy field construction works. The construction was completed at the beginning of October 2007.

Table 6.5.4 Progress of Paddy Field Reclamation

Activity	Schedule				
	2007				
	June	July	Aug	Sep	Oct
1 Topo Survey	■				
2 Design	■	■ ^{2nd}			
3 Stripping, Lnad prepararion		■			
4 Back filling to depression		■			
5 Rough plowing, Leveling		■	■		
6 Plowing		■	■		
7 Canalization, Filling soil of footpath		■	■	■	
8 Filling soil of roads, Embankment		■	■	■	
9 Construction of nursery bed		■			
10 Sowing, Transplanting			▲ ^{11th}	▲ ^{3rd}	■ ^{5th}
11 Leveling (finishing)			■	■	■

Although the transplanting was supposed to be done at the middle of August 2007, it was commenced at the end of August 2007 after a delay of two weeks. Main reasons assumed are i) at the beginning construction works, much time was spent to fill up with soils the depressions, which were dug to fetch water for farming, cow as well as domestic use, ii) it was obliged to pump up water from the canals because of a lot of underground water during canal construction, iii) the heavy soil on the site hardened with drying, then it took much labor to break the soil into pieces, etc.

2) Quantity and Cost for PF Construction

Based on the working record of PF construction, the quantity of PF construction and its cost are summarized as tables below and construction cost was estimated at 5.3 Million Rwf per hectare.

Table 6.5.5 Quantity of the PF Construction

Cell	Name of Marshland	Type of soil	Area of the Pilot Farm reclaimed ha.	Major Quantity of Farm Pond Construction							Construction period (The total number of working days)				The total number of man-days of Casual Labors	
				Volume of Earth Works			Length of Ancillaries				July	Aug	Sep	Oct		
				Excavation	Filling	Total	Roads	Footpath	Embankment	Canal						
				M ³	M ³	M ³	M	M	M	M	Days	Man-days				
Kanzenze	Muzi-Cyeru	Clay	1.1	897	897	1,794	592	381	172	184	2n			5th	64	3,389

Table 6.5.6 Construction Cost of PF

Item	Cost (Rwf)	Remark
Tools, Equipment	1,738,900	Wheelbarrow, Shovel, Pump, etc.
Material	150,000	Lumber, Fuel for pump
Casual labor	3,389,000	
Total	5,277,900	US\$9,752

6.5.4 Introduction of Paddy Rice Cultivation

During the project implementation period (June 2007 - October 2008), the newly reclaimed pilot farm has cultivated with the first rice crop and the second rice has just been transplanted to the main plots on late August to early September 2008, and the fourth field survey has phased out on October 2008 without observing result of the second rice harvest. The outline of paddy rice introduction in Muzi Cyeru Marshland is summarized as below.

(1) Introduction of the 1st Rice Cultivation

1) Nursery Sowing

Sowing on nursery bed was practiced on August 11, 2007 prior to completion of land reclamation of pilot farm. Seed treatment process proceeded in accordance with the following steps.

Table 6.5.7 Seed Treatment Process

Date	Time	Outline of Seed Treatment
August 8th	10:00 am	Commencement of seeds soaking in water
August 9th	10:00 am	Shifting from soaking to incubation under moist condition in dark condition.
August 10th	9:00 am	Check of seeds about progress of incubation of 3 varieties and continued of incubation treatment.
August 11th	8:20 am	Stop of incubation treatment and sown on nursery bed

In this treatment, Gakire reached to optimum condition in less than 48 hours (38 hours enough), while Intsinzi needed more time for incubation. The third variety, Insindagirabigega was fallen in optimum condition after 48 hours. (See Annex VI.6.5.3 for photos.) On August 11, the treated seeds were sown on nursery bed as follows:

- Size of nursery bed is 1.0 m width * 12 m length * 23 beds.

Table 6.5.8 Seed Rate Sown on the Nursery Bed

No	Variety Name	Seed weight	No of bed sown
1	Gakire	7.2 kg	8 beds
2	Intsinzi	7.2 kg	8 beds
3	Insindagirabigega	6.3 kg	7 beds

- Broadcasting of pre-germinated seeds on wet bed at rate of 75 gm/m².
- Seeds were slightly mixed with wet soil by pressing seeds gently from top by hand so as to make seeds stick firmly to wet soils.
- The clayey soils in the nursery beds become very hard once drying up and seeds fail to emerge, so the nursery bed surface were always kept wet condition by splashing water over the beds by hand in combination with engine pump.

As of August 24th, seedlings were well evenly grown and fallen in the two-leaf age plant as right figures. However, one of variety, Gakire began to show some abnormal symptom like yellowing and browning from old leaves since late August and expanded to the 2nd and 3rd varieties gradually. This symptom appeared to be resulted from high pH of irrigation water like 7.3 to 8.1 and caused imbalance of nutrient uptake.



Uniformly emerged seedling



Abnormal symptom of yellowing and browning from old leaves

2) Allocation of Participants to Layout of Paddy Fields

The reclaimed pilot farm consists of the 17 plots and plot size is designed to 500 m² (Muzi Cyeru beneficiary consisting of 32 members were selected by Kanzenze Cell Office).

3) Land Preparation and Transplanting to the Main Field

From August 27, 2007, puddling operation was started by pumping irrigation, while transplanting operation was begun from September 3rd. Planting density was same as Nyaburiba Pilot Project such as 30 cm between rows and 15 cm between hills with one seedling per hill. Transplanting operation was practiced just after completion of land reclaimed plots followed by puddling work, and completed in the 17 plots on October 2, 2007.



Uprooting of seedlings



Application of basal dressing NPK



Transplanting of 3 leaves age at 30 * 15 cm spacing

4) Water Management and Progress of Growth Condition

For the time being, the transplanted plots were irrigated twice a day by pumping from the main canals to keep inundation condition just after transplanting. The first transplanted plots showed yellowing/ browning change from old leaves tips after 4 to 5 days transplanting. However, this abnormal symptom appeared to be stopped from mid-September and recovered. Meanwhile, it was reported that some waterfowl inhabited in the surrounding marshland damaged transplanted seedlings over the 3 plots during dusk and dawn. Therefore some countermeasures should be taken if damage is developed more.

5) Workshop for the Rice Cultivation

The workshop oriented to rice cultivation was held at Kanzenze Cell Office on October 3rd, 2007 by convening the 32 participants of the Project. The workshop participants amounted to 41 members

consisting of RADA, District Office, Sector/Cell Offices including the 32 participants and JICA party. The outline and results of the workshop are summarized as below. (See Annex VI.6.5.3 for details.)

(a) Objectives

- Confirmation of overall implementing framework on rice cultivation in the marshland agricultural development project
- Formulation of Plan of Operation for Rice Cultivation with the Participants
- Technical guidance of rice cultivation so as to urge rice cultivation smoothly

(b) Summary of the Results on Workshop

In this workshop, the following agenda was discussed and adopted.

- a. Selection of Association board member
- b. Management framework of farming input and implements
- c. Operation and Maintenance framework of the newly reclaimed paddy fields

Table 6.5.9 Project Components by JICA

Components		Specification					
1	Reclamation	-Around 1.0 ha of paddy field with 500 m ² plot as standard					
2	Inputs	Improved rice seeds from ISAR	1	Insinzi:10 kg			
			2	Gakire:10 kg			
			3	Insindagirabigega: 10 kg			
		Chemical fertilizers	-NPK (17-17-17): 5 bags=250 kg -Urea: : 2 bags=100 kg				
Agro-chemicals	-Necessary amount for control of pest/disease						
3	Farming implements	1	Rotary weeder	10	6	Plastic sheets	20
		2	Pedal type -thresher	4	7	T- shape leveler	16
		3	Manual type sprayer (15 Lt)	4	8	Balance (20 kg)	1
		4	Mobile pump	3	9	Plastic ball	10
		5	Fuel for pump		10	Winnowing machine	4
4	Supporting Activity	1	Technical guidance of rice cultivation				
		2	Operation and Maintenance of Consolidated Paddy Field in terms of technical advice.				

Table 6.5.10 Division Duties among the Stakeholders Concerned in Project Implementing Framework

Stakeholders		Responsibility
1	JICA-RADA-ISAR	Supply of Input, technical guidance and land reclamation for rice production
2	Muzi Cyeru Rice Association	<ul style="list-style-type: none"> - Production of improved paddy rice in collaboration with ISAR-RADA-JICA joint team and agronomists recruited by JICA Study team - Produce from the assigned plot to each participant belongs to each participant. Thus each participant should take responsibility for plot management. - The participant should contribute a part of the produce to the Muzi Cyeru Rice Association, and which amount shall be discussed among the said association.
3	Ntarama Sector/ Kanzenze Cell Office	- should guide the Muzi Cyeru Rice Association if necessary by monitoring the Pilot Project regularly.

Table 6.5.11 Operation and Maintenance of newly constructed Pilot Farm

	Reclamation Area	Quantity	Responsibility
1	Plots	17 plots	Plot owners
2	Main Road	156 m	All 32 beneficiary farmers
3	Branch Road	435 m	Bordering plots
4	Foot Path	381 m	Bordering plots
5	Ring Levee	172 m	All 32 beneficiary farmers
6	Main Canal A	46 m	Block A
7	Main Canal B	60 m	Block B
8	Main Canal C	78 m	Block C

6) Study Tour

The 32 participants of the Muzi Cyeru Group for study tour visited to the improved rice seed multiplication and dissemination project in Nyaburiba Marshland on December 27, 2007. The party amounted to 35 including JICA employed local agronomist, Cell officer and JICA C/P from the District Office. After arrival at the site, the tour party was briefed by the JICA employed local agronomist about rice farming in Nyaburiba marshland. Then the tour party visited to the paddy fields where harvesting operation in the seed multiplication plots started.

After site visit to the fields, the tour party moved to the newly constructed concrete drying yard and observed demonstration of the manual thresher and winnowing machine operation together with briefing of drying method of paddy rice. Then Vice President of Corinyaburiba Coop briefed them on the history of Nyaburiba rice farming, institutional management and activity of the Coop including present situation from the external support. In a session of question and answer, Muzi Cyeru party raised various questions such as structure of cooperatives, working condition of employees and farming practice on rice crop, thus it resulted in a fruitful discussion for the Muzi Cyeru party.



Observing threshing operation by the Coop member in Nyaburiba Marshland



The agronomists demonstrated how to operate winnowing machine on the newly constructed drying yard



The tour party was briefed by Vice President about Nyaburiba rice farming, Coop structure and its activities in the

7) Yield Survey and Yield Component Analysis

Harvesting operation began from late January, 2008. Plant growth showed severe waves in the canopy associated with much empty grains. Prior to harvesting operation, quadrant sampling was conducted so as to grasp yield level roughly. The survey items consisted of number of panicles/ m², planting density and plant height over the 3 plots including 4 sites. This yield survey was aimed at

grasping rough yield level because of no making sense of doing the detail analysis due to waving of plant canopy caused by uneven soil fertility, and much frequency of empty grains.

Table 6.5.12 Result of Yield Survey in Muzi Cyeru Marshland

Plot No	Variety	No of Hills /m ²	Culm Length (cm)		No of Panicles/m ²	No of Panicles/hill	Yield/m ² (gm)
			Clum	SD			
5	Gakire	16.1	48.6	5.3	216.6	10.3	315.5
6	Intsinzi	18.0	49.0	3.3	135.6	6.5	239.1
7	Intsinzi	22.2	41.0	2.7	133.3	16.3	125.4
13	Insindagirabigega	18.1	68.7	7.1	123.5	7.9	354.6
14	Insindagirabigega	16.3	69.5	6.0	116.3	15.5	243.8
17	Insindagirabigega	22.2	68.7	5.0	182.2	8.7	443.0

Source: JICA Study Team, Feb., 2008

Irregularity of yield by plot was very severe and ranged from 1.2 t/ha to 4.4t/ha. Thus, poor growth caused by soil physical and chemical aspect should be ameliorated in marshland development.

(2) The 2nd Rice Cropping

The Muzi Cyeru beneficiary group organized Umganda day to prepare for the 2nd rice crop on every Friday from early June, 2008. At the same time, they discussed the working plan for the 2nd rice cropping with the JICA Study Team. In accordance with this working plan, newly common use nursery plots (250 m²) were consolidated at south side of main plots, and then 4 rice varieties including 2 upland NERICA varieties were sown on July 26, 2008.

Transplanting operation started from August 20, 2008 and completed on September 1 for 0.8 ha of paddy fields. Then, the nursery plots after uprooting seedlings were transplanted with two NERICA varieties on September 3 - 4, and the rest of the plot was planted with vegetables for demonstration plot for newly consolidated plots in marshland. (See Annex VI.6.5.3 for photos.)

(3) Results of NERICA Observation Trial

NERICA was sown in the hilly side 2 times from the short rainy season (A season), October, 2007 to the long rainy season (B season) over the 8 sites of Ntarama and Ruhuha Sectors.

1) Sowing in the Short Rainy Season

Small scale NERICA observation trial was launched at 5 sites of the 3 Cell in Ntrama Sector from October - November 2007. Initial growth appeared to be good under normal rainfall pattern. However, continuous dry spell occurred from December to January, and which caused severe water stress on NERICA plant associated with stunt, and generated much empty grains. At the yield survey on early April, 2008, 2 sites resulted in no yield and other 2 sites yielded 0.2 - 1.0 t/ha.

2) Sowing in the Long Rainy Season

NERICA was sown on the eight sites over Ntarama and Ruhuha Sector from mid February to early

March, 2008. The trial sites were fallen into the dry season from early June, 2008 and most of the trial sites died before reaching to maturing stage. Only one site over the eight trial sites showed very vigorous growth (see right Photo, Ntarama Sector) resulted in 0.3 t/ha (Ueta JOCV source).



Upland NERICA Field

3) Evaluation of Upland NERICA

Sowing NERICA at hilly side twice from short rainy season and long rainy season, both sowing sites showed poor growth adaptability under unstable rainfall pattern. Form these reasons, introduction of NERICA is obliged to give up under rained condition. Meanwhile, termite causes plant damage when soil desiccation is on-going. From now on, upland NERICA is tested as paddy rice in a part of Muzi Cyeru Marshland Agricultural Project, and its adaptability is tested.

6.5.5 Monitoring and Evaluation

(1) Introduction

Marshland Agricultural Development Project has been launched in Muzi Cyeru Marshland under command area of Kanzenze Cell Office in Ntarama Sector since July, 2007. The said marshland, rich soil has been cultivated with vegetables such as tomato, cabbage and eggplant under bucket irrigation method by local farmers during the dry season. As for acquisition of land from the local farmers who has usufruct, Kanzenze Cell authorities concerned negotiated with them and signed up on the agreement document, then land consolidated work started by recruiting local farmers with only human powers. As no hydrological recording data was available, thus the said work proceeded by estimating a elevation of paddy field via local farmer's interviews, and around 1.0 ha paddy field including the main canal and road was completed on early October, 2007.

On the other hand, rice farming commenced from mid-August by sowing on nursery prior to completion of the construction work, meanwhile transplanting to the plot where completed land consolidation work began from early September. The first year of rice growing in the newly constructed paddy fields resulted in various physiological disorder, outbreak of disease and insect, frequency of empty grains which might be caused by uneven soil fertility and soil physical and chemical property. The first rice farming was completed early February 2008 by supplying of all necessary inputs by JICA Study Team while the beneficiary farmers contributed their labor forces. Paddy yield resulted in extremely low level like 1.24 t/ha, and which discouraged their eagerness for continuation of rice farming.

This project evaluation was compiled by summarizing the problems arisen via implementation of rice farming in the newly consolidated paddy fields. Moreover, carrying out a questionnaire survey to confirm the beneficiary's intentions to rice farming in future, and its results were discussed again at the final evaluation workshop with the all participants and then the discussion was incorporated into

this evaluation results.

(2) Objectives

It is aimed at evaluating the final stage of introduction of rice crop in the marshland agricultural development project.

(3) Methods

The survey items in final evaluation consist of the following five categories.

Table 6.5.13 Outline of Questionnaires Sheets

	Survey Items	Details
1	General	Family aspect, decision making, meal, staple food
2	Income	Income (July-07 to Feb-08) by Rice
3	Expenditure	Expenditure (July-07 to Feb-08) by agricultural input and hired labor for rice
4	10 questions to confirm the beneficiary's about rice farming including their will in post study	1. difficulty of rice crop, 2. taste of rice, 3. intension of organizing coop, 5, continuation of usufruct right in Muzi Cyeru marshland, 6. sharing of information about tax payment of marshland, 7. Information of shallow well irrigation, 8. willness of introducing shallow well irrigation system, 9. Impression of Muzi Cyeru rice project
5	Any Comments to the JICA Pilot Project	

Sampling 10 farm households were randomly made from the 32 beneficiary farmers in Muzi Cyeru Marshland Agricultural Development Project. (See Annex VI.6.5.4 for details.) Enumeration was conducted by the agronomist employed by the JICA Study Team, which directed him and compiled the report.

Table 6.5.14 Number of Sampling Households

	Irrigation Block	No of Sampling Households
1	A	3
2	B	5
3	C	2
	Total	10

(4) Results

1) Income

In the first rice cropping in the Marshland, a total harvest amounted to only 989 kg, not enough for cooking rice, caused by various physiological disorder originated from the newly consolidated paddy fields (see below Table). Calculating yield per ha by each plot also ranges from 0.5 t/ha to 2.2 t/ha, poor yield level, thus no income by selling rice. The harvest was consumed by the beneficiary farmers by polishing it at Ruhuha milling place.

Table 6.5.15 Result of Paddy Yield by Plot in Muzi Cyeru Marshland

Block	Plot No	Variety	Assigned Beneficiary	Paddy Harvested (kg)	Polished Rice (kg)	Milling Rate(%)	Plot size (m ²)	Yield/ha (kg)
A	1	Intsinzi	Kayitankore Telesphore	90	53	59	609.5	1,476.6
	2		Gatabazi Alexis	62	35	56	500.0	1,240.0
	3		Karimganire Rapheal	39	22	56	297.5	1,310.9
	4	Gakire	Mukandori Victorice	50	29	58	500.0	1,000.0
	5		Rusanganwa viateur	80	48	60	500.0	1,600.0
B	6	Intsinzi	Nshimyuremyi Augustin	48	33	69	225.0	2,133.3
	7		Kaneza Ernestine	102	63	62	500.0	2,040.0
	8		Karinamaryo Telesphore	112	66	59	500.0	2,240.0
	9	Insindagirag	Gihana Wensceslas	58	38	66	500.0	1,160.0
	10	Intsinzi	Ndayambaje Donat	41	22	54	420.8	974.3
	11	Insindagirag	Mukeshimana Laurent	82	61	74	500.0	1,640.0
	12		Bunami Innocent	21	12	57	500.0	420.0
13	Hakizumwami Gratien		46	28	61	500.0	920.0	
C	14	Insindagirag	Rumanura Jean Bosco	32	19	59	405.0	790.1
	15		Rukara (Rutayisire Léonard)	28	17	61	500.0	560.0
	16		Rutaganda Jean de Dieu	28	19	68	500.0	560.0
	17		Kayitavu Onesphore	70	46	66	500.0	1,400.0
Total				989	611	62	7,958	1,263

Source: Compiled by Ueta JOCV , March 2008

2) Expenditure

Introduction of paddy rice is positioned as verification trial in a newly consolidated paddy field, thus cost of inputs (seeds, fertilizer, agro-chemical, pump fuel), and labor cost up to October 4th, 2007 were entirely borne by JICA Study Team. The cost generated via cultural practice after October 4th was managed by family labor, and the actual cost shared by the beneficiaries was wage for a bird scarerer employed during the 45 days in maturing stage. The total cost amounted to 56,000 Rwf, which was shared by individual beneficiary at 1,750 Rwf/beneficiary. Besides, nine households purchased hoe (1,600 Rwf) as farming tool.

3) Confirmation of the beneficiary's intention about continuation of rice farming

Introduction of paddy rice in Marshland Agricultural Development Project is aimed at verifying rice cultivation in the newly consolidated paddy field in accordance with the national policy of marshland development in a view of food security in Rwanda. The final field survey is scheduled to be phased out before harvesting of the 2nd rice cropping without solving agronomic issues so far arisen due to time constraints of the development study scheme. In order to make the new paddy field efficiently use for income generation of the local population, continuous support to the newly formed Muzi Cyeru Rice Associations' farming activity is vital factor. For that purpose, the beneficiary's intention was confirmed by asking 11 questions. Below table summarized the results.

Table 6.5.16 Questionnaire and Answer

1	What is your impression of rice farming via your field work? 1. Rice farming is easy----- [80 %]. 2. Rice farming is difficult- [20%].
2	Did you taste your rice harvested in Muzi Cyeru this year? 1. Yes [100%], If yes, how did you find your rice ? 2. No [] 1. Very good taste [100%] 2. Fair taste [] 3. Poor taste []
3	Are you willing to organize Muzi Cyeru Rice Cooperative or Agricultural Cooperatives including rice and vegetable crops together with other Muzi Cyeru association members? 1. Yes I want. [40%], 2. No I don't. [60%], 3. I don't know. []
4	Will you plant rice in Muzi Cyeru with your own expense (pump fuel, seed, fertilizer, agro-chemical) after JICA Study completion in this October 2008? 1. Yes, I will continue by my expense-----[0] 2. No, I can not do without JICA or any external support.-----[10%] 3. I will follow a decision of the Muzi Cyeru Association meeting[10%] 4. It depends on a yield of the 2nd rice farming.-----[80%]
5	Do you want to use Muzi Cyeru paddy field for cultivating vegetables after JICA study completion? 1. Yes, I want to use paddy field for vegetable production after completion of JICA Study-----[90%]. 2. No, I will not use at all-- [10%].
6	Do you know that farmer who cultivates marshland has to pay tax to Bugesera District from this year? 1. Yes I heard it.-----[80%] 2. No I don't know it--[20%]
7	Do you want to keep your cultivation right in Muzi Cyeru future? 1. Yes, I want to keep it always in the future even if rice yield is poor. -[100%] 2. Yes I want to keep it always in the future by planting vegetables.-----[0%] 3. No, I don't want to keep it if profit is poor such as the 1st rice farming in Muzi Cyeru.[0%]
8	Do you know JICA's other supporting project like "Shallow well irrigation" for vegetable cultivation in Ntarama Sector? 1. Yes I know well -----[10%] 2. Yes I heard it but I don't know about details-- [80%] 3. No I don't Know at all [10%]
9	Are you interesting in shallow well irrigation project so as to apply for Muzi Cyeru Marshland future? 1. Yes [90%] 2. No [10%]
10	Do you get positive impression or negative impression on Muzi Cyeru Marshland rice project? 1. I got positive impression -----[0%] 2. I got negative impression-----[0%] 3. It is too early to conclude and verification study should be continued. [100%]
11	Please give your any comments on JICA Muzi Cyeru Rice Project? 1. JICA should support the Muzi Cyeru Group about rice cultivation (O&M cost of pump, fuel, seeds, fertilizer and agro-chemicals) until the fund for forming cooperative is saved. 2. Rice cultivation is very important in rural life from a view of food security. 3. If gravity irrigation is applicable to Muzi Cyeru Marshland, the beneficiary farmer could continue rice cultivation and want JICA Study Team to support.. 4. Although we are not familiar with shallow well irrigation method, we want to apply it to farming if water is secured beside the paddy field. 5. It is not necessary to stop rice cultivation and which is very important for local population. 6. Gravity irrigation method should be essential. 7. JICA scheme plays an important role for local population and JICA should support us about fuel for pump irrigation until gravity irrigation method is applied. 8. If possible, irrigation rice by gravity method is preferred under support of JICA. 9. Introduction of rice farming to Muzi Cyeru by JICA is very important for the local population and we want to continue rice cultivation after JICA scheme is phased out. 10. It is not necessary to continue rice cultivation together with other crop, and we want to continue only rice cultivation if possible.

The beneficiary farmers show their intention to keep usufruct in Muzi Cyeru marshland. Even though some contradiction between question No.5 and No.7 was observed; however, considering of No.11's answer together, it emerged that the beneficiary farmers basically wanted to continue rice farming.

Question No.3 regarding formation of Muzi Cyeru Rice Cooperative or Muzi Cyeru Agricultural Cooperative, the six of the 10 sampled farm households declared against formation of Cooperatives. The reason why they become opponent voter was due to too small of the newly consolidated paddy field and difficult to cultivate vegetables together with rice unless expansion of cultivated area by external support. As for vegetable cultivation, one of the Muzi Cyeru Rice Association Member started tomato cultivation beside the paddy field, thus it appears to be opponent farmer's motivation. As for irrigation method, Muzi Cyeru Group strongly want gravity irrigation method and regarded its difficulty of pump irrigation method in terms of sustainability.

4) Break-Even Point by pump irrigation method

In the countermeasures mentioned in the issues to be considered (later), break-even point of paddy yield and pump fuel cost was analyzed. Agricultural Development Project in Muzi Cyeru marshland is unable to apply gravity irrigation method because of the marshland directly being influenced by Akagera river water system (later). In this analysis, Break and Even Point (BEP) was analyzed with input cost like pump fuel, fertilizer and agro-chemicals, and sale amount of paddy rice without consideration of O&M and labor cost of cultural practice. In addition to this condition, fuel cost with several different cropping patterns by early and late mature varieties were examined as below.

a) Monthly fuel consumption of pump

The table below showed the consumed pump fuel in the 1st rice farming in 2007 season. The amount consumed in the July-August was mainly used for leveling and puddling work. Some fuel amount in August included pump irrigation for the nursery management, but mostly leveling work was significant. Transplanting operation was completed on early October and JICA Study Team returned home, thus purchase of fuel was hindered in October but November and December changed around 60 liters per month. From this tendency of monthly consumption, daily consumption was regarded as 2 liters and used for the norm of fuel estimation by each cropping pattern.

Table 6.5.17 Record of Fuel Consumption

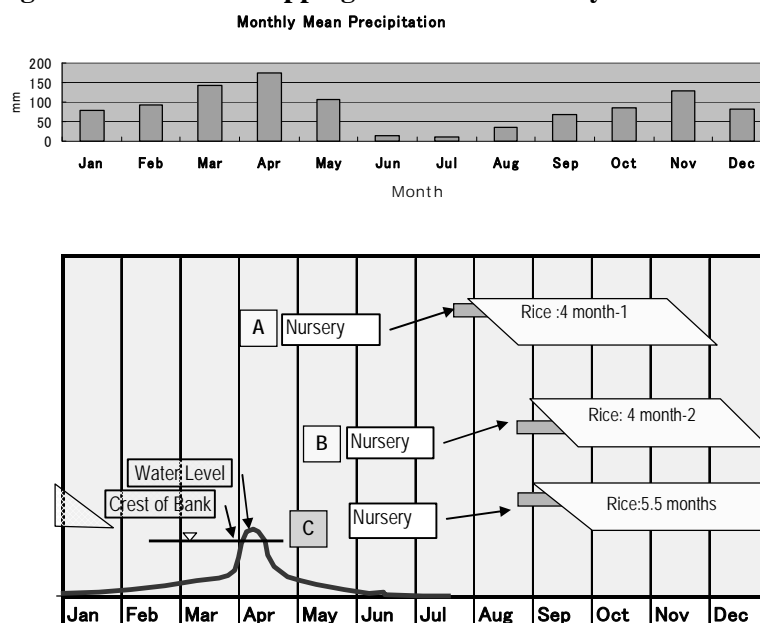
2007 Season							
No	Month	Day	Litter	By Month	cost	sub-total	Remark
1	7	27	20	20	617	12,340	
2	8	9	20		617	12,340	
3		10	20		617	12,340	Sowing on Nursery
4		17	20		617	12,340	
5		31	20	80	617	12,340	
6	9	14	20		617	12,340	Transplanting (9/2~)
7		24	20		617	12,340	
8		28	20	60	617	12,340	
9	10	1	20		637	12,740	Completion of trasplanting
10		2	20	40	637	12,740	
11	11	20	20		637	12,740	
12		22	20		637	12,740	
13		26	20	60	637	12,740	
14	12	1	23		637	14,651	
15		5	20	63	637	12,740	
16		20	20		682	13,640	
17	1	40	40	40	682	27,300	
			363		計	230,751	

Source: JICA Study Team, 2008.

b) Consideration of Cropping Pattern

Possible cropping pattern related to flood cycle of Muzi Cyeru with rainfall pattern is confined to single cropping from the season C to the season A (short rainy season). To minimize fuel consumption of pump irrigation, planting of early matured variety (4 months maturity) is best so as to use rainfall as much as possible during the rainy season. However, no early maturing variety is released in Rwanda so far, thus below three cropping patterns were examined by using NERICA (upland rice) and late maturing variety.

Figure 6.5.1 Rice Cropping Pattern in Muzi Cyeru Marshland



- 4 month variety(NERICA) : August - November period
- 4 month variety(NERICA) : September - December period
- 5.5 months variety(late maturing variety) : September to January period

c) BEP Analysis

Table and graph below show BEP of the possible 3 cropping patterns. In this analytical result, the cropping pattern of 4 month - variety from September transplanting comes out to the minimum cost with BEP of 1,720 kg paddy yield. After that, the same 4 month variety transplanting from August resulted in 1,857 kg paddy as BEP, and the late maturing variety from September transplanting resulted in 1,868 kg paddy as BEP. This result refers to the BEP when all harvest is sold out including 65,000 Rwf of milling charge with transportation cost to Ruhuha. Thus reasonable paddy yield should be necessary at least 3.2 t - 3.4 t harvest.

Table 6.5.18 Break-Even Point of Rice Production in Muzi Cyeru

Cost Items	Q'ty Unit	Sub Total	4 months	4 months CV	5.5 Month CV
			CV Sept - Dec	Aug - Nov [A]	Sept - Jan [C]
Farming period					
a. 4 months CVs			⊙	⊙	
b. 5.5 months CVs					⊙
Fuel Amt					
a. 4 months from Sept-Dec	223 Lt	206,052	206,052	240,240	243,012
b. 4 months from Aug-Nov	260 Lt	240,240			
c. 5.5 Months from Sept-Jan	263 Lt	243,012			
Fertilizer					
NPK	24,000 Rwf/50 kg	4 Bags	96,000	159,000	159,000
Urea	24,000 Rwf/50 kg	2 Bags	48,000		
Agro-chemicals					
a. Cypermetrine	5000 Rwf/1 lit	2 pc	10,000		
b. Kitazin	5000 Rwf/1 lit	1 pc	5,000		
Milling charge					
Transportation (round trip)		50,000	50,000	50,000	50,000
Milling charge (1500 kg pad: 10 Rwf/kg)		15,000	15,000	15,000	15,000
Total			430,052	464,240	467,012
Paddy Rice Price	250 rwf /kg	Equivalent to paddy wt.(l)	1,720.2	1,857.0	1,868.0

Source: JICA Study Team, August, 2008

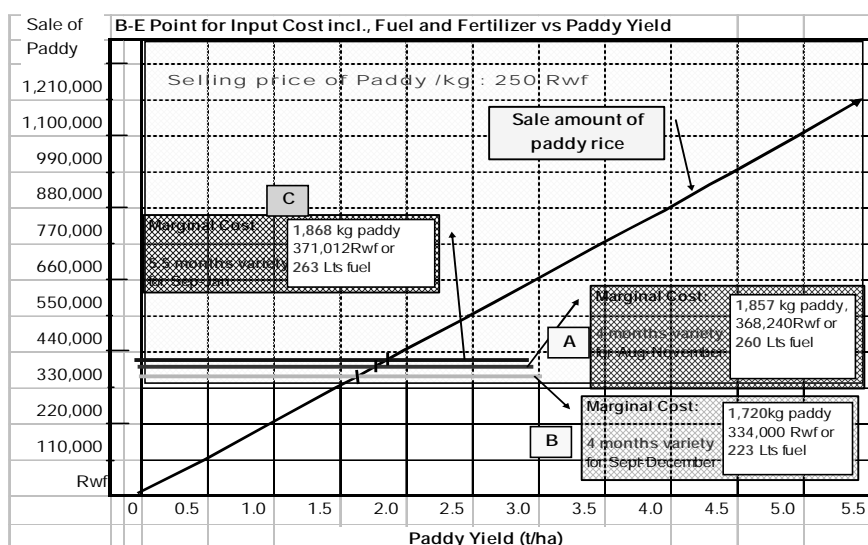


Figure 6.5.2 BEP of Fuel Cost and Paddy Yield

(5) Result of the Final Evaluation Workshop

The final evaluation workshop was held on September 12, 2008 under participation of Muzi Cyeru beneficiary farmers, Cell/Sector staff concerned. This evaluation workshop was aimed at four objectives as below. (See Annex VI.6.5.5 for details.)

- Reviewing of the first rice cultivation and some issues about soil and water quality in rice farming in Muzi Cyeru marshland.
- Briefing of break-even point of pump irrigation for rice cultivation
- Possibility of shallow-well irrigation for Muzi Cyeru Marshland farming activity
- Management and efficient use of Muzi Cyeru Pilot Farm

Above 4 agenda, the first 2 agenda were already fed back to the beneficiary by briefing the chronological farm operation of the 1st rice farming, result of paddy yield by plot and necessary paddy yield by BEP analysis.

As for the shallow well irrigation, Kanzenze Cell Staff who supported the beneficiary during the quick project implementation gave a lecture possibility of shallow well irrigation method to Muzi Cyeru marshland from rice to vegetables cultivation. With regard to the last agenda, the result discussed in the WS was summarized as below.

(a) Confirmation of Beneficiary's Intention to continuation of Rice Farming

The result of the questionnaire survey which was done prior to the WS was cross checked by asking all participants in the WS. As a result, the answers to question No. 3 and 7 in aforementioned in (4)-3) were reversed as below.

Table 6.5.19 Revised Answer to the Question No.3 and 7

No	Question	Answer
3	Intention to form Muzi Cyeru rice cooperative or Muzi Cyeru Agricultural Cooperative	Agree [●] Not agree[]
7	Do you want to keep your cultivation right in Muzi Cyeru future?	1. Yes, I want to keep it always in the future even if rice yield is poor. -[0%] 2. Yes I want to keep it always in the future by planting vegetables.-----[100%] 3. No, I don't want to keep it if profit is poor such as the 1st rice farming in Muzi Cyeru.[0%]

The reason why the answer of No.3 was changed from opposite to agree resulted from the dominant opinion that group activity besides rice farming was convenient as cooperative organization. Also in the question No.7, the beneficiary changed to keep cultivation right by planting vegetables from rice in future appeared to be originated from the effect of lecture about shallow well irrigation.

(b) Framework of Management and Efficient use of Muzi Cyeru Pilot Farm

The JICA Study Team is scheduled to return home on early October, 2008 and Muzi Cyeru Group discussed about management framework of Muzi Cyeru beneficiary group on O&M of the PF

facility, pump fuel and group fund, and the result was summarized as below.

Table 6.5.20 Management Framework of Muzi Cyeru Marshland

No	Agenda	Decision made
1	Key Beneficiary in charge of new developed plot (No.18,19,20)	Newly developed plots were cultivated with NERICA for No.19 and 20, vegetables for No.18. These plots were allotted to individual beneficiary so as to make responsibility clear and the following beneficiaries were appointed. Harvest belongs to each individual beneficiary. No.18 Vegetable plot by Karinganire No.19 NERICA by Kayitavu No.20 NERICA by Karinganire
2	Fuel Fund Management	Support of the fuel on pump irrigation was decided up to January 2009 from October 2008 after JICA Study Team returned home. The fuel fund is managed together with the president and treasury of the Muzi Cyeru Rice Association by opening a bank account under the name of the association.
3	Management of the renovated storage	The storage under renovation by JICA Study Team was managed by Cyeru Umudugudu at present. In the WS, Kanzenze Cell staff announced the storage is exclusively for Muzi Cyeru Rice Association use. The key including spare keys are managed by Association leader and board members.
4	Management of Farming implements and tools supplied by the Muzi Cyeru marshland Agricultural Project	-Materials and farming implements stored at Kanzenze Cell Office are transferred to the new storage just after renovation work is completed. -Pump itself is kept by certain individual house due to insecurity of the storage.

(6) Issues on Implementation of Marshland Agricultural Development Project

1) Matrix of Issues for tackling

The issues on the marshland agricultural development emerged after completion of the first rice cultivation followed by land consolidation work of new paddy fields as a part of marshland agricultural development. The issues were summarized as below.

Table 6.5.21 Future Issues for Tackling

Issues of agricultural civil engineering	Outline	Result	Countermeasure
1 Lack of hydrological data	-Flood water level of Muzi Cyeru marshland is directly influenced by Akagera river water system. -However, the data of water level record is nothing, thus crest of bank was forced to decide based on empirical knowledge of local farmer.	-At the peak of water level on early April, 2008, it overflowed the bank into paddy fields and entirely submerged. Max water level was around 10 cm higher than the crest of the bank and the west road of the paddy field was entirely submerged.	-Crest of the bank should be constructed higher than flood water level. -This bank could protect flood water from outside but flood caused by raising of ground water level appeared not to control. This is easily assumed based on the shallow well water level raising in Muzi Cyeru marshland. -Function of the bank is confined to management of the paddy fields.
2 Handling of surface soils	-Pilot farm was consolidated without handling of surface soils due to cutting and banking by manpower under time constraints framework.	-Rice canopy showed great wave due to uneven soil fertility. -The depression place where is filled with surface soils showed very vigorous	-Handling of surface soils should be examined under a framework of time and budget availability. -In case of difficulty of handling of surface soils, uniformity cultivation should be practiced

Issues of agricultural civil engineering		Outline	Result	Countermeasure
			growth. Contrarily, the place where was not treated with handling of surface soil showed dwarf growth (See Fig 6.6.7)	over several years to make soil fertility homogenized.
3	Irrigation method	-In a view of topographical condition, gravity irrigation is not applicable to Muzi Cyeru Marshland, thus pump irrigation is applied.	-The cost for pump O&M and fuel were financed by JICA Study Team, and the beneficiary farmers could not afford it.	-Break-even point analysis about yield and pump irrigation cost is practiced.
4	Various verification trials shall be carried out.	No observation station for hydrological data is existed in the area.	An elevation about road, canal and paddy field were estimated based on ample experience of JICA Study Team.	Introducing simple hydrological recording equipment and continuing to observe hydrology, appropriate land consolidation work become possible.
Agronomic issues		Outline	Result	Countermeasure
1	Diagnosis of soil fertility by analyzing soil and water quality	<ul style="list-style-type: none"> • At the land consolidation stage, 3 soil samples were submitted to Soil lab in ISAR Butare for analysis of major element +Fe. • Water quality is not analyzed. 	<ul style="list-style-type: none"> -The elements requested for analysis was not completed due to lack of reagent such as Fe element. -Physiological disorder on plant growth was severely observed. -Much empty grains were observed. - Outbreak of many diseases were observed due to poor soil environment (See Fig.6.6.8). 	- Soil samples including water samples should be submitted to external soil lab which is reliable.
2	Practice of uniformity cultivation	- Due to limited field survey period, rice cultivation was started from the first year.	- Severe uneven growth on rice plant was observed. Further, physiological disorder on plant growth in poor soil was induced as well.	-Uniformity cultivation is essential for the newly consolidated plot without handling of surface soils. -Necessary period to homogenize soil fertility by uniformity cultivation should be verified.
3	Various verification trials should be carried out.	- Due to time constraints of limited field survey period, standard farming technology is applied to rice cultivation.	- As mentioned before, many problems on plant growth were observed such as physiological disorder, uneven growth, disease and many empty grains.	-Research approach until production is put on the profitable track is very important as below. <ul style="list-style-type: none"> a. Fertilizer trial b. Soil improvement trial c. Variety/sowing date trial d. Variety test e. Introduction of paddy NERICA f. Saving culture trial on paddy rice



Rice plant growth at point of banking surface soils to depression. Canopy is vigorous and plant growth at cutting place show dwarf growth.



Plant growth condition where banking of surface soils to existing ditch. Canopy shows vigorous growth.



Physiological disorder on nursery caused by paddy soils

Figure 6.5.3 Uneven Plant Growth caused by uneven Soil



Serious plot of physiological disorder



Infected plant caused by poor soil environment



Physiological disorder caused by poor soil

Figure 6.5.4 Physiological Disorder and Disease caused by Poor Soils

2) Prospect

These issues are unable to verify under limited time and budget of the development study. Meanwhile, marshland agricultural development is one of key agricultural policy in Rwanda. However, this marshland agricultural development project is the first trial practice by JICA in Bugesera District, and these issues should be a valuable guideline for future marshland agricultural development project. Therefore, the present pilot project is preferred to be continued by ODA scheme like a technical cooperation project after the development study.

6.6 Hilly Terrain Agricultural Development Project

6.6.1 Background and Objectives of the Project

(1) Background of the Project

As a result of inhabitant's WS held in each Cell (in the second field survey held in January 2007), the following items were made clear on current issues and needs of agriculture on Hilly Terrain; i) shortage of irrigation water, ii) runoff loss of soil and subsequent deterioration in soil fertility, iii) low crop yields due to lack of knowledge/ information on properly cultivated crops etc.

(2) Objectives of the Project

With a view to ameliorate the above-cited state on hilly terrain agriculture, the objectives of this Project were placed on 1(-to pursue stabilized food security by stabilized crop cultivation through

supplemental irrigation during rainy season, 2-) to envisage improved livelihood by means of cultivating cash-crops through small-scale irrigation during onset of dry season, through the construction and utilization of small-scale reservoirs (farm ponds, hereinafter referred to as FP). At the same time, technical transfer was provided on the methodology of design/ implementation for manual construction of FP, also on conservation measures for ambient environment required by the construction of FP.

6.6.2 Plan of Operation and Results

(1) Plan of Operation for the Project Implementation

The plan of operation or time schedule of the project implementation is tabulated as follows:

Table 6.6.1 Plan of Operation of Hilly Terrain Agricultural Development Project

No.	Contents of Project Activity	Period	Stage on the Study
1	Kickoff-Workshop	June 2007	3 rd Field Survey of 3 rd Year
2	Construction of Farm Pond, Execution of Anti-leakage treatment work-1	From July to Sep. 2007	Ditto
3	The FP experienced 1st minor rainy season (season A)	From Nov. to Dec. 2007	4 th Field Survey of 3 rd Year
4	Implementation of anti-leakage treatment work-2	From Dec. 2007 to Feb.2008	Ditto
5	The FP experienced 1st major rainy season (season B)	From Feb. 2008 to May 2008	Period of absent of the Study Team
6	Investigation of FP condition after season B	June 2008	5 th Field Survey of 4 th Year
7	Implementation of anti-leakage treatment work-3	From July to Sep. 2008	Ditto
8	Establishment of Water Users Association	From Aug. to Sep. 2008	Ditto

(2) Result

FP for small-scale irrigation have been constructed at 22 sites through the schedule as tabulated above in Ntarama Sector including operation work against water leakage from FP and Water Users Associations (hereinafter referred to as WUA) have been established for each FP.

According to plan of operation of the Project, implementation processes and remarks to pay attention are briefed as follows.

Table 6.6.2 Processes of Project Implementation

(1) Survey / Planning	Selection of sites for implementing the Project, Kick Off workshop
(2) Construction works	Determination of technical standard, Construction of FP
(3) Monitoring & measures	Technical issues and countermeasures (water leakage), Institutional issues and countermeasures (Operation and Maintenance, Organizing beneficiary)
(4) Technical transfer & others	Technical transfer, Use of locally applicable techniques, environment consideration
(5) Provision of technical guidelines	Provision of technical guidelines in which contents of components by implementation stage and points to be regarded

(1) Survey / Planning

1) Selection of project sites for implementation and their current state

Out of the 44 candidate sites recommended by each Cell and Umudugudu, 22 project sites were selected, witnessed by Cell staff, Umudugudu representatives and concerned landowners taking topography, state of watershed in hinterland, mechanical soil properties etc. (by the 2nd field study in June 2007, refer to Annex VI.6.6.1.).

Out of the selected 22 sites, all the sites are privately owned land except the site of Rugarama, Cyugaro Cell, that is owned by Ntarama Sector. Current land use of the ten sites have been arable land under maize, sorghum, banana etc., meanwhile there were 12 wasted land (refer to Annex VI.6.6.2.).

2) Project Kick Off Workshop (WS)

Prior to the start of the PP, WS were held in each Cell where the project goals, methodology of promoting progress of the Project were consulted (19th - 22nd June 2007). Participants of WS consisted of Cell staff, representatives of Umudugudu, landowners of planned project sites, representatives of users of FP after the construction etc. (46 staff from Cyugaro Cell: 37 staff from Kibungo Cell: 48 staff from Kanzenze Cell). Major contents of consultation and remarks identified in WS comprise the following 7 items.

(a) Land ownership of the project sites

Since all of the project sites except one site belong to privately owned land as mentioned above, it is required to clarify the proprietorship prior to the project implementation. The following items were identified as a result of discussions and consultations among participants in WS, as a memorandum among 4 types of stakeholders, i.e., land owners of the project sites, representatives of Umudugudu, Cell offices and Ntarama Sector (refer to Annex VI.6.6.3.).

Detailed memorandum on land ownership

- The landowners of the project sites provide their land free of charge to Umudugudu to which they belong in constructing FP.
- During the period of utilizing FP after the construction, the land ownership continues to belong to Umudugudu.
- In the case that agreement is made among the stakeholders on discontinuation of use of FP in the future in their consultation, the land ownership of the FP site will be returned to the current owners.

Also, consultation on whether the compensation for the provided farmland for constructing FP should be paid or not was made. As the result of explaining the nature of the project to the stakeholders, namely that this Project was implemented to verify how to develop agriculture and benefit of participating beneficiary farmers in the Study Area, and also that the Project conformed to performance contract by Bugesera District, it was agreed that such a compensation would not be applied to land provision.

(b) Cost sharing / work sharing

The Study Team requested the participants in this Project sharing of costs and works. This request aims at the sustainability of the Project activities through its implementation on the initiative of the inhabitants, thereby pursuing the reduction of the project cost as far as possible. As to labor contribution to the Project in general, it was decided that voluntary labor is provided in each Umudugudu within Project beneficiary. As to the provision of equipment/ material for construction, result of the consultation was led to the sharing as given in the following table.

Table 6.6.3 Draft Agreement on Role Sharing concerning FP Construction

Item	Umudugudu/Beneficiaries	JICA Study Team	Others(Masonry)
Tools/Material	Water, Hoe, Machete, Axe, Jerrycan, Metal Basin, Euphorbia, Wood	Shovel, Pick, Wheelbarrow, Hammer, Strings, Cement, Sand, Stone, Wire, Iron bar, Chisel, Peg	Level, Trowel, Measure tape, Ruler
Personnel	Casual labor (20 people), Assistant Supervisors	Supervisors, Masonry	

(c) Consultations on leakage preventive measures for water storage in FP

In common, such measures are counted for water leakage preventive measures as site (field) ground compaction at the bottom and at embankment of the ponds, surface sealing by smearing clay and other impermeable material, sheeting with engineering blanket/ canvas sheets and concrete lining etc. Considering future sustainability of the Project on the initiative of inhabitants, it is essential to find engineering technology and measures infinitely approaching “zero cost” as far as construction cost is concerned. In this context, the construction costs for the above-exemplified methods are gradually expensive in this order. For this reason, field ground compaction was adopted in this Project, and it was agreed that monitoring the outcome of the work at post-rainy season period, the relevant measures for water leakage prevention is approached.

(d) Implementation system of FP construction

Implementation system of FP construction was planned in a way that the supervisor of the construction works employed by the Study Team and the representatives of each Umudugudu will jointly supervise works on the sites, thus transferring techniques of earthen work engineering to the participants thereof (refer to Annex VI.6.6.4).

(e) Management of material/ equipment for construction

Incomplete / poorly responsible management system for material/ equipment for construction supplied by the Study Team as a lesson learnt in the 2nd field study. (for example, equipment left broken or missing/ disappeared). By this reason, it was agreed that each Umudugudu manages material/ equipment during the FP construction period, and after the completion of FP construction, all of them should be returned to the Cell office concerned so that the office can manage them.

(f) Safety measures

Since a FP is 2.5m deep with effective water depth of 2m, it has been decided to construct a safety fence around the FP as safety measures for FP users etc (by utilizing natural vegetation of Euphorbia thriving in the sites). In constructing this fence, it was agreed to apply Umuganda currently exercised in Rwanda.

(g) Formulation of Plan of Operation for the construction of FP

Participants in WS formulated plan of operation for FP construction. As a result, FP construction works were initiated from early July 2007, with an operational plan taking about 6 - 9 weeks to complete the works.

(2) Construction Works

1) Natural conditions of FP construction sites and size, structure and conditions for applying structures by type

Taking current state of ground slope at FP construction sites into consideration, size of FP by type and dimensions of basic design structure to be applied are given as follows:

Table 6.6.4 Size of FP by Type and Dimensions of Basic Structure

Type of FP	Size / dimension (in meter)				Structure
	Pond area m ²	Water surface	Depth m	Effective storage m ³	
T ₁	4.0 * 4.0	11.5 * 11.5	2.5	116	Excavated, embankment slope 1:1.5
T ₂	2.5 * 6.5	10.0 * 14.0	2.5	120	Excavated, embankment slope 1:1.5
T ₃	3.5 * 5.5	10.5 * 13.0	2.5	120	Excavated, embankment slope 1:1.5
Others	Variable depending on site conditions			Around 120	Variable depending on site conditions

T₁ : topographic gradient < 3°, T₂ : topographic gradient 3°~8°, T₃ : topographic gradient > 8°

Likewise, conditions and ranges for applying structures by FP type in terms of soil mechanical conditions at construction sites are shown in the following table.

Table 6.6.5 FP types by Conditions (1)

Type of FP	Shape of FP	Conditions for applying types, range	
		Topographic gradient	Embankment slope (Common to each type)
T ₁	Square	Gentler than 3°	Ordinary earth: 1:1.5 ~ 1:1.0 Soft & hard rock: 1:1.0 ~ 1:0.7 Max. cutting height: 2.0 ~ 2.5m
T _{2, T3}	Rectangular	About 5° ~ 8°	
	On contour line	Steeper than 8°	
	Division into plural ponds		

2) Construction of farm pond (FP)

Construction works for FP initiated in early July 2007. All the works were manually operated, starting and proceeding one after another with the sites where surface soil had earlier been removed or ground had been leveled, completing the scheduled works at all 22 sites by mid-September 2007. (See Annex VI.6.6.5 for details.)

(a) Progress of FP construction

Progress of FP construction works depended not only on the number of participants in the construction works but also on the natural conditions of the sites (soil physical property, topographic gradient etc) as well as capacity of Umudugudu leaders who supervised the works, leading to fairly different rate of progress. According to records of works at the sites, number of days taken for facility excavation works was averaged at 28 days for all the sites. Observing the difference in progress by the condition on soil mechanical property that particularly influences the progress of the works, the required periods for excavation on ordinary earth and hard/ heavy soils were 23 days and 32 days, respectively (taken as average) (refer to Annex VI.6.6.4).

(b) Quantity of works for FP construction and input cost (initial investment amount of Hilly Terrain Agricultural Development Project)

Based on the quantity of works and input costs, the input expense per 1m³ of stored water created by FP construction was estimated at 7,100 Rwf including expenses for implements of construction works that constitute initial investment. Also, in the case that the expenses incurred for construction implements were deducted the input cost per 1m³ of stored water was 5,500 Rwf, while the mean construction cost per FP with average water storage capacity of 120m³ amounted to 664,000 Rwf.

Further, the cost per FP at the sites where plastic sheets were laid later as the measure for water leakage comes to 1,008,400 Rwf, and if the cost for construction implements is added to this figure, the input cost per 1m³ of stored water is amounted at 8,400 Rwf, while in the case of deducting the cost for implements it comes to 6,800 Rwf.

(3) Monitoring and the Measures

Monitoring of this Project has been carried out as follows:

Table 6.6.6 Monitoring plan on Hilly Terrain Agricultural Development Project

Period of continuing of monitoring	Item of monitoring
From the construction period of FP to the end of the Study period	<ul style="list-style-type: none"> ▪ Possibility of manual FP construction ▪ State of water storage in FP ▪ Measures to prevent leakage from FP and their effect ▪ O.M and establishment of management organization ▪ State of water use at FP etc.

From the result of monitoring after the completion of FP construction, technical issues (water leakage from FP) and institutional ones (operation and maintenance, herein after abbreviated as O.M) were made clear.

1) Technical issue and countermeasures

Issue of technical aspect was water leakage from FP. For this reason, countermeasures works as tabulated below were operated. The following refers to the counter-leakage works applied to FP by

stage of implementation.

Table 6.6.7 Preventive Measures against Water Leakage & Summary of their Effects/Results

Period of operating treatment works	Implemented counter leakage works	Effects / outcome of the implemented works
<Treatment work-1> The 3 rd field study in the 3 rd year (July ~ September 2007, Implemented simultaneously with FP construction)	Coincided with FP construction, present ground (bottom and embankment) was treated with manual compaction. Also, at Gasagara site, measures of smearing clay (about 5cm thick) were taken.	<ul style="list-style-type: none"> ▪ Because the work was applied in dry season, no sufficient rainfall took place for water storage, thorough verification has not so far been made. ▪ Even in the case that rainwater by intense rainfall was stored, about 3 days of storage at longest was observed only.
<Treatment work-2> The 4 th field study in the same year (December 2007 ~ February 2008)	Using locally available material, 3 different types of treatment works were implemented (see below in detail).	<ul style="list-style-type: none"> ▪ Fair extent of effect was observed recording at longest about 2 weeks of flooding, but all the ponds failed to sustain water storage up to dry season.
<Treatment work-3> The 5 th field study in the 4 th year (July ~ September 2008)	A kind of treatment work using plastic sheets was operated (see below in detail).	<ul style="list-style-type: none"> ▪ As of September 2008, stored water was retained at the sites where treatment works had been completed (though water depth was about several ten cm) . In some sites inhabitants living near the ponds utilized stored water.

(a) <Treatment work-1> Implementation of the work and the result

After implementing anti-leakage work by field compaction treatment work-1), water storage state of all the constructed FP was surveyed at the beginning of the 4th field study. The result of this survey showed that leakage still continued at Gasagara site even though some effect of smearing clay was identified as compared with the state of other FP. In the meantime, only 3 opportunities were bestowed as comparatively intense rainfall out of the total rainfall occurred during this period, namely October 25th 2007 (for 1.5 hours during 11:00~12:30), November 12th 2007 (for 1 hour during 15:30~16:30) and November 13th 2007 (for 3.5 hours during 4:30~8:00) , while all other rainfall records were negligible (shorter time with low intensity).

Under such meager rainfall, traceable rainwater storage was identified for a few times, however, stored rainwater was lost unused through vertical percolation and surface evaporation within 3 days at longest. Considerably intense rainfall took place on 15th January 2008 (for 3 hours during 7:00~10:00) though it didn't cause flooding for storage in FP.

(b) <Treatment work-2> Implementation of the work and the result

It is desirable to adopt cheap and easy measures as countermeasures for leakage in FP, considering that inhabitants are hereafter engaged in repairing of facility and operation/maintenance of FP. Therefore, material to be utilized for water leakage treatment should basically be readily available and it is considered realistic to make use of clayey soils, the deposit of which is frequently found in marshland. This is why the following implementing principle has been adopted in <Treatment work-2>.

Implementing principle of treatment work -2

- Water sealing material (clayey soils, fine textured soil) is lined/ smeared over the bottom (bed) of FP.

Since no improvement was resulted from Gasagaro Site (KanzenzeCell) where the thickness of water sealing layer was adjusted at about 5cm for <Treatment work-1>, thicker material around 20~25cm thick is to be applied.
- Countermeasures against water leakage over embankment

In the case, similar to the measures applied for bed of FP, that clayey soil etc is lined as water sealing material over the embankment, slide at the lined surface may take place, therefore thicker lining than that applied to the bed of FP is required to avoid sliding For this reason, sacked soil is an alternative method substituting clay lining.

As to the trial of the proposed treatments mentioned above, the Study Team has no intention to present one-sided proposals, but it considers far better thoroughly consulting with the participants in the Project and prompting them to come up with their own ideas, thus trying to improve capacity of solving issues by the users of FP themselves.

Table 6.6.8 <Treatment work-2> Summary of the Measures by Type

Type of treatment work	Contents of countermeasures	Brief figure
Type 1	<ul style="list-style-type: none"> ▪ Obtaining clayey soil material in the vicinity of the site, and lining it over the bed and embankment of FP, thus forming water-sealing zone. ▪ Trial is also made employing such local, traditional skill as mixing with cow dung in the soil material ▪ Thickness of clayey soil to be smeared over the bed of FP is adjusted to about 20~25cm. 	
Type 2	<ul style="list-style-type: none"> ▪ Similar to Type 1, after forming water tight zone with clayey soil (around 5 cm thick), soil sacks packed with clayey soil is lined/ heaped over the bed and embankment, thus making FP water tight. ▪ Bag for soil sack costs 200Rwf per bag, or within the purchasing capacity of local inhabitants. 	
Type 3	<ul style="list-style-type: none"> ▪ The excavated soil during the construction of FP is packed into soil sacks, then packed sacks are heaped over the FP as practiced in Type 2, thereby trying to make FP water tight. ▪ This type of treatment can be tried in the case that clayey soil material is difficult to obtain around the site. ▪ Vinyl sheets to be used for preventing water leakage are nothing special but commonly sold and readily available kind, costing 280Rwf per 1m²). 	
Type 4	<ul style="list-style-type: none"> ▪ In the case that soil physical property is equivalent to rock or soft rock, it is recommended not to apply particular treatment but the change in the state of water storage is monitored. 	

After working the FP with the above-tabulated 4 types of treatment, the state of water storage in FP during the large rainy season falling in the period February ~ May 2008 was monitored as in the following table, failing to obtain sufficient water storage. (As to detailed state of water storage in each FP, refer to the Annex VI.6.6.5.).

Table 6.6.9 Summary of the Results of <Treatment work-2>

Item	Result observed
State of rainfall during February ~ May 2008	<ul style="list-style-type: none"> ▪ Amount of precipitation was less than ordinary year. It was particularly found from an inquiry that rainfall in April was characteristically less, otherwise, peak of rainfall commonly occur in this month.
State of rainwater storage in FP	<p>Under such climatic conditions, FP stored rainwater mainly in March and May. The state of storage is briefed in the following:</p> <ul style="list-style-type: none"> ▪ Storage in FP was observed 2~4 times in March, about 0~2 times in April and around twice in May. As the duration of storage was extended at longest 2~3 weeks, effect of <treatment work-2> was observed in all the types of FP. Namely type-1, type-2 and type-3. ▪ It was identified that in the FP where several times of full storage up to near high water level we experienced, days of retaining the storage after reaching high water level tended to be longer (at longest a bit more than two weeks, often observed in FP site with their mechanical soil property of silty loam). ▪ On the other hand, in the cases that records of stored water depth did not reach high water level, the duration of rainwater storage lasted about 2~4 days (often seen at the sites with sandy loam). ▪ Stored rainwater percolates in shorter period because, in addition to the change of soil compactness that was loosened by artificial liberation of stress through cutting (excavation), low level of groundwater makes the ground at and around FP sites difficultly saturated with soil-water ▪ In spite of prior expectation, expected runoff discharge of rainwater could not be realized due to reduced rainwater discharge within the watershed of FP sites. Lower precipitation as compared with that experienced in ordinary year, alteration of drainage system on account of road construction worked at upstream side of FP (change in exogenous /ambient environment) etc were counted as the major causatic factors of this insufficient storage in FP. ▪ Drained rainwater was not efficiently collected and conveyed to FP owing to malfunctioned conduct channels. Layout, extension length and OM of conduct channels etc are considered as the causes.

(c) <Treatment work-3> Implementation of the work and the result

Reflecting the result obtained in the above-cited <Treatment work-2>, <Treatment work-3> was operated utilizing plastic sheets, in line with an implementation principle based on the division of soil mechanical property. This treatment has been completed at 15 sites of FP as of September 2008, and the storage effect of the completed sites is to be identified during short rainy season (Season A of 2008). (See Annex VI.6.6.6 for details.)

Implementing principle of <Treatment work-3>

- At the FP sites where silty loam is dominant, finer soil particles flowing in with drain water penetrate into cavities and joints of soil sacks and their back-fill heaped on the sloppy surface of embankment through the alternate cycles of water storage and percolation occurring thereafter, thus precipitating and filling voids leading to expected effect of minimizing lateral seepage loss of stored water. Since visible indication of such effect requires passage of several times of rainy seasons, state of water storage will be monitored keeping current state as it is.
- At the sites where sandy loam predominates, it is considered difficult expecting such effect as mentioned above for a limited period. Accordingly, measures will be taken resorting to input of engineering material (plastic sheets) (= treatment work-3)
- At the sites founded on soft rock, current state will be maintained as specified in the above cases of silty loam.
- Based on the above-mentioned principle, (treatment work-3) is applied to 15 sites
- In addition, it is also important to efficiently intercept/ capture runoff water. To this end, improving measures for better water collecting function are applied to all the sites of FP (including keeping catchment area, extension/ new construction of conduct channels, grass cutting inside the channels, dredging of sedimented earth etc.)

Table 6.6.10 Result of <Treatment work-2> by site and state of implementing <Treatment work-3>

Cell Site	Soil/Type of <Treatment work -2>	State of rainy season 2008 (February ~ May)	<Treatment work-3>	
			Sheet	Leave as it is
Kibungo				
Kagoma II	SL-ML(Pebbly)/Type-1-	<ul style="list-style-type: none"> 4 times of high water level, retained for maximum 7 days Clay smeared over the embankment slid by high intensity raindrop strike sedimenting at the bottom of FP. 	✓	
Kagoma I	SL/Type-3	<ul style="list-style-type: none"> Inlet part of conduct channel (contact point of roadside drain) was kept closed, thus rainwater flow into FP is failing. 	✓	
Nganwa	ML/not treated (by local opinion)	<ul style="list-style-type: none"> Because conduct channel has not been under management, rainwater drain has not adequately been conducted into FP. 		✓
Ruhengeri	ML(pebbly)/not treated (by local opinion)	<ul style="list-style-type: none"> Water was stored 3 times in March and twice in April at the depth of 40cm Because conduct channel has not been under management, rainwater drain has not adequately been conducted into FP. 		✓
Kiganwa	ML-SL/Type-2	<ul style="list-style-type: none"> Water was stored 3 times in March at the depth of 1.5m Since rainwater drain has flown into conduct channel, the channel is considered well capturing rainwater discharge from the catchment. 	✓	
Rusekera	SR/not treated (due to soft rock)	<ul style="list-style-type: none"> Water was stored 4 times in March and once in May at the depth of about 1.5m Storage lasted for 3 days, and lost by percolation in around 4 days Since rainwater drain has flown into conduct channel, the channel is considered well capturing rainwater discharge from the catchment. 		✓
Nyarunazi	SL/Type-3	<ul style="list-style-type: none"> Water was stored twice in March and twice in May at the depth of 0.3m. Because very limited amount of rainwater drained down the conduct channels, most of stored water was considered to have flown directly into FP. 	✓	
Cyugaro				
Rubomborana	SL/Type-3	<ul style="list-style-type: none"> Water was stored twice in March and twice in April at the depth of 0.5m (up to around a half of the total depth). Retained for 3 days at maximum. Since rainwater drain has flown into conduct channel, the channel is considered well capturing rainwater discharge from the catchment, however, the channel section has already been filled with sediment. 	✓	
Gatoro	SL/Type-3	<ul style="list-style-type: none"> Water was stored once in March and twice in May at the depth of 0.8m, retained the storage at longest 3 days. Since rainwater drain has flown into conduct channel, the channel is considered well capturing rainwater discharge from the catchment. However, catchment area has to a large extent been narrowed after a road construction work done in the upstream of the catchment. 	✓	
Rugunga	ML/Type-1	<ul style="list-style-type: none"> During rainfall, only a bit of water flew down in conduct channel, so it is conceived that most of stored water flew directly into FP. 		✓
Kidudu	ML/Type-3	<ul style="list-style-type: none"> Water was stored twice in April and once in May at almost high water level, and the retention of storage lasted at longest 4 days. Since rainwater drain has flown into conduct channel, the channel is considered well capturing rainwater discharge from the catchment, however, the channel section has been narrowed by sediment. 	✓	
Kingabo	SR/not treated (due to soft rock)	<ul style="list-style-type: none"> Water was stored 4 times in March reaching almost high water level then the storage was retained at maximum 8 days. Since rainwater drain has flown into conduct channel, the channel is considered well capturing rainwater discharge from the catchment, however, the channel section has been narrowed by sediment. In addition, catchment area has been reduced after a road construction work implemented in the upstream of the catchment. 		✓

Rugarama	SL/Type-3	<ul style="list-style-type: none"> Water was stored 3 times in March and twice in April and once in May, every time up to the depth of around 1.2m, retained the storage at longest 3 days. Since rainwater drain has flown into conduct channel, the channel is considered well capturing rainwater discharge from the catchment, however, the channel section has been narrowed by sediment. 	✓	
Kayenzi	SL/Type-3	<ul style="list-style-type: none"> Water was stored 3 times in March and once in May at the depth of 0.4m, retained the storage at longest 2 days. During rainfall, only a bit of water flow down in conduct channel, so it is conceived that most of stored water flew directly into FP. 	✓	
Kanzenze				
Kabaha	SR-ML/Type-3	<ul style="list-style-type: none"> Water was stored 3 times in March and twice in May, storage accompanied overflow from the spillway, storage was retained at longest 4 days. Since rainwater drain has flown into conduct channel, the channel is considered well capturing rainwater discharge from the catchment, however, the channel section has been narrowed by sediment. 	✓	
Ruwangara	ML/Type-3	<ul style="list-style-type: none"> Water was stored 3 times in March and once in April and again once in May, storage accompanied overflow from the spillway, storage was retained at longest 6 days. Since rainwater drain has flown into conduct channel, the channel is considered well capturing rainwater discharge from the catchment, however, the channel section has been narrowed by sediment. 		✓
Cyeru	ML/Type-3	<ul style="list-style-type: none"> Water was stored 3 times in March and once in May, at the depth of around 1.0m (up to around a half of the total dept), storage was retained at longest 4 days. Flowing direction was split into two ways at the upstream side of the catchment, leading to a decrease of flow into FP to a half of hitherto flow. 	✓	
Kabeza	ML/Type-3	<ul style="list-style-type: none"> Water was stored twice in March and 3 times in April. Storage accompanied overflow from the spillway, but lasted only one day. Since rainwater drain has flown into conduct channel, the channel is considered well capturing rainwater discharge from the catchment, however, catchment area has been altered through a road construction work implemented in the upstream of the catchment, leading to a reduction of discharge toward FP as compared to hitherto experienced volume 	✓	
Karumuna	ML/Type-2	<ul style="list-style-type: none"> Water was stored once in March and twice in April, accompanied overflow from the spillway, retaining at longest 3 weeks. Since rainwater drain has flown into conduct channel, the channel is considered well capturing rainwater discharge from the catchment, however, catchment area has been altered through a road construction work implemented in the upstream of the catchment, leading to a reduction of discharge toward FP as compared to hitherto experienced volume 	✓	
Kurugenge	SR-SL(pebbly)/Type-1	<ul style="list-style-type: none"> Water was stored twice in March and once in April, with the storage depth of about 1m (at almost high water level), retained at longest 7 days. Since rainwater drain has flown into conduct channel, the channel is considered well capturing rainwater discharge from the catchment, however, drainage system at upstream side underwent change, leading to reduced discharge into FP as compared with hitherto experienced discharge. 	✓	
Nyamabuye	SR/Type-3 (soft rock)	<ul style="list-style-type: none"> Water was stored twice in March and once in May, at the depth of about 0.5m, the storage lasted at maximum 5 days. Because a part of the catchment has a channel that conveys water out of watershed, water flowing into FP has been reduced as compared with hitherto experienced discharge thereto. 		✓
Gasagara	SL(pebbly)/Type-1	<ul style="list-style-type: none"> Water was stored twice in March and again twice in May, storage reaching high water level, retained for the maximum 3days. Rainwater discharge from the catchment was much less than hitherto anticipated rate. Hence, excavation of new conduct channel should be examined. 	✓	

Remarks : As to the indication of soil mechanical property, ML stands at silty loam, SL indicates sandy loam and SR means soft rock.

2) Issues and measures in the organizational/ institutional dimension

Issues posed from the aspect of the organization of this Project lie in inert activities of the

beneficiary towards the operation and maintenance of the storage facility. During the period of absence of the Study Team, post-construction period (October - November 2007) and post-leakage treatment period (February - May 2008), operation/management of FP facilities was rather poor. Conceivable reasons of this poor approach include: significance and motivation of involvement in O.M. were not felt due to scanty, less than expected water storage attributable to water leakage from FP, lack of ownership for FP prevailed among beneficiaries, lack of leadership of Umudugudu leaders. Number of scheduled beneficiary people was too many etc. In order to solve these issues, the Study Team consulted with Ntarama Sector and the establishment of WUA was agreed.

(a) Background / process of approach

After the completion of FP construction in September 2007, approaches on the promotion of O.M activities for FP facilities, formulation of rule/ by-law for water use and establishment of safety measures are as follows:

Table 6.6.11 Process of Promoting O.M Activities

Period	Content & state of Study activities	Results, comments and remarks etc.
September 2007	Completion of FP construction	
October ~ November 2007	Almost no O.M activity by the beneficiaries was developed	<ul style="list-style-type: none"> ▪ Absent period of the Study Team ▪ No effective rainfall for water storage during late dry season
December 2007	Each FP formulated O.M plan for coming 6 months, and rough agreement on water use and safety measures were discussed and identified.	<ul style="list-style-type: none"> ▪ Implementation of anti-leakage <Treatment work-2>
January 2008	WS was held at the level of Cell to share information on the state and issues of O.M activities at each FP site.	<ul style="list-style-type: none"> ▪ Local beneficiary leaders recognize importance of O.M, while beneficiary people at large have poor understanding, thus large gap is observed between two beneficiary levels. ▪ In consequence, actual participation was less than expected in response to calls of Umudugudu leaders for the participation in O.M works. ▪ As O.M plan requiring such expensive material as cement was formulated, actual O.M stranded without any prospect of procuring material, implying tendency of a heavy dependency on the external assistance.
February ~ May 2008	O.M was almost neglected though an extent of water was stored owing to major rainy season and anti-leakage <Treatment -2>	<ul style="list-style-type: none"> ▪ Absent period of the Study Team ▪ As the causes of inertness, significance and motivation of involvement in O.M. were not felt due to scanty, less than expected water storage attributable to leakage from FP, lack of ownership in terms of FP prevailed among beneficiaries, leadership of Umudugudu leaders were lacking, Number of scheduled beneficiary people was too many etc are considered.
July ~ September 2008	Organizing water user's group for each FP <Water Users Association: WUA>, by law was established in which FP management hereafter, O.M and safety measures were explicitly described	<ul style="list-style-type: none"> ▪ Clarification of responsibility (O.M) and right (water use) through the qualification of beneficiary member. ▪ Implementation of anti-leakage <Treatment-3>.

(b) Establishment of WUA and provision of by-law

Coincided with the establishment of WUA, by-law of WUA was provided in which contents of

O.M, rule of water use within members of WUA, allocation of the harvests and safety measures were described. (See Annex VI.6.6.7 for details.)

Establishment of WUA

- Qualification of target beneficiary persons and organizing group of water users (Water Users Association: WUA) .
- Selection of the leader within the group and elaboration of the rules (such arrangements as rule on water use, on O.M, on harvest allocation, practice of safety measures etc. are registered) .

Table 6.6.12 Outline of WUA By-Laws

Item	Content of by-law
O.M	<ul style="list-style-type: none"> ▪ Ensure the FP cleaning condition (inside, outside and the FP) all the time when the area is not clean ▪ Rehabilitating the FP fence, Plastic sheeting, Repair materials ▪ Removing sediment from the FP and canal, and so forth
Water Use	<ul style="list-style-type: none"> ▪ The purpose of use of farm pond water is for crop irrigation. ▪ The farm pond water will be basically used by association. ▪ The association will be using water of 500 lit to 700 lit per day meaning using 200 lit in the morning and 300 – 500 lit in the evening.
Harvest allocation	<ul style="list-style-type: none"> ▪ First of all food security in the respective family of association members ▪ Look for the market of the produced crops in the Umudugudu ▪ Take the production to the market ▪ Purchase seeds for the next cropping as well as fertilizers and pesticides. ▪ 1/3 of the production would serve for home consumption of the association members ▪ 2/3 of the production would be sold and the income would constitute the association fund (account).
Safety measures	<ul style="list-style-type: none"> ▪ Fix a signposts preventing people from entering the farm pond ▪ Put a padlock on the farm pond gate door ▪ Sensitize people to avoid disturbing the farm pond and the plots of the WUA. ▪ Buy a notebook that would be filled every day by whoever wish to visit the farm pond and association's activities. ▪ Association members will ensure security of the farm pond.

(4) Technical transfer and others

1) Technical transfer

Technical transfer was targeted to field supervisors for construction works, Umudugudu leaders and those who were engaged in the works. At the planning stage, the Study Team provided field instruction at the sites on the selection of correct FP types judging from topographical situation etc at the sites of construction, also at the implementation stage, peg driving of the excavation area, fixed ruler stretching, formulation of plan of operation, works for preventing soil erosion, those for flow energy dissipater, fencing and other conventional engineering techniques, as well as safety measures until these target stakeholders understood the contents of transferred techniques.



Simple techniques were transferred to participants.



Works for preventing soil erosion by using grasses



Water energy dissipater by using rock/stones

2) Introduction of indigenous techniques, utilization of local natural resources and safety measures

Average depth of FP reaches 2.5m. So as to avoid such contingencies as falling down into FP under / after construction or just beginning collective use, safety fences were installed to apply around FP as a safe management of the facilities. For building this safety fences, the Team made use of traditional fencing employing low-height shrub specie (*Euphorbia tirucalli*) that is frequently found everywhere. Use of this specie does not require expense for year to year repairing work, thus enabling (zero-cost) O.M. Similarly, aiming at protection of FP embankment and preventing erosion over the ground around embankment, a specie of annual grass (*Paspalum commersonii Lam*) that is also very common in the field was planted and identified the effect thereof.

3) FP type matching topographic conditions

In the case that FP is constructed on steep slope, quantity of excavation will unnecessarily be augmented if the area of construction is enlarged to the direction of slope, or toward topographically vertical section (in this regard, all the FP adopted in this Project have dugout structure because only manual work can be applied, basically without accompanying any earth filling works at the embankment of FP). For this reason, the Team instructed through the site construction works that layout of FP along contour line was suitable. Throughout the stage of construction, it has been identified that application of rectangular shape with the longer side parallel to contour line is desirable in the case that topographical gradient exceeds about 5°.

4) Environmental consideration

(a) Spoil (surplus soil) treatment

As to treatment of spoil produced during construction works of FP (about 200m³ /site), preventive measures against drifting of spoil out of the sites of FP were taken through its utilization for the maintenance of local road, application to upland field reclamation around FP and also use as material of earth wall for house construction etc.

(b) Preventive measures against earth drifting

As regards spoil inevitably taken place from the construction of FP, because the area for banking spoil was limited at some sites, the spoil was treated filling just under the construction sites. Further, in order to prevent its drift to the downstream side of FP by rainfall runoff, fascine mattress was applied to the foot of fill embankment (hedge-shaped fence utilizing *Euphorbia* that is commonly thriving in the field). Vigorous survival and fast growing of *Euphorbia* as well as effectiveness of this shrub to check earth drifting were identified, when 4 months had passed after the construction work.

(5) Provision of a guideline

A guideline on FP construction works was provided containing a series of operations mentioned above, such as survey/planning, construction, application of locally adoptable techniques etc,

thereby offering to inhabitants as reference to hereafter project implementation.

6.6.3 Monitoring and Evaluation

(1) Method of Project evaluation (internal and external evaluations)

As adopted in the case of Quick Project mentioned in 5.6.3 (2), the method of evaluating this Project consists of internal evaluation by the beneficiaries, Umudugudu leaders and administration officers in charge of the Project and external one by the third person. The internal evaluation was carried out in the course of WS, while the external one was conducted through an independent survey by an evaluation team.

Proposal to the District Development Plan (DDP) and tasks to be addressed hereafter in terms of Hilly Terrain Agricultural Development Project will be elaborated from the result of these evaluations and also from lessons /fruit learnt from the Project implementation.

(2) Result

1) Internal evaluation -1 (evaluated by the beneficiaries and Umudugudu leaders)

In the evaluation WS, the participants discussed and evaluated the Project from the three transactions, i.e., “possibility of sustaining the Project on the initiative of inhabitants”, “measures for assisting inhabitants taken by the administration” and “method of extension and deployment by way of Farmer to Farmer”, and from other viewpoints and they elaborated/ extracted tasks hereafter to be tackled for sustaining the Project. The results of WS (held on 27th ~ 29th August 2008) participated by beneficiary farmers and Umudugudu leaders are attached in Annex VI.6.6.8. Project evaluation by beneficiary farmers and Umudugudu leaders are summarized as follows:

“Degree of inhabitant’s understanding toward the Project” was high enough to be well acquainted with the Project objectives and usefulness of FP.

Interpreting “possibility of sustaining the Project on the initiative of inhabitants” from the viewpoint of extent of difficulty to construct FP, the relative difficulty depends on relative hardness of soil mechanical property, but this is not an issue that even denies the sustainability of the Project itself because technical measures to cope therewith are available. Issue on the project continuation rather lies in provision of input implements and material etc required for the construction. Also in the debates on “from spot to an area” deployment of FP, the participants were of the opinion that construction techniques /knowledge have already been learnt and acquired and the continuous construction was possible if inputs are available. This point can be interpreted as one of the measures for hereafter assisting inhabitants by the administration.

Appropriate O.M of the facilities is one of the important elements for sustaining the Project. In this respect, comment was made in a way that “O.M was not practiced just because there was no storage in FP” on one hand, while another comment pointed out that “no instruction was issued from Umudugudu leaders” on the other hand, thus leadership affects the sustainable continuation of the

Project on the initiative of inhabitants.

As to the problem of water leakage from FP, matting with plastic sheets is applicable for addressing this problem and hereafter water use can be expected, hence it is essential to provide pragmatic system in which O.M is practiced by WUA in coordination with administration.

While mentioning acquisition of knowledge in terms of FP construction techniques and water harvesting as “positive impact”, the evaluators account the Project as the chance of earning cash income strongly characterizing the Project with the view influenced by <Food for Work> and <Cash for Work>. Inhabitant’s heavily dependent attitude on external assistance remained and there also observed conservative attitude of not voluntarily involving in the Project, hence sustainability of the Project in this regard seems skeptical.

“Negative impact” included water leakage from FP, injury damage of plastic sheets where issues from technical and social aspects were pointed out.

As mentioned above, application of plastic sheet as measures against water leakage began showing the effect in such a way that some of the sites already started use of stored water though the usable amount is very limited, implying that environment for cultivation farming to proceed to the next step is ready. Yet, verification on the durability (durable period) of plastic sheet is required. Since there is a skeptical opinion on the economic significance of the Project from the aspect of cost for purchasing new sheets by the inhabitants, possibility of thereafter sustaining the Project depends upon this economic significance. Also, monitoring the effect of water storage in the FP treated by the above-mentioned <Treatment work-2> is imperative to judge possibility of future project maintenance.

Damages of plastic sheet in the form of drilled holes were most probably sustained out of jealousy hidden backward against construction of FP and its effect of benefit, but explicit judgment is rather difficult due to failure of fact identification. Follow up from the standpoint of social organization is also required to judge “possibility of sustaining the Project on the initiative of inhabitants”

As concern “measures for assisting inhabitants taken by the administration”, assistance of supplying farming equipment/ material, extension of farming techniques and provision of various training courses are included as measures. Acquiring budget is a prerequisite precondition and this should be clearly mentioned as a proposal to DDP.

As regards “method of extension and deployment by way of Farmer to Farmer (FtF)”, if hereafter management of FP is made at WUA level, and if the effect is identified, there remains possibility by FtF. Yet, assistance by the administration is indispensable because eager requests for assistance in the form of input have issued.

As to “Feasibility of the Project”, the result of evaluation pointed out usefulness, here the feasibility can be recognized because the Project matches local needs. Nevertheless, as for its continuity

/sustainability, opinions were split in particular from the aspect of cost incurred by plastic sheets, hence hereafter attentive observation on the outcome of hitherto implemented counter-leakage <Treatment work-2> is indispensable.

With regard to “degree of attaining Project objectives” and “technical transfer”, a series of technical transfer on the construction of FP has been judged achieved. Hereafter, benefits of FP through crop cultivation should be identified.

Concerning “safety mind “, awareness of safety use of FP has thoroughly been created.

2) Internal evaluation-2 (Evaluated by administration officers)

The final evaluation WS by the administration officers was held (on 22nd August 2008, 9:00~14:30 at Mandela Village). The participants in this WS were as follows:

- Ntarama Sector Office: Executive Secretary, Civil Request (Deputy ES), Agronomist
- 3 Cell Offices: Executive Secretary, Coordinator, Secretary, Development & Economy

The result of the final evaluation by administration officers are attached in Annex VI.6.6.8. The project evaluation by administration staff in charge of the Project can be briefed as follows:

“Degree of inhabitant’s understanding toward the Project” was high enough to be well acquainted with the Project objectives and usefulness of FP.

In the item of “Positive impact by the Project”, evaluators pointed out acquisition of knowledge on the effective use of rainwater as well as economic impact through the creation of labor opportunities brought about by the construction works of FP.

As to “negative impact” they posed such technical as well as organization-managerial issues as water leakage of FP, incomplete project follow-up system. In dealing with these issues that were pointed out, measures against water leakage were addressed by matting the bottom with plastic sheets, while that against weakness of organization /management was coped with the establishment of WUA.

As regards WUA, its exigency of establishment has been reiterated in “possibility of sustaining the Project on the initiative of inhabitants” (described in former section).

In addition, failure of timely site study by the Study Team in accordance with the progress of the Project is also considered as one of major causes of delay in follow-up activities that should be examined later (after the implementation of counter-leakage <Treatment work-2>, a delay was caused for timely verification on the effect of the treatment work due to the absence of the Team throughout the main rainy season during February ~ May 2008.

As concern “measures for assisting inhabitants taken by the administration”, they appealed necessity of a permanent superintendent person for monitoring use and O.M of a FP, thus monitoring the state of WUA’s activities, instruction /advice on the establishment of follow-up system, method of O.M

of FP and of crop cultivation. As lack of transport means presently serves as limiting factor in the official activities by administration, provision of means of patrol is also one of the priority tasks. Acquiring budget is a prerequisite precondition to address these issues and this should be clearly mentioned as a proposal to DDP.

As regards “method of extension and deployment by way of Farmer to Farmer (FtF)”, it was suggested “the trained users give training for other users (inhabitants) through Umuganda” is what the users should do through their self-help effort for making the Project sustainable. As about 600 local inhabitants took part in the works in the construction of FP, there is possibility of applying FtF in the aspect of FP construction.

As to “feasibility of project implementation” and “safety mind”, similar evaluation was herewith given as observed in the evaluation by beneficiary farmers and Umudugudu leaders.

As concern “technical transfer” through the Project implementation, it can be accounted that a series of technical transfer on the construction of FP has been fulfilled. Further, there found some replies that promotion of the Project based on inhabitant’s participatory approach could be learned through the participation in WS that have been held with inhabitants concerned in many times, thus it is expected that this way of approach is hereafter applied.

Through the implementation of the Project up till now, it can be concluded that technical environment of hilly terrain agricultural development by means of small-scale irrigated farming has been well arranged. Hereafter, it’ll be necessary to pursue further sensitization on the O.M activities by WUA in order to urge the beneficiary to practice O.M activities. Moreover, it is indispensable to continue to monitor WUA’s activities by strengthening liaison / coordination among Sector / Cell offices.

On the other hand, Sector and Cell offices have been suffering from complete lack of human resources equipped with sense of engineering or expertise in such engineering as watershed management, or those acquainted with organization’s management and strengthening, also from lack of satisfactory traffic means, requiring hereafter assistance.

6.6.4 Recommendation to District Development Plan and Further Issues

Proposal to District Development Plan (DDP) and issues to be addressed hereafter are briefed in a project sheet (draft) shown below based on fruit and lessons learnt through the project evaluations by stakeholders as well implementation of the Project thereby offering it as a guideline to review DDP hereafter (refer to section 5.9 and section 7.3.5).

6.7 Livelihood Improvement Projects

Livelihood improvement project is composed of six components; namely (1) rabbit rearing, (2) bee keeping, (3) pineapple cultivation, (4) fruit banana cultivation, (5) solar cooker and (6) simple treatment of marshland water.

6.7.1 Background and Objectives of the Projects

(1) Rabbit Rearing (Kanzenze Cell)

In Bugesera District, rabbit rearing has not been very much common as compared to other medium/small livestock such as goat and chicken. The number of rabbits reared in the district recently counts only 1,627 while the figures of goats and chickens are 71,000 and 39,700, respectively. Distribution among the 15 Sectors is attached in Annex VI.6.7.1.

At the weekly market held in Nyamata on every Wednesday and Saturday, those who sell rabbits were much fewer than the sellers of other livestock. The price of one rabbit ranged from Rwf 1,200-2,500 (depending on the body size), which is slightly cheaper than local chicken sold between Rwf 2,000 and 3,000. (August 2007) The project aims to improve livelihoods of the local people living in Kanzenze Cell through diversification of income sources with rabbit rearing

(2) Bee Keeping (Cyugaro, Kanzenze and Kibungo Cells)

Bee keeping is rather popular than rabbit rearing in Bugesera District. There are more than 2,800 bee hives in the district, but about 90% of them (2,483) are traditional beehives made from local materials such as banana leaves and timber. Modern beehives, which are more productive than the traditional ones, count only 325. Detailed distribution data of the 15 Sectors are attached in Annex VI.6.7.1.

The farm gate price of honey ranges Rwf 800-1,400 per liter, and, in many cases, the product is a mixture of beeswax and broken comb honey since many of them don't have neither technologies to separate honey from honeycomb and extractors. The project aims to improve livelihoods of the beekeeping farmers through introduction of modern bee keeping.

(3) Pineapple Cultivation (Kanzenze and Kibungo Cells)

In Bugesera District, avocado is the most popular because its annual production amounts to 3,800 tons, the largest production among the five fruit crops. Mango, orange and passion fruits are following with the annual production of 2,056 tons, 687 tons and 114 tons, respectively. Pineapple production records at the fifth rank with 84 tons. (Here, banana is excluded since the statistics seem to contain both fruit and cooking bananas.) Production of the 15 Sectors are shown below and Ntarama Sector is placed at the fourth rank with 7.8 tons of production. However pineapples are not commonly observed on farmlands during field observation. (See the Figure attached in Annex VI.6.7.1.)

The project aims to improve livelihoods of the local people living in Kanzenze and Kibungo Cells through diversification of income sources with pineapple cultivation.

(4) Fruit Banana Cultivation (Cyugaro, Kanzenze and Kibungo Cells)

Banana is cultivated all over the district except for the dry area around Rweru Lake, the south eastern part of the district. Total annual production of the district records 5,700 tons and, in Ntarama Sector, 256 tons of banana are produced, which is the fourth major crops after beans, sweet potatoes and

sorghum. In Ntarama, some cooking and brewery banana varieties are popularly cultivated but fruit banana varieties are not widely grown except Poyo. Some high market value varieties of fruit bananas such as Kamaramasenge and Gros Michel are not commonly grown at the moment.

The project aims to improve livelihoods of the local people living in Ntarama Sector through diversification of income sources with fruit banana (Kamaramasenge and Gros Michel) cultivation.

6.7.2 Progresses of the Projects

(1) Rabbit Rearing (Kanzenze Cell)

Because rabbit rearing has not been commonly practiced in Ntarama Sector, innovative rabbit rearing farmers don't exist within the sector, and the Study Team sought possible resource persons (trainers) outside Ntarama Sector. In the end, a monastery in Nyamata Town, the Centre Filippo Smaldone, which does rabbit rearing agreed to provide a venue for training of rabbit rearing. Together with the vet-technician who takes care of the livestock of the Centre Filippo Smaldone, the Study Team made a rabbit rearing guideline containing the following 6 items; (1) Varieties of Rabbit, (2) Shed for Rabbit, (3) How to construct Rabbit Shed, (4) Reproduction of Rabbit, (5) Feeding Rabbit, and (6) Diseases of Rabbit.

As for the selection of model farmers for rabbit rearing, the Study Team had meetings with the Kanzenze Cell officers and agreed as follows:

- Two model farmers will be selected from each Umudugudu in Kanzenze, where there are 8 Umudugudu.
- Since these farmers live shatteringly over 8 Umudugudu, they will do rabbit rearing individually, not as a group or association, after the training.
- To expand and extend rabbit rearing, the benefit sharing system will be established. (Some of the new born rabbits will be given to others within each Umudugudu after the commencement of rabbit rearing by the model farmers.)

Based on the above criteria, following model farmers were selected in each Umudugudu.

Table 6.7.1 List of Participants for Rabbit Rearing Component

Umudugudu	Model Farmer 1	Model Farmer 2
1. Rwangara	Musengamana Beline	Gasirabo Emile
2. Kabaha	Mbonigaba J. Pierre	Garukurore Ernestine
3. Cyeru	Mutimura Evariste	Hakizumwami Gratién
4. Kabeza	Kayitare René	Habyalimana Théoneste
5. Karumuna	Rugambage Emmanuel	Nyirarudodo Marie
6. Kurugenge	Hatangimana Léodomir	Mutimucyeye Elie
7. Nyamabuye	Hategekimana Ferdinand	Sengorore Alphonse
8. Gasagara	Munyakazi	Mukarubereti Elisabeth

On 10 December 2007, the training workshop for rabbit rearing was held at the Center Filippo Smaldone in Nyamata. The training program included lectures and observation of rabbit rearing. After

the training sessions, it was discussed with the model farmers how to share the necessary materials for rabbit rearing, and the following table shows the result.

Share of the JICA Study Team			Share of Model Farmers
- Timbers	- Plywood	- Nails	- Woods
- Wire net	- Iron sheet	- Rabbits	- Hinges

After the site selection of rabbit shed by each farmer on 11 Dec. 2007, both the JICA Study Team and the model farmers started procurement of materials for rabbit cages. The materials procured in Kigali were transported to Kanzenze on December 24. Since then, the model farmers had begun constructing shed and all the 16 members finished the works on 3 January. 2008. On 4 January 2008, 48 rabbits were purchased from three different places, 2 in Masaka and 1 in Nyirangarama, to avoid mating among close rabbits. Mixed combinations of the rabbits from the three places were distributed to model farmers (2 females and 1 male per household).

(2) Bee Keeping (Cyugaro, Kanzenze and Kibungo Cells)

The field survey revealed that there were three existing associations for bee keeping in Kibungo and Cyugaro Cells. Although many of the association members are engaged in traditional bee keeping, there are some farmers who do modern bee keeping with modern beehives. One farmer who started modern bee keeping in 1999 is a president of one of the existing bee keeping associations. It was also revealed that modern bee keeping needs some technical knowledge and, hence, training of modern bee keeping should be given to those who have some experiences of traditional bee keeping.

Table 6.7.2 Model Farmers for Modern Bee Keeping

Association	Name of Members / Model Farmers	
Abatarambirwa Association (Rgunga, Cyugaro Cell)	1.Iyakaremye Aphrodis 3.Rugira Jean Pierre 5.Munyankore Jean Baptiste 7.Nkomeje Jean Bosco	2.Karangwa Jean Népo 4.Muhizi Alphonse 6.Nsengiyumva Vincent
Abadatana Association (Rugarama, Cyugaro Cell)	1.Mukabukizi Angélique 3.Mukandoli Spéciose 5.Uwimbabazi Claudine 7.Murenzi Justin	2.Nkunzurwanda 4.Nkunzeyuhi Faustin 6.Uwimana Thérèse 8.Karebya Anastase
Twuzuzanye Association (Kibungo Cell)	1.Gakwisi Innocent 3.Uwingabire Jacqueline 5.Murayire Védaste 7.Mukakimenyi Séraphine 9.Umutesi Eusébie	2.Ndagijimana Thomas 4.Uwampinka Emma Marie 6.Kamanayo Etienne 8.Nyirangirumwami Astérie 10.Mwitirehe Epimaque
Not Association members, one each from eight Umudugudu (Kanzenze Cell)	1.Manzanga F.Régis (Rwangara) 3.Murenzi J.M.V (Cyeru) 5.Kanakuze Madeleine (Karumuna) 7.Maborogo (Nyamabuye)	2.Gasherebuka (Kabaha) 4.Mudaheranwa Cléophas (Kabeza) 6.Nikoruhoze Alfred (Kurugenge) 8.Gatabazi Justin (Gasagara)

Source: The JICA Study Team

Considering the above conditions, the JICA Study Team decided to strengthen the existing association members in Cyugaro and Kibungo Cells. In case of Kanzenze, where there are no bee keeping associations, one trainee would be selected from each Umudugudu, but he/she should have strong

motivation for modern bee keeping as well as experiences of traditional bee keeping. Accordingly, the 25 association members from Cyugaro and Kibungo and 8 individual bee keeping farmers from Kanzenze became the model farmers for bee keeping as shown below.

On 30 August 2007, innovative farmers and a technical assistant employed by the JICA Study Team completed making a textbook for training. 3-day training sessions were done at the Mandela Village, Kanzenze, from September 3 to 5. Following the 3-day training sessions, field practices with beehives were done on September 7 and 8.

After the 2-day practice, the model farmers and the JICA Study Team discussed how to share the materials for modern bee keeping including sheds for beehives. Although the farmers themselves would work and provide local materials such as timbers, they requested the JICA Study Team to provide roofing materials for sheds: iron sheets and nails. In consideration of security and protection of beehives from wild animals, the JICA Study Team decided to provide these materials, and construction of the sheds for beehives started in the middle of September 2007. Because there were some conflicts among the two associations in Kibungo and Cyugaro Cells, construction works often stopped but four sheds for bee keeping were finally constructed in the beginning of February 2008 and beehives were put in there one after another.

(3) Pineapple Cultivation (Kanzenze and Kibungo Cells)

As for the model farmers of the pineapple cultivation, the Study Team proposed the idea that those who had received no benefits so far from the JICA Quick/Pilot Projects could become the model farmers to the Sector and Cell Officers on 6 August 2007. This idea came from the fact that: (1) pineapples are rather suitable to be planted on hilly areas because they need less water than other crops, and (2) this means that there are a few technical pre-conditions to become the participants of pineapple cultivation. The local authorities agreed on the idea and the JICA Study Team asked the Cell Executive Secretaries to select 100 possible farmers in each Cell. (Because the original plan intended to introduce 1 ha of pineapple cultivation in each cell, if one participant receive 160 suckers/stems and plant on 100 m² with the space of 0.8m x 0.8m, number of participants amounts to 100 in each cell.) The selected participants were supposed to distribute the same number of pineapple suckers/stems to their neighbors after harvesting pineapples.

Selection of participants for pineapple cultivation was done in each Cell and Umudugudu, and the participant's lists of them were given to the JICA Study Team on 10 and 21 Aug. 2007. The study tour to the Caritas Farm in Ngeruka was conducted on 29 Aug. 2007. Because it was rather difficult to take 200 participants to the Caritas Farm in Ngeruka, the JICA Study Team requested to select 2-3 representatives of the participants from each Umudugudu. (Those who visit the Caritas Farm in Ngeruka and learned practical knowledge of pineapple cultivation are supposed to teach other participants in various Umudugudu after coming back from the study tour.)

From Kibungo Cell, 15 participants from 6 Umudugudu joined the study tour, but only 6 participants from 4 Umudugudu did from Kanzenze Cell. Although the notification of the study tour was done in the previous week, it seemed that information dissemination within Kanzenze Cell was ineffective. In total, 21 participants went to the Caritas pineapple farm in Ngeruka, and had 2-hour lecture and 1-hour field visit with an agronomist who works there.

On 4 Sep. 2007, around 9,200 pineapple stems/suckers were purchased from the Caritas Farm in Shyara and transported to the Kanzenze Cell Office. On September 11, the next batch of pineapple stems/suckers was transported to Kibungo Cell. The procurement and transportation of pineapple stems/suckers from another private farm in Ruhuha was also done, and more than 16,000 stems/suckers were unloaded at Kibungo Cell Office on September 12 and at Kanzenze Cell Office on September 13. After the transportation of stems/suckers, distribution of the stems/suckers to participants started in each Cell. On September 13, all stems/suckers were distributed to participants in Kibungo. In Kanzenze, most stem/suckers were also distributed to participants on September 14.

(4) Fruit Banana Cultivation (Cyugaro, Kanzenze and Kibungo Cells)

Originally, both fruit (higher sales price) and cooking bananas (consumed by local people) were requested to be introduced. During the meeting with the executive secretary of Ntarama Sector on 22 November 2007, introduction of three fruit banana varieties, namely Kamaramasenge, Gros Michel and Poyo, were requested. After investigating availability of suckers at Kamara Cooperative in Kirehe District, Eastern Province, the meeting with sector officials was held on November 30, and the followings were requested by them.

1. Fruit banana varieties (Kamaramasenge and Gros Michel), which are at high demand and can be sold at higher prices than cooking banana, should be introduced instead of cooking banana varieties.
2. Banana suckers should not be planted shatteringly as the same manner of the pineapple stem distribution because propagation and distribution of the introduced banana suckers would be done easily at some large farms, not at many small farms.

Based on the above requests, the two varieties, Kamaramasenge and Gros Michel, were planned to be introduced, and model farmers of banana suckers would meet the following two conditions: having a certain area of farmland for banana cultivation and consenting to distribute the same number of banana suckers received to neighboring farmers after growing banana. Selection of recipient farmers was done with a counterpart of the Study Team, Mr. MURAGWANKUKU Eric, in consultation with the Sector and Cell officials. Finally, the following farmers were selected and the number of banana suckers to be distributed was adjusted in accordance with their farmland sizes. Total number of banana suckers to be distributed to each Cell is 1,200 (600 Kamaramasenge and 600 Gros Michel suckers), which can be planted on 1-ha farmland.

Table 6.7.3 List of Model Farmers for Fruit Banana Cultivation

Cell	Umudugudu	Name	No.
KZZ	Kabeza	BIHOYIKI Odilo	350
	Kabeza	NSHIMIYIMANA J. Claude	200
	Kabeza	NTEZIYAREMYE J. Marie	200
	Cyeru	KARINAMARYO Thresphore	184
	Cyeru	GORRETI	266
CGR	Rugarama	NYINAWANKUSI Jossienne	1,100
	Gatoro	BATAMURIZA Ema	100
KBG	Nyaruanzi	RUGAMBA Splien	1,070
	Nyarunazi	YANKURIJE Forthonata / MUGABOWINDEKWE Theoneste / NGARINDE	130

Note: Each model farmer received both Kamaramasenge and Gros Michel suckers half-and-half.

After the selection of participants, the JICA Study Team asked each model farmer to start land preparation, namely digging planting holes and manure preparation. On 17 Dec. 2007, after confirmation of completion of land preparation, 3,600 banana suckers (1,800 Kamaramasenge and 1,800 Gros Michel) were ordered to the Kamara Cooperative which supplies banana suckers countrywide. The suckers were transported and distributed to the model farmers on December 20, and all the suckers were planted by the end of December.

6.7.3 Monitoring and Evaluation of the Projects

(1) Rabbit Rearing (Kanzenze Cell)

Since the start of rabbit rearing stray dogs have been a problem because they attack rabbits in cages during night. On 14 January 2008, the first attack by a stray dog, which brought loss of one baby rabbit, was reported. After the incident, the Study Team immediately advised the model farmers of the rabbit rearing component to make protection fences around their cages. On the other hand, many of model farmers started to have newborn baby rabbits. The table below indicates the monitoring result for 5-month period, from January to June 2008.

Table 6.7.4 Changes of Number of Rabbits (From Jan. to Jun. 2008)

No.	Name	Umudugudu	Number of Rabbits at the beginning	Increase				Decrease					Total No. of Rabbits	Remarks	
				No. of Births	New Born Babies	Newly Purchased	Dead Born	Attacked by Dogs/Cats	Consumed	Gave to Neighbors	Sold	Stolen			Dead by Disease, etc.
1	Musengamana Beline	Rwangara	3	5	23	0	-6	0	-1	0	0	0	0	19	Each household was given 1 male and 2 females.
2	Gasirabo Emile	Rwangara	3	6	31	1	-1	-2	0	0	0	0	0	32	
3	Mbonigaba J. Pierre	Kabaha	3	2	9	0	-4	0	-1	0	0	0	0	7	
4	Garukurore Ernestine	Kabaha	3	3	17	0	-6	-1	0	0	0	0	0	13	
5	Mutimura Evariste	Cyeru	3	1	4	0	0	-3	0	0	0	0	0	4	
6	Hakizumwami Gratién	Cyeru	3	2	6	0	-3	0	0	-2	0	-1	0	3	
7	Kavitare René	Kabeza	3	4	26	0	-10	0	0	0	0	0	0	19	
8	Habyalimana Théoneste	Kabeza	3	1	6	0	-1	0	0	0	0	0	0	8	
9	Rugambage Emmanuel	Karumuna	3	3	17	0	0	-7	0	-4	-7	0	0	2	Selling price: Rwf 500/head
10	Nyirarudodo Marie	Karumuna	3	2	7	0	-1	-1	0	0	0	0	-1	7	
11	Hatangimana Léodomir	Kurugenge	3	2	11	0	-7	0	0	0	0	0	0	7	
12	Mutimucyeye Elie	Kurugenge	3	0	0	0	0	-3	0	0	0	0	0	0	
13	Hategekimana Ferdinand	Nyamabuye	3	2	12	0	0	0	0	0	0	0	0	15	
14	Sengorore Alphonse	Nyamabuye	3	2	10	0	0	0	0	0	0	-2	0	11	
15	Munyakazi	Gasagara	3	1	6	0	-1	-1	0	0	0	0	-1	6	
16	Mukarubereti Elisabeth	Gasagara	3	2	6	0	-5	0	0	0	0	0	-1	3	
Total			48	38	191	1	-45	-18	-2	-6	-7	-3	-3	156	
Average/Household			3.0	2.4	11.9	0.1	-2.8	-1.1	-0.1	-0.4	-0.4	-0.2	-0.2	9.8	
Average/birth			-	-	5.0	-	-1.2	-	-	-	-	-	-	-	

Source: The JICA Study Team

During this period, there were 38 births with 191 newborn baby rabbits. Unfortunately, 45 baby rabbits were stillborn or dead within a few days and other 18 rabbits were lost by dogs/cats' attacks. One model farmer sold 7 rabbits at Rwf 500/head and 2 rabbits were consumed by model farmers themselves. One model farmer in Rwangara increased his rabbits from 3 to 32 in this period. As a whole, the number of rabbits increased from 48 to 156 rabbits for the 5-month period. Following table indicates the summary result for the second monitoring period, from June to August 2008.

Table 6.7.5 Changes of Number of Rabbits (From Jun. to Aug. 2008)

No.	Name	Umudugudu	Number as of beginning of June	Increase				Decrease					Total No. of Rabbits	Remarks	
				No. of Births	New Born Babies	Newly Purchased	Dead Born Babies	Attacked by Dogs/Cats	Consumed	Gave to Neighbors	Sold	Stolen			Dead by Disease, etc
1	Musengamana Beline	Rwangara	19	2	8	0	0	0	0	0	-9	0	0	18	Rwf 1,500 and 2,000 /head
2	Gasirabo Emile	Rwangara	32	1	8	0	0	-3	-1	-18	0	0	0	18	Constructed new cages
3	Mbonigaba J. Pierre	Kabaha	7	2	5	0	0	-3	0	0	0	0	0	9	
4	Garukurore Ernestine	Kabaha	13	1	5	0	0	0	0	-3	0	-1	14	Rwf 800/head	
5	Mutimura Evariste	Cyeru	4	0	0	0	0	0	0	0	0	0	0	4	Advised to buy other rabbits due to infertility
6	Hakizumwami Gratien	Cyeru	3	2	16	0	-6	0	0	0	0	0	0	13	
7	Kayitare René	Kabeza	19	1	6	0	0	-3	0	0	0	0	0	22	
8	Habyalimana Théoneste	Kabeza	8	0	0	0	0	0	0	0	0	0	0	8	
9	Rugambage Emmanuel	Karumuna	2											2	The family removed to Ngenda area.
10	Nyirarudodo Marie	Karumuna	7	1	8	0	0	-3	0	0	0	0	0	12	
11	Hatangimana Léodomir	Kurugenge	7	0	0	0	0	-1	0	0	0	0	0	6	
12	Mutimucyeye Elie	Kurugenge	0	0	0	5	0	0	0	0	0	0	0	5	
13	Hategekimana Ferdinand	Nyamabuye	15	1	2	0	0	0	-1	0	-6	0	0	10	Rwf 1,500/head
14	Sengorore Alphonse	Nyamabuye	11	0	0	0	0	0	0	0	0	0	0	11	
15	Munyakazi	Gasagara	6	0	0	0	0	0	0	0	0	0	0	6	
16	Mukarubereti Elisabethe	Gasagara	3	0	0	0	0	0	0	0	0	0	0	3	
Total			156	11	58	5	-6	-4	-10	-1	-36	0	-1	161	
Average/Household			9.8	0.7	3.9	0.3	-0.4	-0.3	-0.7	-0.1	-2.4	0.0	-0.1	10.7	
Average/birth			-	-	5.3	-	-0.5	-	-	-	-	-	-	-	

Source: The JICA Study Team

In the three-month period, there were 11 births with 58 newborn baby rabbits. The average number of stillborn babies per birth reduced to 0.5 head in this period as compared to 1.2 head in the first period. It is worthy to mention that one model farmer sold 18 rabbits in this period; hence, the total number of sold rabbits recorded 36, more than 5 times of the previous period. Also more model farmers started to consume their own rabbits since 10 rabbits were eaten at their homes. Unfortunately, one model farmer in Karumuna moved to Ngenda area so there are presently 15 rabbit rearing model farmers in Kanzenze Cell. The table below shows the overall results for the monitoring period, from January to August 2008.

To sum up the results of the 15 model farmers, following facts are obtained.

- There have been 46 births with 232 newborn baby rabbits for the 8-month period, but, among them, 51 were stillborn / dead within a few days. In addition, 15 rabbits were lost by attacks of dogs/cats.
- As for the benefits from rabbit rearing, 36 rabbits were sold and 12 rabbits were eaten by the model farmers themselves since the commencement of rabbit rearing in January 2008.

Table 6.7.6 Changes of Number of Rabbits (From Jan. to Aug. 2008)

No.	Name	Umuugudu	Distributed Number (M.L.F2)	No. of Births	Increase			Decrease					Total No. of Rabbits	Remarks	
					New Born Babies	Newly Purchased	Dead Born Babies	Attacked by Dogs/Cats	Consumed	Gave to Neighbors	Sold	Stolen			Dead by Disease, etc.
1	Musengamana Beline	Rwangara	3	7	31	0	-6	0	-1	0	-9	0	0	18	
2	Gasirabo Emile	Rwangara	3	7	39	1	-1	-2	-3	-1	-18	0	0	18	
3	Mbonigaba J. Pierre	Kabaha	3	4	14	0	-4	0	-4	0	0	0	0	9	
4	Garukurore Ernestine	Kabaha	3	4	22	0	-6	-1	0	0	-3	0	-1	14	
5	Mutimura Evariste	Cyeru	3	1	4	0	0	-3	0	0	0	0	0	4	
6	Hakizumwami Gratien	Cyeru	3	4	22	0	-9	0	0	-2	0	-1	0	13	
7	Kavitare René	Kabeza	3	5	32	0	-10	0	-3	0	0	0	0	22	
8	Habyalimana Théoneste	Kabeza	3	1	6	0	-1	0	0	0	0	0	0	8	
9	Rugambage Emmanuel	Karumuna													The data are excluded.
10	Nyirarudodo Marie	Karumuna	3	3	15	0	-1	-4	0	0	0	0	-1	12	
11	Hatangimana Léodomir	Kurugenge	3	2	11	0	-7	-1	0	0	0	0	0	6	
12	Mutimucyeve Elie	Kurugenge	3	0	0	5	0	-3	0	0	0	0	0	5	
13	Hategekimana Ferdinand	Nyamabuye	3	3	14	0	0	0	-1	0	-6	0	0	10	
14	Sengorore Alphonse	Nyamabuye	3	2	10	0	0	0	0	0	0	-2	0	11	
15	Munyakazi	Gasagara	3	1	6	0	-1	-1	0	0	0	0	-1	6	
16	Mukaruberezi Elisabethe	Gasagara	3	2	6	0	-5	0	0	0	0	0	-1	3	
Total			45	46	232	6	-51	-15	-12	-3	-36	-3	-4	159	
Average/Household			3.0	3.1	15.5	0.4	-3.4	-1.0	-0.8	-0.2	-2.4	-0.2	-0.3	10.6	
Average/birth			-	-	5.0	-	-1.1	-	-	-	-	-	-	-	

Source: The JICA Study Team

- There were differences among the model farmers in terms of multiplication of rabbits, hence, the numbers of sold and consumed rabbits varied.

Followings are the summary results of internal project evaluation workshop with the model farmers held on 11 September 2008. (Some of them had no answers for some questions.) (See Annex VI.6.7.2 for details.)

- 1) Out of the 10 model farmers, all of them thought that it was good to participate in this project.
 - ✧ Good points include; eating rabbit meat, getting income, good relation with neighbors after giving rabbits, quick benefits, getting manure, etc.
- 2) Out of the 9 model farmers, 5 thought that they received enough supports from this project.
 - ✧ Those who didn't think that support was enough wanted more material support for another cage because their rabbits increased quickly.
- 3) Out of the 8 model farmers, 5 thought that they could start this project without support.
- 4) Out of the 10 model farmers, 9 wanted to expand the present rabbit rearing activity.
- 5) Out of the 10 model farmers, 6 thought that rabbit rearing was easy and one farmer thought it was very easy. Also one farmer thought that it was very difficult.
- 6) The model farmers thought that the Cell Office should do the following things for the sustainable project implementation.
 - ✧ To organize more meetings to share the merits of rabbit rearing
 - ✧ To visit his rabbit rearing and help distribution of rabbits
 - ✧ To mobilize people and make them like rabbit rearing

- ✧ To organize workshops
 - ✧ To give technical assistance
- 7) The model farmers thought that the Sector Office should do the following things for the sustainable project implementation.
- ✧ To give technical assistance
 - ✧ To visit his rabbit rearing and check whether his rabbit rearing is well or not
 - ✧ To help organize rabbit rearing association
 - ✧ To mobilize people and make them like rabbit rearing
 - ✧ To find a veterinary
 - ✧ To help farmers to get credit
 - ✧ To support material provision
- 8) The model farmers thought that the District Office should do the following things for the sustainable project implementation.
- ✧ To find the market
 - ✧ To find support providers for farmers
 - ✧ To organize workshops
 - ✧ To support material provision
- 9) Out of the 10 model farmers, 8 thought that rabbit rearing would expand within the cell.
- 10) Out of the 10 model farmers, 2 thought that rabbit rearing would not expand within the cell because number of received rabbits was a few and more supports were necessary for another cage construction.
- 11) Out of the 10 model farmers, 6 model farmers have already started distribution of rabbits to neighbors and 3 thought that they would start distribution after getting many rabbits.

Based on the project component and the purchased materials (material cost and other miscellaneous costs such as hiring lecturers, workshop materials, stationery, etc.), project cost is derived, and benefits from the project are also estimated as follows.

Table 6.7.7 Benefit / Cost Ratios for Rabbit Rearing

Item	Unit price (Rwf)	Quantity	Amount (Rwf)	Benefit / Cost Ratio
Cost				
Unit cost per model farmer			32,713	with 1 male and 2 female rabbits
Benefit				
After 6-month rabbit rearing	1,800	9.05	16,290	0.50
After 1-year rabbit rearing	1,800	18.10	32,580	1.00
After 1.5-year rabbit rearing	1,800	27.15	48,870	1.49

Notes: Benefits are estimated based on the following assumptions: one female rabbit gives 2.3 births per year and 3.9 live baby rabbits are born per birth. (See Annex VI.6.8 for details.)

Although the benefit figures are estimations, rabbit rearing with 1 male and 2 female rabbits achieves the break-even point if a model farmer continues his/her activity more than one year.

(2) Bee Keeping (Cyugaro, Kanzenze and Kibungo Cells)

After the completion of four sheds for beehives in February 2008, empty beehives were put in there and gradually bees came to make beehives. In May 2008, there were 10 beehives with bees. They increased to 15 in June and 18 in August, partly due to the transfer of traditional beehives to modern ones. In particular, more bees came to make beehives in Kibungo and many of beehives are presently two-story there. In Rugunga, Cyugaro Cell, 2 beehives were recently abandoned because many bees were killed by the nectars contaminated with chemical insecticides. Because insecticides were used for the tomato farmland near the shed, it seemed that bees collected the nectars tainted with the insecticides from the tomato flowers and they eventually abandoned the contaminated beehives.

Table 6.7.8 Changes of Number of Beehives with Bees

Association / Group	27 May 2008	10 Jun. 2008	28 Aug. 2008	Remarks
Abatarambirwa Association (Rugunga, CGR)	0/6	2/5	3/8	2 beehives were abandoned due to the tomato flowers tainted with insecticide.
Abadatana Association (Rugarama, CGR)	0/5	0/4	3/4	
Twuzuzanye Association (KBG)	7/9	10/10	8/10	8 beehives are already 2-storied.
Kanzenze	3/8	3/8	4/8	
Total	10/28	15/27	18/30	

Followings are the summary results of internal project evaluation workshop with the association members and model farmers held on 12 September 2008. (Some of them had no answers for some questions.) (See Annex VI.6.7.3 for details.)

- 1) Out of the 16 model farmers, all of them thought that it was good to participate in this project.
 - ✧ Good points include; can develop, getting honey and/or money, getting knowledge, etc.
- 2) Out of the 17 model farmers, 12 didn't think that they received enough supports from this project. They wanted more materials such as beehives and iron sheets for sheds.
- 3) Out of the 11 model farmers, 10 wanted to expand the present bee keeping activity.
- 4) Out of the 11 model farmers, 7 thought that bee keeping was very easy, whereas 3 farmers thought that it was very difficult.
- 5) The model farmers thought that the Cell Office should do the following things for the sustainable project implementation.
 - ✧ To mobilize people for bee keeping activity
 - ✧ To show the farmers how to construct beehive shed
- 6) The model farmers thought that the Sector Office should do the following things for the sustainable project implementation.

- ❖ To help farmers to get support
 - ❖ To help bring the modern knowledge
- 7) The model farmers thought that the District Office should do the following things for the sustainable project implementation.
- ❖ To look for support providers
 - ❖ To give technical support
 - ❖ To find honey market
- 8) Out of the 10 model farmers, 9 thought that bee keeping would expand within the cell. Only 1 didn't think that bee keeping would expand within the cell because governmental organization should mobilize people.
- 9) Out of the 12 model farmers, 6 model farmers thought that they would get honey in this October. Other 5 thought that honey could be harvested in 2009.
- 10) Out of the 12 model farmers, 7 thought that over 15 kg of honey could be harvested from one 2-level beehive.
- 11) Out of the 12 model farmers, 9 thought that the expected selling price of honey ranged from Rwf 1,500 to Rwf 2,000 per kg.

Based on the project component and the purchased materials (material cost and other miscellaneous costs such as hiring lecturers, workshop materials, stationary, etc.), project cost is derived, and benefits from the project are also estimated as follows.

Table 6.7.9 Benefit / Cost Ratios for Bee Keeping

Item	Unit price (Rwf)	Quantity	Amount (Rwf)	Benefit / Cost Ratio
Cost				
Unit cost per model farmer			42,545	
Benefit				
After 1-year	1,500	13.2	19,800	0.47
After 2-year	1,500	26.4	39,600	0.93
After 3-year	1,500	39.6	59,400	1.40

Notes: Benefits are estimated based on the following assumptions: one beehive can be harvested 3 times in 2 years and 12 kg (8.8 liters) of honey is harvested per time. (See Annex VI.6.8 for details.)

Although the benefit figures are estimations, modern bee keeping with 1 beehive achieves the break-even point if a model farmer continues his/her activity more than three years.

(3) Pineapple Cultivation (Kanzenze and Kibungo Cells)

About 32,000 pineapple suckers were distributed to 200 model farmers and each of them planted on his farmland. Some suckers started to bring fruits in May 2008 but many of them are still at the growing stage. The following table shows the survival rate of pineapple suckers by Umudugudu as of August 2008.

In Kibungo Cell, the survival rate records 73% while it does 83% in Kanzenze Cell. But in Kanzenze Cell, the differences of survival rates within the same Umudugudu are larger than these figures in Kibungo Cell. Moreover, there are no specific Umudugudu where survival rate is significantly low as compared to other Umudugudu. These facts suggest that farming practices are rather important than natural conditions such as the level of soil fertility.

Table 6.7.10 Number of Growing Pineapples by Umudugudu

Kibungo Cell

Umudugudu	No. of Model Farmers	No. of Suckers		Growing Suckers		
		Planted	Growing	Average	Max	Min
Kagoma I	5	784	575	73.3%	79.3%	64.2%
Kagoma II	21	3,166	2,406	76.0%	92.9%	56.0%
Kiganwa	15	2,398	1,744	72.7%	86.2%	49.1%
Nganwa	9	1,427	911	63.8%	73.8%	50.3%
Ruhengeri	23	3,628	2,648	73.0%	88.8%	44.5%
Rusekera	28	4,405	3,261	74.0%	90.6%	59.5%
Total	101	15,808	11,545	-	-	-
Average	-	156.5	114.3	73.0%	92.9%	44.5%

Kanzenze Cell

Umudugudu	No. of Model Farmers	No. of Suckers		Growing Suckers		
		Planted	Growing	Average	Max	Min
Cyeru	37	6,744	5,703	84.6%	100.0%	35.7%
Kabaha	11	1,995	1,559	78.1%	100.0%	33.3%
Kabeza	31	6,001	5,075	84.6%	100.0%	51.0%
Karumuna	3	511	375	73.4%	95.2%	53.8%
Kurugenge	3	464	316	68.1%	90.6%	27.1%
Nyamabuye	1	160	130	81.3%	81.3%	81.3%
Total	86	15,875	13,158	-	-	-
Average	-	184.6	153.0	82.9%	100.0%	27.1%

In Kanzenze, there was some confusion when the pineapple suckers were distributed and some farmers who were not in the list of model farmers received pineapple suckers; hence, number of model farmers is only 86. Among these model farmers, those who harvested fruits are still few since 137 fruits had been harvested and self-consumed only in Kanzenze Cell but no in Kibungo Cell. Even in Kanzenze Cell, about 1% of growing pineapple (137 suckers out of 13,158 ones) had so far born fruits. Followings are the summary results of interviewing survey of 40 sampled model farmers (20 from each cell), which was done in September 2008. (See the Annex VI.6.7.4 for details.)

- 1) All the 40 respondents thought that it was good to participate in this project. Good things include free pineapple sucker distribution, getting pineapple fruits, getting knowledge on pineapple cultivation, etc.
- 2) For the sustainable project implementation, the respondents expected the Cell Offices to do the followings: to provide technical assistance, to assist establishment of cooperative or

association, to organize meetings for pineapple cultivation, etc.

- 3) For the sustainable project implementation, the respondents expected the Sector Office to do the followings: to provide technical assistance, to organize study tours or seminars, to provide materials such as wheelbarrow and manure, etc.
- 4) For the sustainable project implementation, the respondents expected the District Office to do the followings: to provide materials such as fertilizer and manure, to provide cow for manure, to provide more suckers, to provide farmponds, to provide technical assistance, etc.
- 5) In Kibungo Cell, all the 20 respondents thought that pineapple cultivation would expand within the cell, while only 9 out of 19 respondents did so in Kanzenze Cell. Many of them didn't think that the quantity of distributed pineapple suckers were enough.
- 6) In Kibungo Cell, 8 out of 20 respondents have gotten fruits so far but they harvested less than four. In Kanzenze Cell, 12 respondents have harvested fruits so far. Among them, 2 respondents had over 10 fruits and 4 had between 4 and 9 fruits. All the harvested fruits were consumed by themselves except for one sold at Rwf 200.
- 7) Among the 40 respondents, 26 expected the selling price of pineapple ranging Rwf 250 and 300 per piece.
- 8) Many respondents thought that they could start distribution of pineapple suckers from the next year.

Based on the project component and the purchased materials (material cost and other miscellaneous costs such as transportation, bags and unloading fee), project cost is derived, and benefits from the project are also estimated as follows.

Table 6.7.11 Benefit / Cost Ratios for Pineapple Cultivation

Item	Unit price (Rwf)	Quantity	Amount (Rwf)	Benefit / Cost Ratio
Cost				
Unit cost per hectare (16,000 suckers/hectare)			756,110	78% survival rate
Benefit				
After 1.5 years	150	12,480	1,872,000	2.48

Notes: Benefits are estimated that one sucker brings one pineapple in 1.5 year. (See Annex VI.6.8 for details.)

Although the benefit figures are estimations, pineapple cultivation achieves the break-even point if a model farmer safely gets the first harvest one and a half year after planting.

(4) Fruit Banana Cultivation (Cyugaro, Kanzenze and Kibungo Cells))

After planting banana suckers in the end of December 2007, it rained very little and top parts of most banana suckers seemed to be dead. From the middle of January 2008, it gradually started raining which, in turn, brought many of banana suckers revived. Following table shows the survival rate of banana suckers as of June 2008.

Table 6.7.12 Number of Growing Bananas by Model Farmer

Cell	Umudugudu	Name	No. of Banana Suckers		Survival Rate
			Planted	Growing	
KZZ	KABEZA	BIHOYIKI Odilo	350	194	55.4%
	KABEZA	NSHIMIYIMANA J. Claude	200	48	24.0%
	KABEZA	NTEZIYAREMYE J. Marie	200	54	27.0%
		Sub total of KABEZA	750	296	39.5%
	CYERU	KARINAMARYO Thresphore	184	169	91.8%
	CYERU	GOLLETI	266	215	80.8%
		Sub total of CYERU	450	384	85.3%
	Sub total of KZZ	1,200	680	56.7%	
CGR	RUGARAMA	NYINAWANKUSI Jossienne	1,100	729	66.3%
	GATORO	BATAMURIZA Ema	100	96	96.0%
		Sub total of CGR	1,200	825	68.8%
KGB	NYARUNAZI	RUGAMBA Splien	1,070	1,002	93.6%
	NYARUNAZI	YANKURIJE Forthonata	20	4	20.0%
	NYARUNAZI	NGARINDE	50	50	100.0%
	NYARUNAZI	MUGABOWINDEKWE Theoneste	60	56	93.3%
		Sub total of KGB	1,200	1,112	92.7%
	Total		3,600	2,617	72.7%

As of June 2008

In Kanzenze Cell, survival rate is relatively low, 56.7%, as compared to other two Cells. In particular, the survival rates in Kabeza Umudugudu were lower than the figures in Cyeru Umudugudu. This might result from the fact that rainy days in January 2008 in Kabeza were fewer than in Cyeru. Kibungo Cell records the highest survival rate, 92.7%, among the three Cells. But one model farmer records low survival rate, 20%, and this may suggest that careful farming practices are vital for good growth of bananas. The survival rate in Cyugaro is 68.8%, which is between Kanzenze and Kibungo.

Followings are the summary results of internal project evaluation workshop with the model farmers held on 9 September 2008. (Some of them had no answers for some questions.) (See Annex VI.6.7.5 for details.)

- 1) Out of the 18 model farmers, 17 thought that it was good to participate in this project.
 - ✧ Good points include; getting modern banana suckers, getting knowledge, can get out of poverty, etc.
- 2) Out of the 16 model farmers, 9 thought that they received enough supports from this project.
 - ✧ Those who didn't think that support was enough wanted support for wheel barrows, shovels, manure and more suckers.
- 3) Out of the 11 model farmers, 5 thought that they could start this project without support.
- 4) The model farmers thought that the Cell Office should do the following things for the sustainable project implementation.
 - ✧ To visit other fields with Agronomist and advise farmers

- ❖ To motivate people to plant bananas
 - ❖ To organize more meetings for banana cultivation
 - ❖ To give manure
 - ❖ To support livestock farming which helps to get manure
- 5) The model farmers thought that the Sector Office should do the following things for the sustainable project implementation.
- ❖ To give farmers materials (wheel barrow, shovel, manure)
 - ❖ To find the market and provide study tour
 - ❖ To advise people how to plant banana appropriately
 - ❖ To visit farmers and give technical assistance
 - ❖ To extend banana cultivation, particularly fruit banana
- 6) The model farmers thought that the District Office should do the following things for the sustainable project implementation.
- ❖ To find the market and agronomist for farmers
 - ❖ To motivate people to cultivate banana
 - ❖ To make a research on banana cultivation
 - ❖ To give materials (manure, wheel barrow and shovel) and technical assistance
 - ❖ To transform banana into more value-added product
- 7) Out of the 16 model farmers, 7 thought that banana cultivation would expand within the cell.
- 8) Out of the 17 model farmers, 7 thought that their banana conditions were very good and 6 did that they were good. Remaining 4 thought that they were average.
- 9) All of the model farmers thought that they would get harvest next year, 2009.
- 10) Their expected selling price ranges from Rwf 2,000 to Rwf 5,000 per bunch.
- 11) Most model farmers thought that they would start distribution of banana suckers to other farmers from 2010.

Based on the project component and the purchased materials (material cost and other miscellaneous costs such as transportation, bags and unloading labor fee, etc.), project cost is derived, and benefits from the project are also estimated as follows.

Table 6.7.13 Benefit / Cost Ratios for Fruit Banana Cultivation

Item	Unit price (Rwf)	Quantity	Amount (Rwf)	Benefit / Cost Ratio
Cost				
Unit cost per hectare (1,200 suckers/hectare)			496,333	73% survival rate
Benefit				
After 2 years	2,500	876	2,190,000	4.41

Notes: Benefits are estimated that one sucker brings 1 bunch of bananas 2 years after planting. (See Annex VI.6.8 for details.)

Although the benefit figures are estimations, fruit banana cultivation achieves the break-even point if a model farmer safely gets the first harvest two years after planting.

(5) Solar Cooker

Introduction of solar cookers intended to reduce expenditures and firewood consumption which is a major energy source for rural livelihoods in the Study Area. After preliminary investigation, training for introduction was done on 12 August 2008 with 71 participants from the three Cells. One month after the training, interviewing survey was done in the beginning of September to monitor the use of the solar cookers. The summary results are indicated below.



Beneficiaries try making the Solar Cooker.

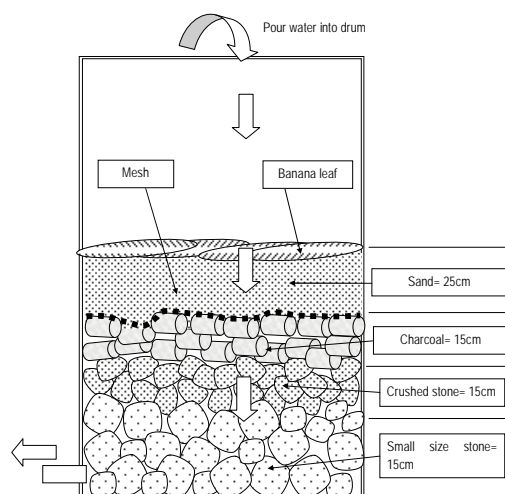
Table 6.7.14 Monitoring Results of the Solar Cookers Utilization

Number of Persons Interviewed	39
Questions	Answers
Do you use your solar cooker?	Yes: 35 persons (90%) No: 4 persons (10%) Reasons for Not Use The solar cooker is not yet completed. The solar cooker didn't work well because of insufficient sunshine, so it was not used any more.
Purpose of Use	Boiling water: 14 persons (40%) Cooking: 21 persons (60%) According to the interviewees, it takes about four hours to cook boiled eggs and about two hours to cook simple dishes such as potatoes.
Saving of Firewood and Kerosene	It was still difficult to grasp the reduction amount.
Do you continue using the solar cooker?	All of the interviewees who use the solar cooker presently replied that they would continue using it.

(6) Simple Treatment of Marshland Water

Simple water filter was made from a drum and local materials as shown in the figure. The marshland water was poured and then muddy water came out from the tap below because of dirty filtering materials. It was expected that one rainy season would clean the filtering materials but it didn't. After getting the unsuccessful result, the simple water filter made of a drum was judged to cancel because of the reasons described below.

- Because the drum size was so big that plenty of filtering materials were necessary, and the model farmers had difficulties to collect these



materials.

- The filtering materials such as sands, gravels and stones were necessary to be washed before putting inside the drum. This work needed a lot of water, which, in turn, brought hard labor works to the model farmers.



Figure 6.7.1 Processes of Making the Simple Water Filter

6.7.4 Recommendation to District Development Plan and Further Issues

Followings are the lessons learned from the implementation of the rabbit rearing component.

Quick and dual benefits, easy handling and less time-consuming are important factors for successful results.

In general, rabbits increase rapidly and bring benefits quickly, which, in turn, makes the model farmers happy. The farmers also get benefits in two ways: meats for their diet and cash income. In addition, the rabbits eat weeds, which means that any fodder crops are unnecessary to feed rabbits. It seems to be one of the important merits of rabbit rearing since the model farmers just need to collect some weeds in a short time and doesn't need to use many hours on the field to cultivate fodder crops. This means that even elderly people and women can do rabbit rearing. In fact, children are taking care of rabbits in many of the model farmers and they also like eating rabbit meats.

With some tact, problems can be solved.

On the other hand, some model farmers lost their rabbits by attacks of stray dogs/cats because they were delayed to make protection fences around their rabbit cages. Some of them requested to be provided materials for fences but some others made them with locally available materials such as sticks. This is an example that if someone who has some tact, he/she can solve a problem very easily.

High technologies, locally unavailable materials and group works may cause slow progress.

These are facts that modern bee keeping needs a certain level of technical knowledge and some tools which are not available in rural areas. Moreover, some tasks need group works with others, which means that the farmers need to adjust their schedules prior to the group works. It seemed that these factors greatly affected the progress of modern bee keeping activities this time.

Women could be catalysts for income generation works.

As for modern bee keeping, three existing associations had been supported together with 8 individual bee keeping farmers. Among them, activity progress had been better in one association in which many

women are members. Since they are basically earnest and punctual, many of them come to group works. On the other hand, those men with less interest in bee keeping tend to cancel group works, which often retarded the association activities. For the income generating activities, in particular, for the non-agricultural ones, women involvement can be an important factor.

Mulching is vital for pineapple cultivation.

It was clear that pineapple suckers didn't grow well on the farmlands without proper mulching and the suckers were grown better on the fields with good mulching. To keep soil moisture and reduce evaporation from surface soil, mulching is essential for pineapple cultivation. It is also effective for surface soil conservation against torrential rain.

Better to check the soil suitability before crop introduction

In some specific fields in Kibungo Cell, pineapple suckers didn't grow well. The soils there are stony and very shallow. Even though the farmers are familiar with the cultivation of pineapples, they don't grow well on the poor soil. If some crop is promoted in some areas, trial cultivation should be done before the extensive introduction of that crop; otherwise, initial investment would be lost.

Road side irrigation surely boosts the banana productivity.

Before the implementation of the pilot projects, quick projects which included road side irrigation were implemented. This labor-intensive but inexpensive irrigation improved banana yield very much. If the farmlands are located next to any roads, this system can be introduced only with labor works. Road side irrigation should be simultaneously promoted together with the banana suckers distribution.

Short term benefits should be combined.

Fruit crops such as fruit banana and pineapples take more than one year to get fruits if they are planted with new suckers. This implies that the farmers have to wait for getting cash income more than one year. For those who need cash income urgently, multiple cropping such as intercropping and mixed-cropping should be promoted to get short term benefits from the same farmland. Otherwise these fruit crops are not recommendable for resource-poor farmers.

6.8 Cost Benefit Analysis

The objective of the cost benefit analysis is to examine the economic efficiency at each project. Cost benefit ratio was calculated comparing between the project cost and the benefit from the project at fixed period by project. If the cost benefit ratio is more than 1.0, the project becomes an economic relevance.

Cost benefit ratios are shown in following table by project. Due to the limitation of the project implementation, some projects that do not bring the results up to now are estimated using assumed values. Detail is shown in Annex VI.6.8. As for the improved rice seed multiplication and dissemination project, shallow well irrigation project, and rabbit rearing, the effectiveness appear

faster than other projects and are high investment efficiency projects.

In case of the modern cow distribution project, in order to get the benefit recovering the cost, it will be necessary to produce milk more than 5liter/day for selling in Kigali market and 9 liter/day in Nyamata market respectively. But actually, almost all of model farmers have obtained 2 to 3 liter/day of milk production only. Due to purchasing the sprayer in shallow well irrigation, the benefit recovering the cost takes 2 year but a slight investment to the vegetable seeds and pesticides, the effectiveness appears quickly.

The improved rice seed multiplication and dissemination project in Nyabyriba Marshland is the most effective project among the QP and PP and the benefit can recover the cost until the 2nd rice cropping stage. On the contrary, marshland agricultural development project in Muzi Cyeru Marshland introducing new rice farming can not get enough benefit against the cost due to low paddy yield caused by soil problems. In order to achieve the economic efficiency in the project, it should require soil improvement and other countermeasures for securing paddy yield of more than 3.5 to 4 t/ha.

The rainwater storage installation and farm pond for small scale irrigation projects which benefit recovers the cost up to 5 to 6years are to be promoted by the administration because these projects have the characteristics of public benefit or environmental conservation aspect as priority projects of CDF (refer to section 2.2.4).

Pineapple cultivation and fruit banana cultivation same as shallow well irrigation and rabbit rearing mentioned above are expected to expand spot to area and to obtain the benefit with a little initial cost subject to introducing planned distribution to the 2nd applicant but it takes about 2 years to harvesting. Compare to the other livelihood improvement projects, bee keeping requires professional expertise and technique for operation and maintenance of daily activity so that it is necessary to support from outside continuously same as the modern cow distribution project.

Table 6.8.1 Cost Benefit Ratio at each Project

Project Name	Assumed Benefit Period	Unit	Cost (C) Rwf	Benefit (B) Rwf	Cost Benefit (B)/(C)	Remarks
(1) Quick Project						
1) Modern Cow Distribution	1year	HH	310,590	108,000 ¹ 180,000 ²	0.35 0.58	5 lit/day ¹ 9 lit/day ²
2) Rainwater Storage Installation	10years	Site	167,800	323,000	1.92	5 th year*)
3) Shallow Well irrigation	10years	Site	114,650	504,000	4.4	2 nd year*)
(2) Pilot Project						
1) Improved Rice Seed Multiplication and Dissemination Project	1year	ha	2,873,095	3,911,500	1.4	0.7 year*)
2) Marshland Agricultural Development Project	1year	ha	1,234,900	231,500	0.2	3.5-4.0 t/ha is required
3) Hilly Terrain Agricultural Development Project (FP)	10years	Site	1,920,700	3,023,000	1.57	6 th year*)
4) Livelihood Improvement Project						
(a) Rabbit rearing	1year	HH	32,713	32,580	1.0	1 st year*)
(b) Bee keeping	3 years	HH	42,546	59,400	1.40	3 rd yera*)
(c) Pineapple Cultivation	1.5 years	ha	756,110	1,872,000	2.48	1.5years*)
(d) Cooking & Fruit Banana Cultivation	2 years	ha	496,333	2,190,000	4.41	2 years*)

Note ¹, ²: show selling price of milk at Nyamatam and Kigali, respectively.

Note ³: Land reclamation cost of labor fee(3.4million Rwf) and construction tools and materials (1.9million Rwf) are excluding in Cost

Note *) :Break-Even Point; cost recovery period

6.9 Environmental Consideration

In order to assess the environmental impact, Ms. Sylvie Uwacu in charge of environment in Bugesera District visited the Muzi-Cyeru Marshland as well as farm ponds at Cyeru, Kanzenze Cell and Kingabo, Cyugaro Cell on 1st August 2007. After site inspection she submitted the field report to the Bugesera District and a copy was given to the Study Team. The report addressed some comments regarding PP activities but does not mention any serious environmental issues. Since the size of cultivation area is apparently small (<5ha) and the project does not develop new areas. Thus no negative impacts are predicted and there is no need to implementing the EIA. However it should be necessary to discuss and conclude whether EIA should be done or not on the PP components at the Steering Committee meeting in the next 4th fieldwork.

6.9.1 Response to the Comments by the Environmental Officer of the District

(1) Flood damage by the reclamation paddy field in Muzi-Cyeru Marshland

No drainage canals damage by flood was pointed out but the constructed canals have the dual function of irrigation and drainage to control water level during the farming period. In this regard, circle levees are designed with enough height to prevent from flood during the farming period.

(2) Residues streamed flow into farm pond

To prevent residues streamed into farm pond, a sedimentation pond and wooden fence in the conduits canal upstream of the farm pond are designed.

(3) Damages by overflow from the farm pond

An effluent outlet and canal are designed to avoid the overflowed damages not only dike but also downstream

(4) Farm Pond: Source of malaria

To avoid the infection of malaria, it was decided to locate farm ponds as far away from the residents as possible. In future, fish culture in the pond is envisaged as one of the countermeasures.

6.9.2 Environmental Consideration

(1) Social aspect during the implementation of the QP and the PP

In order to judge the genocide suspects, Gacaca court is scheduled once a week and all the local population are required to actively participate. It would be inconceivable for foreigner alone to be in/around the Study Area on Gacaca day etc. The Study Team has to respect community schemes meant to reunite the social fabric torn out by the genocide. As another instance of social consideration, while selecting the model farmers /beneficiaries for QP or PP, vulnerable groups and orphans are given priority as model farmers taking into due consideration of the equity and transparency to the all stakeholders. Under present situation, all projects progress well and no conflict among local population has occurred

(2) Process of making consensus for land acquisitions

For smooth progress of the PP, making consensus in terms of existing cultivation right for marshland and land acquisition for farm pond site was prerequisite. In order to make a consensus for land acquisition among all stakeholders, it was imperative at early stage to have ideas and opinions of participants in Kick-Off meeting. During a series of workshops, the participants carefully discussed this issue and reached an agreement.

(3) Agro-chemical use for paddy field

The Pilot Project regarding rice production consists of two sites namely “Improved rice seed multiplication and dissemination project” in Nyaburiba marshland, and “Marshland agricultural development project” by reclamation of newly paddy fielded in Muzi Cyeru marshland. Rice

production without using agro-chemicals within project implementation period is impossible, thus agro-chemicals are compulsory to control pest and disease outbreak. Apart from the rice production in both PP sites, vegetable growers beside the PP plots manage intensive farming including spraying agro-chemicals for several years. However, no agro-chemical poisoning has been reported so far. In Nyaburiba Marshland, local population fetches drinking water from public water tap originated from spring water source located at hill bottom. Meanwhile in Muzi Cyeru, local population fetches drinking water not from the surrounding of newly reclaimed paddy field except for domestic use. Hereinafter, advocacy activity may proceed in accordance with progress of rice farming in Muzi Cyeru Marshland.

(4) Monitoring the QP from environmental aspects

Farmland of Fodder crop and Cowshed logs for Introduction of Modern Cow

From the environmental point of view, two points were designated in Chapter 3.4.2 in ItR (1), i.e., a. production of fodder crop may sacrifice other farmland to support cow husbandry so as to increase lactation performance, b. logs used for construction of cowshed are collected from surrounding forests. Concerning the first point, the model farmers selected for the Cow QP afford to manage cow keeping in his/her farmland via monitoring result made by JICA Study Team. Meanwhile it was reported that poor farmer nominated as model farmer by Cell Office refused because of difficulties to manage cow keeping.

The 2nd point, as a brake on cutting tree, it is required to get permission from Sector office through Cell office prior to cutting trees and illegal cutting is fined under watch system at Cell level. However, it is necessary to follow up actual operation of this rule via monitoring general condition of community forest and write it in the Action Plan.

Introduction of Household Rainwater Storage

At the beginning stage of the project, it was worried that Malaria mosquitoes will breed in the storage. According to the monitoring result in this stage, breeding of mosquitoes in/around the storage was found few. Only a mosquito was found at the storage without cover. It could be assumed the relation between putting the cover and breeding of malaria mosquitoes, and the cover of the storage is effective to prevent breeding of mosquitoes.

Introduction of Shallow Well Irrigation

At the beginning of the project, there was concern about mosquitoes, too. But the shallow wells have been constructed at isolated area from the residential area. Consequently, there is little impact on health condition of the local population.

Introduction of Road Side Irrigation System

It was anticipated damage caused by excessive runoff by heavy rainfall flows into the farm plots through the roadside irrigation system. According to the monitoring, such damage was not reported

because the systems were introduced to the banana plantation mainly that equips depletions around the banana trunk to tap the runoff temporally.

6.10 Publicity Activities

(1) Issue of Newsletter

The issue of newsletter was started from early July 2007 at the interval of every other week to broadly share such information as state of progress and topics of PP with those who are related with PP and inhabitants concerned. The newsletter has a size of A4, printed on both sides,



Inhabitants reading newsletter
(Bugesera District)



Children reading newsletter
(Kibungo Cell)

using as many photos as possible so that readers can understand the articles at a glance, and has been distributed to the minister, secretary general and director of planning of MINAGRI, to the staff of related District, Sectors and Cells. Files of PDF type have been sent to the members of the steering committee and it has also been distributed to other donors through JICA Office of permanent staff.

Copies of the newsletter printed on single side have been distributed to Bugesera District, Ntarama Sector and 3 related Cells so that local inhabitants can read them on bulletin boards. In order to provide further frequent information to the inhabitants in Ntarama Sector, additional printing has been made from serial No. 11th distributing at the rate of 5 copies per Umudugudu, in total 110 copies in addition to hitherto published number of copies. By the completion of this Study, late September 2008, the letter has been published up to serial No. 22.

(2) Making Use of Bulletin Boards

Bulletin boards were provided means of public communication / diffusion activities, and they were distributed to each Cell by the end of July 2007. It was expected that these boards were utilized for providing information to the inhabitants. The above-mentioned Newsletters were put up on the board in Kanzenze Cell, thus conveying information to local inhabitants therein.



Bulletin board in Kanzenze Cell

(3) Making Use of Radio Broadcasting by MINAGRI

In reply to the request from the Study Team, a producer of radio-program by MINAGRI (Ms. Maria GORETTI) visited sites of QP and PP where she collected news material (on 14th August 2007, 18th

June 2008 and 24th September 2008). In each site, interview to model farmers in QP and beneficiary farmers in PP was made, based on which a radio program was produced and broadcast (date of broadcasting: 28th August 2007, 24th June and 30th September 2008).

(4) Video Picture Shooting /Editing

Video picture was frequently photographed in every activity at turning point in PP. Throughout the Study period, 28 times of photographing were made including those for QP. The total pictures were edited into a DVD with an emission time of 20 minutes per project (QP and PP respectively) so that they can be used on the occasion of future expansion of the activities and of extension services.

CHAPTER 7 Supporting to the District Development Plan (DDP)

7.1 District Development Plan (DDP) in Bugesera District

7.1.1 Summary of the DDP

The DDP outlines the priority needs of the population of Bugesera. Activities in the log frame were defined on the basis of due consultation with the beneficiaries and different stakeholders through meetings and workshops organized at district and sector level. Throughout the formulation process the district followed a bottom-up planning approach from the initial stage so as to effectively formulate and prioritise strategies, which will ensure success in the implementation of the DDP. The district is committed to work hand in hand with the stakeholders throughout the implementation process of the DDP. The DDP conforms to the priorities and orientations of the government as given in its strategies such as EDPRS, PSTA, Good Governnance, Decentralization Policy and also in line with all sectoral approaches concerning the youth, public service, education, gender, energy and infrastructure. During the 5 years from 2008-2012, goals and objectives are set as summarized as below.

- (i) Halve the proportion of people living with hunger and increase their income by 2012;
- (ii) Reduce maternal and infant mortality;
- (iii) Combat HIV/AIDS, Malaria and other diseases;
- (iv) Ensure that all children complete the first cycle of secondary school;
- (v) Be able to significantly improve the lives of at least 12,000 vulnerable people and allow them to accede to productive jobs by 2020;
- (vi) Promote gender equality and emancipation of women;
- (vii) Develop professional skills among the youths for them to get sustainable jobs;

On the other hand. Agricultural Sector has set up the following 4 priorities:

- (i) Ensure food security for the population;
- (ii) Increase productivity through soil/ water conservation, increase in the use of fertilizers, and promotion of commodity chain;
- (iii) Promote processing units and the competitiveness of agricultural/ animal products;
- (iv) Promote grouped habitat and put in place basic infrastructure ;

7.1.2 DDP Budget

The DDP budget is estimated at 109.7 Billion Rwf in total including the external finance as development partners at 93.8 Billion Rwf (85%) and district budget at 16 Billion Rwf (15%). It is regrettable to say that the budget for the DDP still depends on external budget supports.

Among all Sectors, Economic Development sector shares 52.9 Billion Rwf (53%) in Total budget.

There is Ubudehe fund as the own fund of the district and as one of the measures to reduce poverty in community, 660,000 Rwf/year of budget has been allocated to each Umudugudu. Because the

Table 7.1.1 DDP Budget Share by Activity Category Unit:Rwf

projects for rainwater storage installation, shallow well irrigation, farm pond construction implemented by the Quick Project and Pilot Project are the targets as Ubudehe activities, implementation of these projects by local people and expansion from spot to area will be enable to be expected. And also prompt implementation with needs of local population will be expected just only approved by the audit committee in Umudugudu level without any other authority’s approval.

CATEGORY	Amount
TOTAL PROGRAM FOR 5 YEARS	99,759,550,300
MONITORING AND EVALUATION of DDP	9,975,955,030
TOTAL OF DDP	109,735,505,330
PARTICIPANT OF DISTRICT (TIG, UBUDEHE, UMUGANDA, IMPOTS, TAXES)	15,976,000,000
EXTERNAL FINANCE (DEVELOPMENT PARTNERS)	93,759,505,330
CENTRAL GOVERNMENT (Among them, 45,000,000,000 are for road asphaltting)	56,297,708,290
PRIVATE SECTOR	23,703,465,390
CIVIL SOCIETY	13,758,331,650
TIG	1,200,000,000
UMUGANDA	132970 028
UBUDHE	200,000,000
OWN FUND OF DISTRICT	13,246,295,972
DDP Budget Share by Sector	Rwf
SECTOR	Amount
Economic Development (53%)	52,872,561,659
Social Development (37%)	36,911,033,611
Good Governance (10%)	9,975,955,030

7.1.3 Rural and Agricultural Development Components in DDP

Figure below shows that 67 projects related to agricultural and rural development in the DDP are picked up and classified into 4 development strategies, namely 1) Sustainable Agricultural Production, 2) Promotion of Income Generation Activity, 3) Improvement of Life Style, and 4) Natural Environmental Conservation. The agricultural and rural development project components amount to 78.9 Billion Rwf (72%) against 99.8 Billion Rwf in total for the 5 year program. More detail in the 67 projects are shown in Table 7.2.2

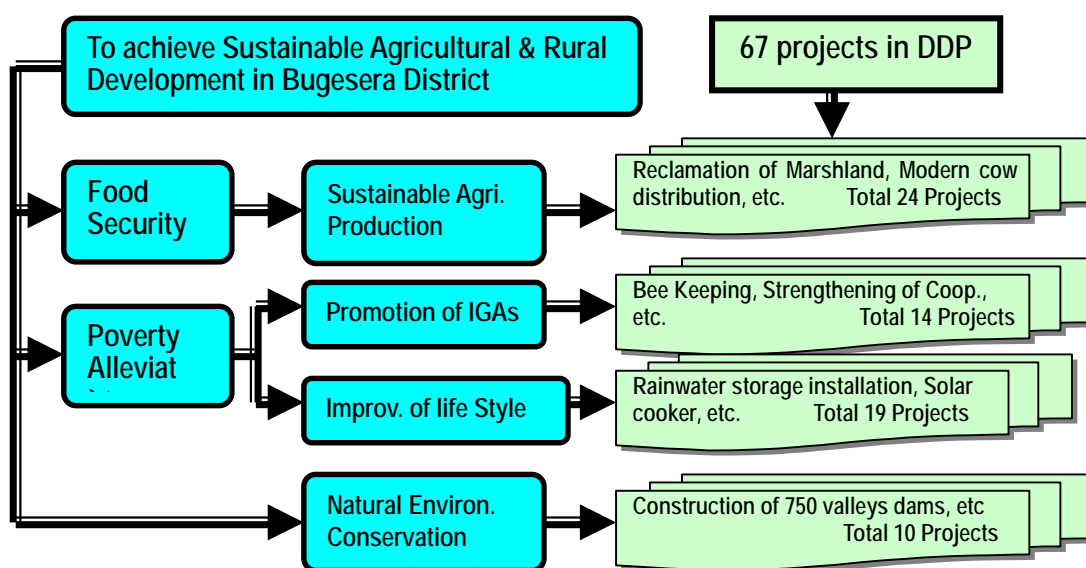


Figure 7.1.1 Agricultural and Rural Development Projects in DDP

7.1.4 Monitoring and Evaluation System in DDP

Bugesera district has planned to initiate a process to put in place a mechanism for monitoring and evaluation (M&E) of programs and projects contained in its 5 years district development plan and its annual performance contracts (Imihigo). The M&E system to be introduced is expected to effectively maximize the outcomes of several kinds of development projects/programs in Bugesera district as well as securing transparency and accountability and, managing natural and human resources efficiently.

The system could be officially introduced through the following stages; i) definition of the objects of M&E and, ii) constraints on system operation, iii)organizing a structure for effective information/data collection and, iv) analysis of those data, v) establishment of operation environment of the O&M system. Implementation of the M&E will be carried out by each Sector and Cell, then finalized by the District. The operational cost of the System is estimated at 65,000,000 Rwf per year approximately which consists of M&E committee activities, logistics for workshop and field trip, and so forth. The GTZ has decided to support its budget in 2008.

7.1.5 Issues in DDP

According to MTEF in 2008, Bugesera district budget is estimated at 5.3 Billion Rwf. On the contrary the annual district budget for the DDP is estimated at around 20 Billion Rwf/year. There is 4 times gap between the DDP and District Budget. It shows that implementation of the DDP is very tight in the budgetary aspect.

Joint Action Forum Meeting (JAF) consists of Donors and staff of Bugesera district is held in every August so as to discuss and decide the executing agencies and funds for project components in the DDP. Because of not enough finance from Donors, it is very difficult to implement these components. In addition, lack of staff in the District, Sector and Cell and abilities and not enough transportstion measures are the hardle to make a plan, implemeting and monitoring for projects in the DDP.

Under such circumastances, small scale and sustainable projects intorducing the methods of implementation by local population and extension

through farmer to farmer approach oriented from spot to area development propoesd by the Study are essential to carry out so as to overcome food security and poverty reduction in Bugesera district.

Table 7.1.2 Bugesera District Budget in 2008

Item	Rwf	%
Promotion of the Community Program and Panning, Economic Development and Employment	780,614,777	14.8%
Infrastructure, Land, Housing and Administration	126,241,048	2.4%
Education, Youth, Sports and Culture Unit	618,278,840	11.8%
Health, Gender, Family Promotion and Child Protection	1,980,976,148	37.7%
Finance and Resource Mobilization Unit	1,126,752,318	21.4%
Human ResourceDevelopment and Support Services	58,141,000	1.1%
Mayor, Council and Executive Secretariat	492,006,410	9.4%
Total	76,885,400	1.5%
	5,259,895,941	100.0%

Source: District MTEF 2008

7.2 Objective of the recommendation to the DDP

According to the Scope of Work (SW) agreed upon 1st April, 2005 for the Study, An Action Plan (A/P) for agricultural and rural development in Bugesera District had to be formulated by the Study. Objective of the formulation of the A/P was to prepare a detailed Development Plan for promoting sustainable rural and agricultural development in order to secure food and to alleviate poverty facing the local population in Bugesera District. Based on the results of the Study during Phase I until the end of March 2007, the Interim Report (1), (ItR(1)) including the draft A/P was prepared and submitted to the Governmental agencies concerned to reflect the Study results to a DDP which was under formulation by MINALOC-GTZ and the planning unit of Bugesera District.

DDP (2008-2012) in Bugesera district was formulated on 24th May 2007 and Performance Contract in 2008 was also formulated in the beginning of the January 2008 as the first year's AP of DDP. DDP is in line with the central governmental strategy and policy such as PSTA, EDPRS and including the necessity of the projects components proposed by the Study in the ItR(1).

Taking into due consideration on the above, the objective of the Study is to reflect the lessons learnt and information on the DDP as recommendations through the implementation of the QP and PP verifying the probability for project implementation by local population, support from administrative structures to local population, extension and expansion plan through an approach "farmer to farmer" with trials and errors. And as a part of guideline for making plans and estimating the project cost by the district providing the information obtained through the implementation of the QP and PP such as i) formulation of the plan for implementing by local people, ii) construction methods, iii) improvement of the farming practice, iv) cost benefit v) issues drawn from the hilly terrain agricultural development project as well as the marshland reclamation for rice cultivation.

Above mentioned objective, in order to clear the orientation of the Study, relation between DDP, QP, and PP is shown on Figure 7.2.1.

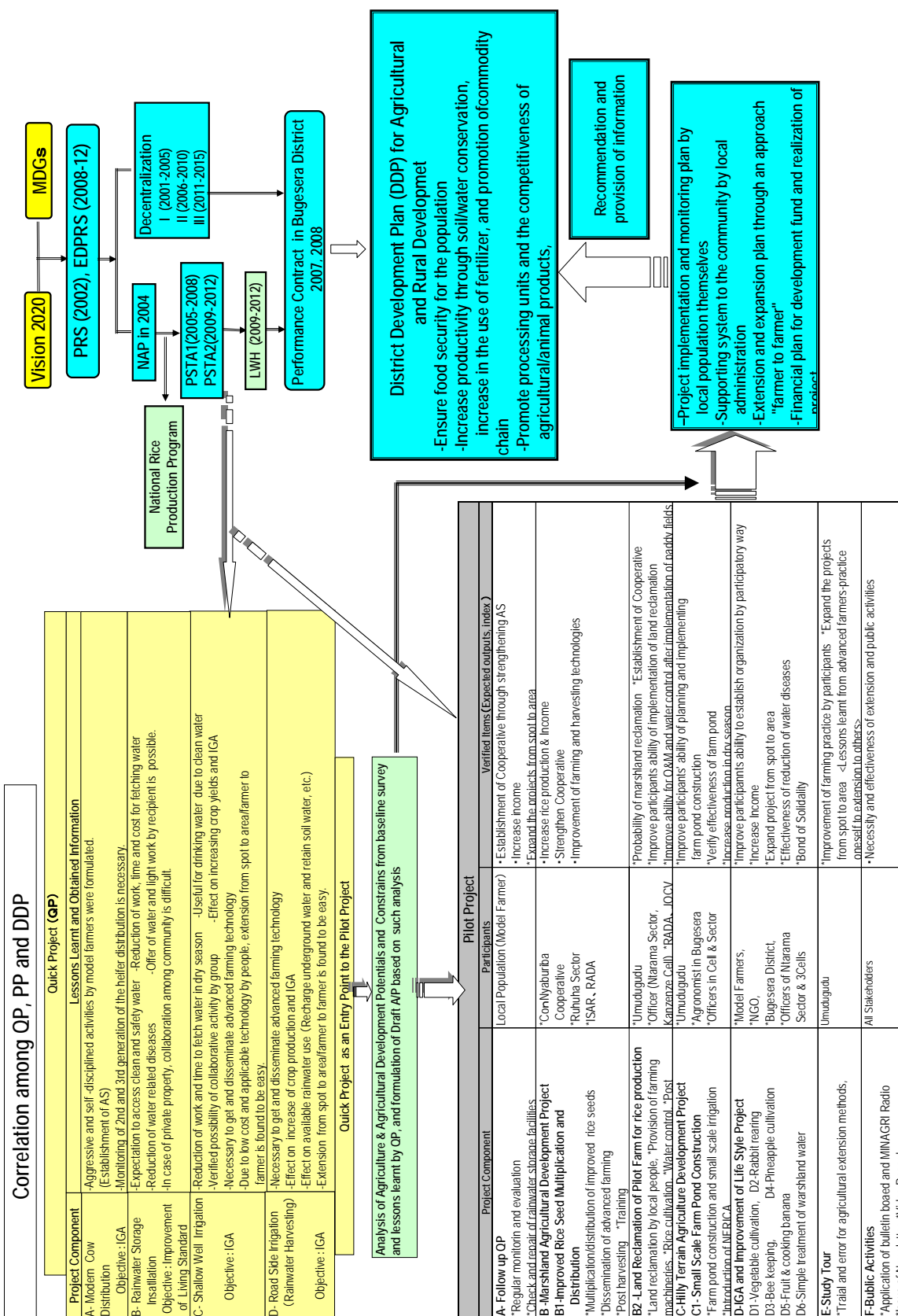


Figure 7.2.1 Correlation among QP, PP and DDP

Table 7.2.1 District Development Plan for Agricultural and Rural Development in Bugesera District

Goal	Development Strategy	Specific objectives / Results	Verifiable indicators	Projects	Priority Sector/Site	Source of Fund	Executive Agency	Estimated cost in .000 USD	Period of execution						
									1	2	3	4	5		
To Achieve Sustainable Agricultural & Rural Development in Bugesera District		Sub-program: Supply and utilisation of agricultural inputs and mechanization. By 2012, Agriculture and animal use of agricultural inputs and mechanization are developed.	*Increased productivity per hectare: From 3 to 6 t per ha for rice and from 4 to 8 t per ha for maize. *100% of the farmers apply inputs in their gardens	P1: Promotion of the selling of agricultural inputs by cooperatives. P2: Agricultural mechanization on 1,800 ha in Gashora and 200 ha in Niyama. P3: Mobilisation of micro finance institutions to promote the use of agricultural inputs.	Ruhuha, Nyamata, Gashora Gashora, Niyama			15,000 50,000 500,000	X	X	X	X	X		
		Sub-program: Development of Commodity chains and Horticulture Commodity chains are developed	*At least 5 commodity chains are identified, developed and are operational.	P1: Development of commodity chains (legumes, fruits, flowers, aquaculture, cosmetics, oils) P2: Intensification of pine-apple production P3: Multiplication and intensification of cassava cropping P4: Development of maize commodity chain P5: Intensification of coffee (2,000,000 trees); and rice (2,650 ha)	15 sectors 15 sectors 15 sectors District District			10,000 4,000 4,000 4,000 20,000	X	X	X	X	X	X	
		Sub-program: Irrigation development Arable land is increased Irrigation is developed	Additional farming area for rice: 3,650 ha and maize: 1,100 ha.	P1: Study on hill side irrigation P2: Hillside irrigation from the lakes	District Lakes of Rumira Mirayi and Cyohaha south			20,000 120,000	X	X	X	X	X	X	
		Marshlands in the district are reclaimed	*In 2012, a map and study on the reclamation of district marshlands are available.	P1: Elaboration of a map and reclamation study of marshlands of the district. P2: Reclamation of Akagera marshland on an area of 15,000 ha P3: Reclamation of Rwaburoro marshland on an area of 3,000 ha P4: Reclamation of Umurago marshland on an area of 12,000 ha P5: Reclamation of the valley of Mwesa on an area of 650 ha	Shyamba, Musenyi Shyamba, Nyarugenge Mareba, Ruhuha, Nyarugenge Mwogo, Nyamata			20,000 6,000,000 1,500,000 4,800,000 260,000	X	X	X	X	X	X	
		Sub-program: Food security and dealing with vulnerable cases Food security and management of vulnerable cases are assured.	*Two systems of hermetic stocking are installed, 1 for 1,800 t in 2007; and another for 6,000 t in 2011 *9 stocking silos with storing capacity of 20	P1: Installation of 2 systems of hermetic stocking in each sector P2: Construction of 9 silos with storing tonnes each.	15 sectors Shyamba, Mareba, Mwogo, Juru, Musenyi, Ruhuha, Niyama, Nyamata, Nyarugenge			90,000 45,000	X	X	X	X	X	X	
		Sub-program: Integrated intensive Agro-sylvo- pastoral system and Animal husbandry Crop and animal production is increased.	* 200 cows of improved race. * Veterinary centres	P1: Intensification of exotic cows in households and zero grazing P2: Constructing and equipping veterinary centres P3: Mobilisation of micro-finance institutions for the development of P4: Promotion of poultry and rearing of small ruminants P5: Planting of pasture	15 sectors Nyamata, Ruhuha, Gashora 15 sectors 15 sectors District			210,000 100,000 5,000 25,000 50,000	X	X	X	X	X	X	X
		Sub-program: Rural support infrastructure. Rural infrastructure is developed.	Number of infrastructures built.	P1: Construction 5 drying surfaces and storing of maize P2: Construction 5 drying surfaces and storing of rice	Gashora, Rwaburoro, Mareba, Nyamata, Ruhuha, Nyarugenge			25,000 25,000	X	X	X	X	X	X	

Table 7.2.1 District Development Plan for Agricultural and Rural Development in Bugesera District

Rural Development in Bugesera District		Poverty Alleviation		Poverty Alleviation		Rural Development in Bugesera District	
Sub-program	Activities	Impact	Cost	Location	Year	Impact	Cost
Sub-program: promotion of cooperatives							
Capacity building for Producers	Rural organisations are developed. *A support service for cooperatives is established **micro finance institutions support agricultural development.	P1: Support to the establishment and reinforcement of agricultural cooperatives. P2: Mobilisation of micro-finance institutions to finance agricultural development.	15 sectors 15 sectors	75,000 2,000	X X	X X	X X
Sub-program: Restructuring services to producers and rural innovation							
Aquaculture navigation maps and linkages are developed.	*A cooperative of fishers for each lake is in place and operational. **A navigation map for 3 lakes is developed. *Regulations on fishing are elaborated and enforced.	P1: Study on the potential of aquaculture and fishing navigations maps in the lakes of the district. P2: Establishment of a support and information service for fishing. P3: Mobilisation of micro-finance institutions (MFIs) for the development of aquaculture.	Lakes of Ruvira Mirari, Rweru Cyohoha south 15 sectors 15 sectors	15,000 5,000 2,000	X X X	X X X	X X X
Agriculture commodity chain is developed.	*In 2012, total production of honey increases by 125 tonnes. **42 banks for cereals are established *Agricultural micro-credit institutions are established.	P4: Strengthen the capacity of apiculture farmers. P5: Support for the establishment of cooperatives/banks for cereal stockholding. P6: Mobilisation of MFIs for the development of agri-business products.	15 sectors Nyamata Nyamata	6,750 10,000 2,000	X X X	X X X	X X X
Sub-program: Competitiveness and transformation of agricultural products							
Competitiveness and transformation of agricultural products is developed.	3 transformation units in the 3 urban centres of Nyama, Ruhuba, Gashora are operational.	P1: Construction of a pineapple processing plant. P2: Construction and provision of equipment to 3 milk collection centres. P3: Construction of a cassava processing plant. P4: Construction of 5 coffee washing stations	Nyamata Nyamata, Ruhuba, Gashora Nyamata Niyama, Juru, Shyara Musenyi, Nyatunge	60,000 60,000 50,000 400,000	X X X X	X X X X	X X X X
Sub-program: construction of market places							
Modern markets are constructed	5 markets are constructed	P1: Construction of modern markets in 5 rural centres: Nyamata, Kankubabulima, Mkarana, Katushwa.	Nyamata, Kabukuba, Rilima, Nkanda, Katushwa. Nyamata	1,750,000 50,000	X X	X X	X X
Sub-program: Access to clean water							
Handicraft is developed	1 handicraft house	P2: Construct and provide equipment for the handicraft house	Nyamata	50,000	X	X	X
Infrastructure for water, energy							
Infrastructure for the supply of clean water in settlements and urban centres is constructed.	Number of water points constructed/rehabilitated. *Number of water collection reservoirs constructed *Rate of access to clean water increases from 60% to 100% in 2012.	P1: Elaboration of a water master plan. P2: Elaboration of a program for the supply of clean water. P3: Rehabilitation and extension water facilities. P4: Rehabilitation of water sources P5: Construction of reservoirs for rain water collection in grouped settlements and public establishments. P6: Capacity building for community water management structures.	15 sectors 15 sectors 15 sectors 15 sectors 15 sectors	30,000 5,000 120,000 45,000 5,000 10,000	X X X X X X	X X X X X X	X X X X X X
Sub-program: Development and maintenance of transport infrastructure							
119 km of roads are constructed and asphalted.	*Kms of asphalted road. *Kms of rural roads rehabilitated and maintained B11 124 km of rural roads are rehabilitated and maintained.	P1: Construction and tarmacking 60km road. Gashora - Rwabusoro P2: Constructing and tarmacking 48km road. Nyabarongo-Nemba P3: Study & rehabilitation of Nyamata-Musenyi-Shyara road: 27 km P4: Study & rehabilitation of Nyamata-Musenyi-Shyara road: 27 km P5: Rehabilitation of Nyamata - Mwogo - Rilima road :30 km P6: Rehabilitation of Arele - Kibungo - Kagoma road : 15 km P7: Rehabilitation of Kagasa Isar-Nkanga-Ballima-Rweru road: 20 km P8: Rehabilitation of Kindama-Gahembe road: 20 km P9: Construction of rural road along lake Cyohoha south: 78 km P10: Construction of bus parks in urban centres P11: Support for the establishment and strengthening of community structures for the management of road infrastructure.	5 sectors 5 sectors Niyama-Rilima Niyama, Musenyi, Shyara Niyama, Mwogo, Rilima Niyama 3 sectors 3 sectors Rweru, Kamabuye, Nyatunge, Ruhuba, Niyama, Nyamata, Ruhuba, Niyama	22,500,000 18,500,000 4,000,000 1,000,000 2,000,000 1,000,000 1,500,000 800,000 9,000,000 600,000 20,000	X X X X X X X X X X X	X X X X X X X X X X X	X X X X X X X X X X
Sub-program: Promotion of alternative sources of energy and their diversification							
Alternative sources of energy are developed	*200 households and public institutions use bio-gas and solar energy. **1 unit to exploit peat is installed.	P1: Inception of a centre to promote alternative sources of energy. P2: Inception of a unit for the exploitation of peat	15 sectors 15 sectors	50,000 50,000	X X	X X	X X

Table 7.2.1 District Development Plan for Agricultural and Rural Development in Bugesera District

To Achieve Sustainable Agricultural &		Natural Environmental Conservation											
Sub-Program: Sustainable management of Ecosystems to generate income		100% of the land is protected against soil erosion, 30% is covered with trees; lakes and rivers are protected from drying.											
All steep slopes are protected against soil erosion		Area with radical terraces increases from 100 ha to 2,000ha.			P1: Construction of radical terraces on 2,000 ha.			15 sectors			200,000		
Progressive terraces are constructed on entire arable land		Area with progressive terraces increases from 40,898 ha to 46,400 ha.			P2: Dig progressive terraces on all arable land.			15 sectors			100,000		
All lakes and rivers of the district are protected.		Protection plan for lakes and rivers of the district.			P3: Elaboration of a plan for the protection of lakes and rivers of the district.			15 sectors			10,000		
Flowing water is retained		30 ha of lakes and rivers are protected against water hyacinth			P4: Up rooting of water hyacinth on an area of 30ha in lakes and rivers.			15 sectors (except Nyamala)			15,000		
Hydrometric data are regularly collected and published		750 valley dams are constructed to retain rain water			P5: Construction of 750 valley dams			15 sectors			750,000		
All projects in the district are sensitive to the environment		Monthly hydrometric data available.			P6: Establishment of hydrometric observation centres.			15 sectors			100,000		
		An environmental integration guide is available.			P7: Elaboration of a guide / protocol for environmental integration for all projects in the district.			District			10,000		
		A monitoring and evaluation team for environmental integration is put in place.			P8: Establishment of a Monitoring and evaluation team of environmental integration in all projects of the district.			District			5,000		
		Sub-program: Management of forest resources											
All hills are covered with trees.		*10,000,000 trees are planted.											
Fauna and Flora of the district are protected.		Forest development plan for the district.			P1: Elaboration of a simplified plan for forestry development in each sector.			15 sectors			30,000		
		A plan for the protection of Gashora natural forest.			P2: Elaboration of a plan for the protection of flora and fauna of the district (Gashora natural forest, Zoological museum).			15 sectors			15,000		
		A zoological museum.									78,719,750		

7.3 Provision of recommendations and information from the Study to the DDP

Based on the lessons learnt and outputs through the implementation of the QP and PP in the Study, project components formulated in the DDP concerning the agricultural and rural development are classified into 5 categories namely 1) strengthening of CD of local population and local government staff and local population's needs, 2) extension through farmer to farmer approach oriented from spot to area development introducing low cost and easy technology, 3) livelihood improvement in consideration of WID, 4) consevation of natural environment project 5) high publicity project applying CDF fund. Based on the 5 classifications, recommendations by the Study are given to the DDP in order to realize the projects, which should be implemented by local people themselves with sustainability. In addition, information such as the project costs, cost benefit, impementation period, issues arised during implementation of the Study were provided to the local government agencies. Because the DDP is a 5 years rolling plan that is to be readjusted every 3 years, it will be easy for them to review and monitor and also to clear the possibility of the project impementation. Main outputs and lessons learnt (draft) drawn from the implementation of the QP and PP so far. Based on the final evaluation of the PP WS carried out during the 4th year field survey, recommendation and information was descrived as below. Table 7.2.2 summarized the relation among the projects in DDP related to the agricultural and rural development and QP and PP.

7.3.1 Project Implementation by Community

(1) Umudugudu

Umudugudu is the smallest administrative unit under the Cell, comprising at least 50 households. This grassroots organ works with local population at front lines (see below figure) and has the mandate to harness cooperation, welfare and security among the community. Umudugudu consists of the last grassroots level to strengthen the decentralization process. Its activities are (i) to identify basic data, problems and needs of the local population as well as development plans to and

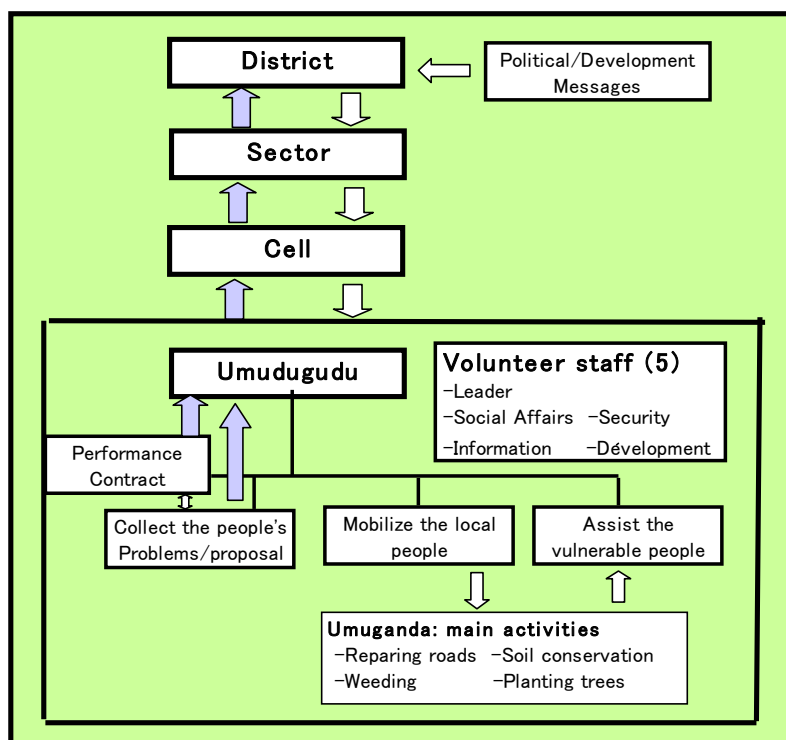


Figure 7.3.1 Project Implementation Structure

(ii) to mobilize local population for community activities such as Umuganda, etc. (iii) to take necessary assistance measures to the socially vulnerable. It has been understood through implementing the QP that Umudugudu might be a core organ to formulate an implementation plan of the projects. Umudugudu serves as a monitoring organ of the local people's activities such as income generating groups and ASs, etc. Umudugudu will be developed as a responsible organ for project implementation and monitoring by community and it will be strengthened to become the core body for administrative services. So as to achieve above, Umudugudu was involved in the Pilot Project (PP) implementation through making the Plan of Operation (PO) as well as monitoring process.

In land reclamation for paddy in Muzi-cyeru Marshland and construction of farm ponds in hilly terrain agricultural development, implementations were carried out by Umudugudu people as a main body. According to the final evaluation WS, it was cleared as below.

- ◆ Farmers are depending on the support from outside such as “Food for Work”, or “Cash for Work” and they don't work at their own initiative
- ◆ Weak to the Top-Down control and no independence
- ◆ Strong Umudugudu Leaders, Advanced farmers are very few in the community
- ◆ The progress of the work is dependent on the Umudugudu leaders, and if their performance is poor, he/her was removed. In general, strong leadership persons are very few

A series of the final evaluation WS, strengthening ideas of Umudugudu has been proposed by Cell, Sctor representatives as below.

- ◆ To cause activation in community inviting projects from outside by establishing many AS in Umudugudu
- ◆ To enlighten Umudugudu leaders who are the core person to promote community development
- ◆ Cell, Sector staff have to inform their experiences and technologies gotten from seminar or training to Umudugudu people

Muzi-Cyeru rice association was established and under the process to organize cooperative. Besides modern cow model farmers are also under organizing the cooperative as well as water users association has been established at each farm pond. Though the Study Team mainly supports these activities, an ability of local population got a little stronger and stronger; but it will take a long time to improve. It is very difficult to strengthen people's ability in a brief space of time within the limited period of the Study. Further supporting to strengthening Umudugudu by outside should be essential.

(2) Supporting in strengthning of the Corinyaburiba cooperative

In “improved rice seed multiplication and dissemination project”, strengthening of the Corinyaburiba cooperative having more than 20 years rice farming experiences has been tried introducing simple farming tools and instructing improved rice farming practices. Being different from the Muzi-Cyeru

rice association, so many good results have been achieved within a year as below.

- ◆ Paddy yield is increased .from 3-4t/ha to 7-8t/ha
- ◆ One improved rice seed out of 3 was selected as certified seed by RADA and has been availed for sale.
- ◆ Letter of application from the Ministry of Labor issued to the Corinyaburiba coop for his good performance of rice farming activities.
- ◆ Corinyaburiba coop has opened his office in Ruhuha town and employed an accountant to strengthen accounting.
- ◆ Rice milling business has commenced purchasing of one-pass milling

The reasons why achieved such good outcomes are i) beneficiaries have experiences in rice farming and simple agricultural inputs provided and instruction of improved farming technologies are responded to their daily needs properly, ii) target to the existing farmers organization to strengthen, iii) president of the cooperation has strong leadership, and iv) give beneficiaries satisfied impact, etc.

On the other hand, it found a difficulty to establish and strengthen new organization because Muzi Cyeru Marshland rice association established in the Study has a first challenge to rice cultivation, and what was worse was low yield of paddy due to the barrier for growing as caused by marshland soils characteristics with discouraging beneficiaries' willingness to practice farming.

To implement sustainable project by local population, it is one of the effective way to focus on the existing organization to support its activities. Nyabiriba Marshland will be a model area for rice farming not only 360ha of neighboring Marshland but also nearby area of the other provinces in future.

(3) IGMA¹ approach

In Kamabuye Sector, people at Umudugudu level have initiated a community fund using IGMA approach for sustainable development in the grassroots. People forms groups and contribute money every week depending on individual means and capacity. The total of contributions makes a fund from which members can apply for a loan to resolve their daily problems or to invest in income generating activities. For Kamabuye case, they have a fund of 10 million Rwf that are rotating among beneficiaries. Apart from Kamabuye, the system is being tried in Rweru, Ntarama and Juru Sector, respectively. It is planned that the system will cover the whole District by the end of the 2008. In parallel with the micro finance, IGMA approach will be expected to be a financial source for community development as implemented by local population.

¹ Kinyarwanda abbreviation: meaning is "way of working together in group or neighbors together who need one another".

7.3.2 Extension through farmer-to-farmer approach oriented from spot to area development

(1) Fact finding through QP and PP implementation

In order to expand the extension of project by community through farmer-to-farmer approach oriented from spot to area, problems and constraints are summarized as below. To promote and expand the project by community under these circumstances, precious lessons learnt from the QP and PP were obtained as the following.

- Almost all of farmer’s annual incomes are below US\$ 300/year.
- Advanced farmers as well as strong leadership of Umudugudu are very few.
- Information source measure from outside is only portable radio and enlightening activities by agricultural extension workers are few.
- Local people have much been interested in the QP components and projects introduced by study tour to other area but it is very difficult for them to implement similar project. But willingness to do themselves is hampered by poverty, impatience and conservative culture. It is necessary for them to disseminate and enlighten technology and knowledge offering information and lecture again and again.
- Above-mentioned facts confirm that it is effectiveness to introduce low cost/zero and adoption of simple technology/measure to implement sustainable project implemented by local people (e.g. shallow well irrigation system and road side rainwater irrigation

(2) Heifer Distribution System after Modern Cow Distribution

Distribution of modern cow was adopted according to the “one cow, one family” project as national policy. Through the implementation of the project, heifer distribution system has been agreed between Ntarama Sector and model farmers. Ntarama Sector has prepared the waiting list for next modern cow recipients. Based on the list, 2nd heifer will be distributed to the 2nd recipient as shown in the figure on the right. Within a year, modern cow will be able to be distributed to the applicant and continuously modern cow breeder will be disseminated and increased. Recipient has the responsibility to

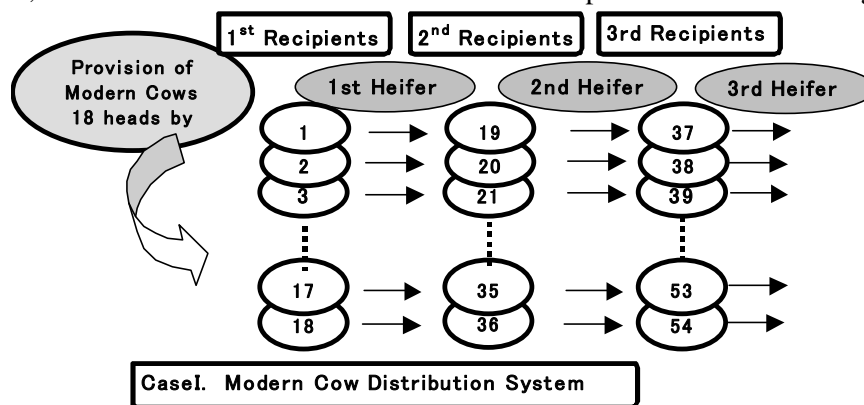


Figure 7.3.2 Modern Cow Distribution System

prepare cowshed and fodder plot at least 0.75ha as well as to secure drinking water before receiving a cow. The system has a disadvantage to exclude poor farmers but it is expected to provide manure to fields, to increase income, and to improve nutrition.

In the project 2 model farmers out of 18 have produced milk about 8 liter/day but others only 2 to 3 liter/day. One of the success model farmer was able to buy 2nd modern cow by loan, but almost all of them have a hard battle with low milk production.

Under this situation, heifer distribution system has not been still functional. From now supporting system for i) high lactation modern cow distribution system (replacement with high potential lactation heifer) to enhance beneficiaries' motivation, ii) strengthening the beneficiaries' livestock husbandry technology by RARDA is essential. And also monitoring and instruction for heifer distribution is difficult for RARDA, Sector and Cell. For management of large scale husbandry, contract system between beneficiaries and NGO, such as Heifer International, etc. who has enough experience for cattle management is recommended to expand one cow, one family project.

(3) Rabbit rearing

Similar to the heifer distribution system, for rabbits, a pair of male and female baby is distributed to next applicant In comparison with the modern cow, rabbit rearing is much easier for poor farmers because small scale gages in the homestead is required and feed rabbits by weeds growing around the house only. According to the rabbit rearing, 48 rabbits provided in January 2008 have increasing up to about 160 rabbits in August 2008. Extension from farmer to farmer is able to be expected easily because demand of rabbit meat has been increased recently due to price escalation of chicken.

(4) Pineapple cultivation and fruit and cooking banana cultivation

Pineapple and banana consist of stem distribution after growing those plants. From the 2nd recipients, they will get benefit with little investment and endeavourer. So that the extension from spot to area is possible.

(5) Extension from spot to area by Zero Cost project

1) Road side irrigation system project in Kibungo cell

The Study Team proposed the former Executive Secretary in Kibungo Cell who was interested in the roadside irrigation system to visit advanced farmer's small-scale

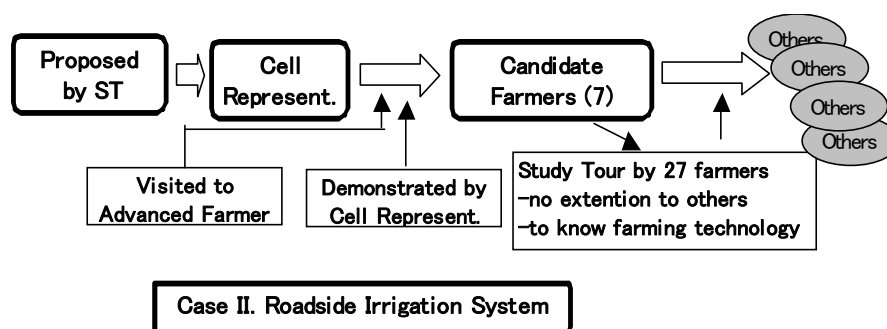


Figure 7.3.3 Diffusion System of Roadside Irrigation

banana plantation in Mwogo Sector. After that he tried to construct a demonstration farm of this system in cooperation with 7 farmers in Kibungo Cell. Some of the participant farmers introduced the roadside irrigation system to their mixed farm of banana and taro and they wanted the Study Team to let him know the advanced farming practice as a practical matter. The Study Team made a plan for the

study tour to visit the said advanced farming in Mwogo including applicants from Cyugaro and Kanzenze Cells. Despite motivation to introduce the system in Kibungo, such willingness was not observed in Cyugaro and Kanzenze Cells due to the reasons described in (1) Fact finding through QP implementation. This project is mainly expected to expand from spot to area by farmer to farmer extension system as the project cost is almost zero and construction of simple and small scale canal only is required. According to the final evaluation WS, quantity and quality of banana had improved and the selling price increased by 5 times, being different from without project case as was reported by the model farmer.

2) Probability for Extension Activity from one area to other area by shallow well irrigation system

This project is similar to the roadside irrigation project. Project cost is nearly zero and also small-scale shallow well or irrigation canal constructed by farmers are required. It was easy to enable implement the project by farmers and they reduced burden for fetching water to the farm. But extension of the project is only within the same site. In order to expand extension from spot to area, study tour or extension activities to the other site by experienced farmers were provided by the Study Team. Cell and Sector officer should manage the study tour or delegation of the person to provide lecture. Through the activities, extension of the project from spot to area as well as strengthening the management ability for local administration are expected to be practically realized.

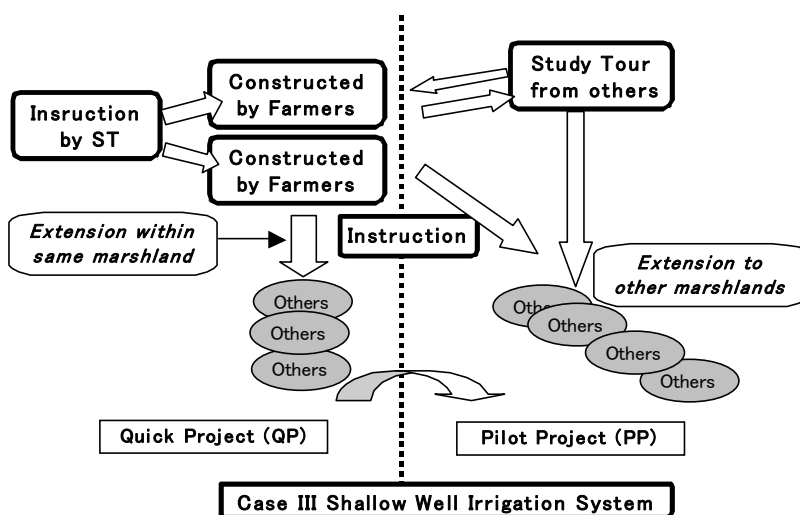


Figure 7.3.4 Diffusion System of Shallow well Irrigation

According to the final evaluation WS, 2 main issues were given to the model farmers namely, 1) lack of fund for vegetable seeds, pesticide, etc. purchasing and 2) provision of no extension services. As for the 1st issue, micro-credit and Ubudehe fund are applicable. Sector officer should inform and instruct the application ways to the community. The shallow well irrigation sites are increased from 6 sites in July 2006 to 19 sites in July 2008. It was reported one model farmer earned 6,000 Rwf in C season (dry season vegetable cultivation) equivalent to the annual benefit with project.

3) Probability of extension from spot to area by farmer-to-farmer

According to the current situation in the area, initial cost should be borne by donors and NGOs, but after distribution system is expanded with zero-cost. These systems are very effective for extension

through farmer-to-farmer approach oriented from spot to area development. But monitoring should be done from outside at present due to the lack of staff and their ability in Cell and Sector offices.

Taking into due consideration of the probability of extension from spot to area by farmer-to-farmer, the above-mentioned 5 examples includes so many suggestive ideas such as,

- i) If project cost is expensive and the budget cannot be born by the community, initial investment cost should depend on support from outside. Introduction of modern cow is a good example; so that the distribution system was applied to small-scale livestock rearing as rabbit rearing in the PP.
- ii) It goes without saying that the project introducing low/zero cost and easy technology to the local population is likely to extend through farmer-to-farmer approach oriented from spot to area development.
- iii) And also, collaboration work in Umuganda, installation of bulletin board at each Umudugudu which is the information tools for local population, and utilization of MINAGRI radio program as promotion of the agricultural extension services are important for farmer's enlightening campaign.
- iv) News letter for PP activities were issued to the stakeholders 2 times per month and was found useful for enlightening the local population as well as providing information to development partners. But it was too heavy burden for Sector office to issue like this news letter.

7.3.3 Supporting System to the Community by Administration

Through the site survey, QP and PP implementation, it was noted among others, the limited number of staff, lack of administrative ability, budgetary deficit, shortage of facilities, lack of means of transportation (The policy to sell all government vehicles and motorbikes forced the administrative staff to rent vehicles for public use). In addition, due to output-oriented goals by performance contract, administrations as well as local population tend to put a more emphasis on performance rather than on quality of the project. Under these circumstances, the following supporting system to the community by administration should be made clear.

(1) Countermeasures to the central administrative function, role, constraints to promote the agricultural and rural development by community

At present situation around the districts are as the following.

- i) MINAGRI has the responsibility to decide the policy and monitor the projects then the District has to execute making plans and implementing the project. MINALOC has supported the DDPs in collaboration with the rural development clusters.
- ii) DDP in Bugesera District was formulated by the end of May 2007 in collaboration with the donors. Through preparation of the DDP, workshops will be carried out at each cell level involving the staff of District, Sector, and Cell to enhance their Capacity

Development. In line with CD, the JICA Study Team-GTZ carried out the workshop to formulate A/P in 2007 in Bugesera District.

- iii) ISAR, RADA, RARDA, and RHODA are institutions and extension agencies concerned with agriculture and livestock. RADA and RARDA have plans to strengthen CD of the local government staff through a series of workshop and training basing on their performance contract.

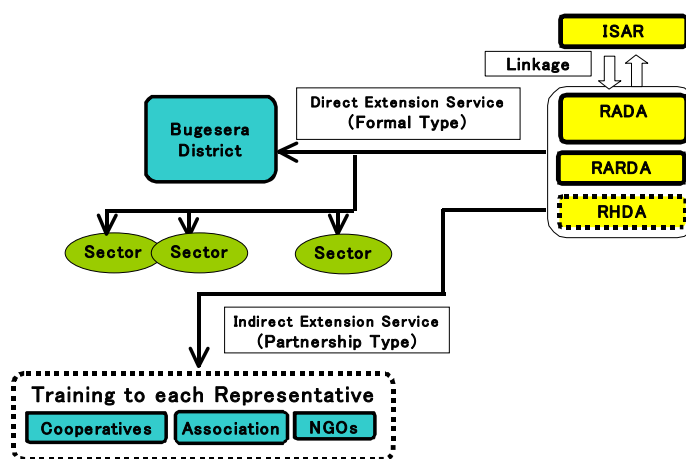


Figure 7.3.5 Agricultural Supporting System to Community

- iv) RADA delegated the 2 numbers of extension workers to each Sector in Bugesera District for one month from December 2006 so as to explain his extension policy as well as extension services.
- v) RARDA trained the livestock hygiene technicians selected at each Sector for artificial insemination during the workshop held from 12-18 January 2007. The Figure above shows the types of extension services currently carried out by RADA and RARDA.
- vi) Renovation and introduction of database at Sector offices has been implemented step by step by CDF based on the Performance Contract.
- vii) Introduction of modern cow project has been implemented in collaboration with RARDA and introduction of shallow well irrigation project was supported by RADA. However, it is worth noting cooperation among the above agencies was not at satisfactory level since these agencies have been newly organized and do not have enough budgets as well as supporting staff.
- viii) As mentioned at Paragraph 7.3.1. Project Implementation by Community, Umudugudu should play a key role in rural development by the community and is the front line of the smallest local administration in touch with the local population, thus, a need to strengthen Umudugudu organ is strongly recommended.

Currently RADA/RARDA has started the extension services to the local government and population gradually. The Study Team intends to strengthen the linkage with the ISAR/RADA/RARDA through implementing the QP follow-up as well as the Pilot PP. But regret to say that it was very difficult to collaborate with these agencies due to their lack of budget as well as number of staff. Under this situation, MINAGRRII radio program for promotion of the agricultural extension services is one of the

most important tool for the farmers. Through the Study, MINAGRI radio broadcasted the introduction of projects and lessons learnt from the QP and PP and active use of this tool should be done more and more.

(2) Strengthening Sector and Cell organization to support the project and activity by self-help effort of the community

Currently monthly operational fee in Sector is increased from 100,000 Rwf to 200,000 Rwf but still not enough to take necessary public services to the local population and Cell leaders are volunteer without budgetary support from the government. It will be required for Sector and Cell to secure not only his own operational budget to provide services to the local population but also the budget to strengthen their organ.

It was tried to introduce small-scale mobile pumps, simple threshing and milling machines that will be managed by Cell or Sector in the PP implementing stage. Thus, in order to create fund for operation of these administrative units, rental system to the farmers was tried in the PP. Through the implementation of the PP, it was found that it is still difficult for them to manage and operate these systems due to lack of ability and number of staff, and still necessary to support from development partners, NGOs.

For strengthening of CD, it was tried that Umudugudu people and administrative staff concerned with the PP had a chance to present a plan and lessons learnt from the PP through a series of WS at each PP components. Until the end of the Study especially Ntarama Sector and 3 Cells staff understood the project objectives and learned how to make a plan and implementing with participatory manner.

GoR has encouraged the executive secretary in Cell to enter into the diploma course to enhance their capacity building supported by the scholarship system. Ex-executive secretary in Kanzenze Cell and Kibungo Cell have learned in university in Kigali applying the scholarship system.

On the other hand, RADA and RARDA will try to strengthen the CD for Sector and Cell staff through training workshop or seminar, etc. They have many chances to learn their expertism. The central administration should disclose information to the local administration and community because the CD for people is an essential need for rural and agricultural development.

(3) Pump irrigation for marshland development

The marshland development for rice cultivation has been promoted similar to the Muzi Cyeru Marshland in DDP and small scale land reclamation by labor force in community was verified in the PP project. In marshlands directly connected with the Akagera river and Akanyaru river, water level in

dry season becomes lower and pump irrigation is unavoidable due to topographical condition. Results from the rice cultivation project in Muzi Cyeru, beneficiaries are too much burdened to pay pump fuel fee because of low yield of paddy. If they harvested paddy more than 3.5 t/ha, the project will be sustained. In case of new marshland rice cultivation, the administration should consider supporting system to the farmers until they secure enough production of paddy.

7.3.4 Financial Plan for Development Fund and Realization of Highly Public Project

Financial resources for District development are governmental support, donors and NGOs, CDF and tax revenue in the District. During 2006, 15 CDF projects were implemented in Bugesera District. Total project cost amounted to 1.0 billion Rwf (refer to Chapter 3.5.3). According to the table below, ratio of estimated development fund at government, District, CDF, and Donors/NGOs in 2007 is shown as 24%, 2%, 27% and 47%, respectively.

CDF plays a central role for highly public project and 3.2 billion Rwf was allocated in 2007 which was increased by 3 times as compared to that in 2006.

Actually formulation of the plan, project cost estimation, application procedure, etc. are carried out by the local consultants or contractors, the district's role is to apply for CDF. The priority was given to the social infrastructures components such as electric supply, construction of bridges, renovation of Sector's office, terracing and reforestation for soil conservation, etc. which are highly public (see chapter 2.4.4). but after completion of these projects, the basic human needs for water supply, health, education, etc. will be expected to apply. However the rainwater storage installation in QP and construction of farm pond in PP are given with a priority as securing safety water and environmental conservation method respectively in CDF. These are possible to apply for the CDF so that guidelines and project sheets prepared by the Study will be useful for application to the CDF

Table 7.3.1 Estimated cost of financial resources for Performance Contract (Unit: Million Rwf)

Item	Total	Government	District	CDF	Donors
Good governance	832	6	25	9	801
Economic	9,168	1,065	124	3,287	4,692
Social Affairs	2,146	1,802	38	0	306
Justice	109	92	17	0	0
Total	12,255	2,965	205	3,287	5,799
Ratio (%)	100	24	2	27	47

Source: Bugesera District January 2007

7.3.5 Accelerate use of Project Sheets

Lessons learnt from the QP and PP is organized as the recommendations and issues in future to the DDP. In addition, in order to refer implementing the similar project and review of the DDP by local administration and Umudugudu level, project sheets are prepared and also main projects are compiled

as guidelines for technology transfer materials. Active promotion for use of these materials are expected to be done in future. The project sheets are shown in at the end of this chapter.

Table 7.3.2 Project Sheets and Guidelines

Project Component	PS	GL	Project Component	PS	GL
Modern cow distribution	QPS1	•	Marshland agricultural development project	PPS2	•
Rainwater storage installation	QPS2	•	Hilly terrain agricultural	PPS3	•
Shallow well irrigation	QPS3		Rabbit rearing	PPS4	•
Road side irrigation	QPS4		Bee keeping	PPS5	
Improved rice seed multiplication and dissemination project	PPS1	•	Pineapple cultivation	PPS6	
		•	Fruits & Banana cultivation	PPS7	

Remark PS : Project sheet GL : Guideline

Taking into due account of the above mentioned items, in order to check the probability of implementation by local population or review DDP in future, 67 number of rural and agricultural development project components in DDP are classified into 5 categories to clear the executing agencies concerned and lessons learnt from the QP and PP are reflected to the DDP (see following table).

Table 7.3.3 Basic Concept for District Development Plan for Agricultural and Rural Development in Bugesera District Based on the lessons learnt through QP and PP implementation

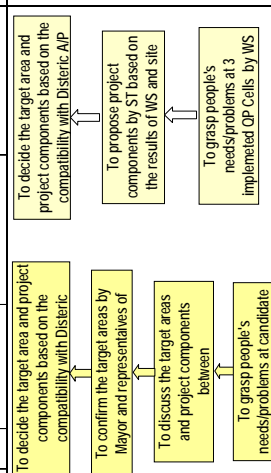
Goal	Development Strategy	Specific objectives /Results	Verifiable indicators	Projects	Priority Sector/Site	C1	C2	C3	C4	C5	Pilot Project (PP)	Verifiable Subjects	Quick Project (QP)	Project Sheet/ Guideline		
To Achieve Sustainable Agricultural & Rural Development in Bugesera District	<p style="text-align: center;">Food Security</p> <p style="text-align: center;">↑</p> <p style="text-align: center;">Sustainable Agricultural Production</p>	Sub Program: Supply and utilisation of agricultural inputs and mechanization.	Additional farming area for rice: 3,650 ha and maize: 1,100 ha	P1: Promotion of the selling of agricultural inputs by Rubuha, Nyamata, Gashora	+						Improved Rice Seed Multiplication & Dissemination Project	Is it possible to strengthen Coop. based CD of local population and administration through implementing the project components ?		PPS1/GL		
		Use of agricultural inputs and mechanization are developed.	*Increased productivity per hectare From 3 to 6 t per ha for rice and from 4 to 8 t per ha for maize. *100% of the farmers apply inputs in their gardens	P2: Agricultural mechanization on 1,800 ha in Gashora and 200 ha in Nyamata	Gashora, Nyamata	+										
		Sub program: Development of Commodity chains and Horticulture	*At least 5 commodity chains are identified, developed and are operational.	P3: Multiplication and intensification of cassava cropping	15 sectors	+							Pineapple Cultivation Fruit & cooking banana Cultivation	Is it possible to increase production & to develop spot to area by farmer to farmer through implementing the projects ?		PPS6 PPS7
		Commodity chains are developed		P4: Development of maize commodity chain	District	+										
		Sub program: Irrigation development	Additional farming area for rice: 3,650 ha and maize: 1,100 ha	P5: Intensification of coffee (2,000,000 trees) ; and rice (2,650 District)	District	+								Is it possible to construct FP by local people & to increase agricultural production ?		PPS4,QPS4/GL
		Arable land is increased		P1: Study on hill side irrigation	District	+							Hilly terrain Agricultural Development Project	→ To develop spot to area → Shallow Well Irrigation		OPS3
		Irrigation is developed		P2: Hillside irrigation from the lakes	Lakes of Rumira Mityi and Cuhobaha ssalin	+										
		Marshlands in the district are reclaimed	*In 2012, a map and study on the reclamation of district marshlands are available.	P1: Elaboration of a map and reclamation study of marshlands of the district. P2: Reclamation of Akagera marshland on an area of 15,000 Shyamba, Musesenyi P3: Reclamation of Ryababurora marshland on an area of 3,000 Shyamba, Nyarugenge. P4: Reclamation of Umuraga marshland on an area of 12,000 Mareba, Rubuha, Nyarugenge P5: Reclamation of the valley of Mvusa on area of 650 ha Mwoogo, Nyamata	District	+							Marshland Agricultural Project in Murucyuru	*To verify project cost, construction period by labor force. *Is marshland suitable for rice cultivation ?		PPS2/GL
		Food security and management of vulnerable crisis are assured.	*Two systems of hermetic stocking are installed: 1 for 1,800 t in 2007 and another for 6,000 t in 2011 *9 stocking silos with storing capacity	P1: Installation of 2 systems of hermetic stocking in each sector P2: Construction of 9 silos with storing tonnes each.	15 sectors Shyamba, Mareba Mwoogo, Juru, Musesenyi Ruhuha, Nyamata, Nyarugenge	+								To develop /strengthen the organization of modern cow MF through guidance & monitoring (Necessary to strengthen extension linkage among local population, Sector, District and RARDA)		
		Crop and animal production is increased.	*200 cows of improved race. *Veterinary centres	P1: Intensification of exotic cows in households and zero grazing P2: Constructing and equipping veterinary centres P3: Mobilisation of Micro-finance institutions for the development P4: Promotion of poultry and rearing of small ruminants P5: Planting of pasture	15 sectors Nyamata, Rubuha, Gashora	+							Follow up	→ Increase income → To develop spot to area by farmer to farmer us the 2nd generation distribution system		QPS1
Subprogram: Rural support infrastructure.	Rural infrastructure is developed.	Number of infrastructures built	P1: Construction: 5 drying surfaces and storing of maize P2: Construction 5 drying surfaces and storing of rice	Gashora, Ryababurora, Mareba, Nyamata, Rubuha, Nyarugenge	+						Improved Rice Seed Multiplication & Dissemination Project	*OMM is well managed *Extend to other areas as a model		PPS4		

Table 7.3.3 Basic Concept for District Development Plan for Agricultural and Rural Development in Bugesera District Based on the lessons learnt through QP and PP implementation

Sub-program	Activities	Impact	Beneficiaries	Resources	Timeline	Indicators	Notes	
Sub-program: promotion of cooperatives Capacity building for Producers Rural organisations are developed.	P1: Support to the establishment and reinforcement of 'A support service for cooperatives is established	+	15 sectors					
	P2: Mobilisation of micro-finance institutions to finance agricultural development.	+	15 sectors					
	Sub-program: Restructuring services to producers and rural innovation							
	P1: Study on the potential of aquaculture and fishing navigations lakes in the lakes of the district.	+	Lakes of Rumira, Mirayi Rweru, Cyohoha south					
	P2: Establishment of a support and information service for 15 sectors	+						
	P3: Mobilisation of micro-finance institutions (MFIs) for the development of aquaculture.	+	15 sectors					
	P4: Strengthen the capacity of apiculture farmers.	+	15 sectors				Bee keeping	
	P5: Support for the establishment of cooperatives/banks for local stocking	+	Nyamala					
	P6: Mobilisation of MFIs for the development of agri-business	+	Nyamala				To develop/strengthen the organization of AS and Coop. increase income	
	Sub-program: Competitiveness and transformation of agricultural products							
P1: Construction of a pineapple processing plant.	+	Nyamala				Pineapple Cultivation		
P2: Construction and provision of equipment to 3 milk collection centres of Nyama, Ruhuha, Gashora	+	Nyamala, Ruhuha, Gashora				Follow up		
P3: Construction of a cassava processing plant.	+	Nyamala				Modern Cow Distribution		
P4: Construction of 5 coffee washing stations	+	Nyamala, Juru, Shyara, Musenyi, Nyatugugue						
Sub-program: construction of market places								
P1: Construction of modern markets in 5 rural centres: Nyamala, Kabukuba, Rilima, Akanga, Kabosha.	+	Nyamala, Kabukuba, Rilima, Akanga, Kabosha.						
P2: Construct and provide equipment for the handicraft house	+	Nyamala						
Sub-program: Access to clean water								
Infrastructure for water, energy, transport and communication are constructed by 2012								
P1: Elaboration of a water master plan	+	15 sectors						
P2: Elaboration of a program for the supply of clean water	+	15 sectors					To reduce water borne diseases by boiling water	
P3: Rehabilitation and extension water facilities.	+	15 sectors					To reduce the burden to fetch firewood by women	
P4: Rehabilitation of water sources	+	15 sectors					Follow up	
P5: Construction of reservoirs for rain water collection in groups.	+	15 sectors					Rainwater Storage Installations	
P6: Capacity building for community water management	+	15 sectors					To construct as a public facility based on Umudugudu level.	
Sub-program: Development and maintenance of transport infrastructure								
P1: Construction and tarmac 60km road. Gashora - Nyamala	+	5 sectors						
P2: Constructing and tarmac 49km road. Nyabarongo - Nyamala - Rilima	+	5 sectors						
P3: Construction and tarmac 10km road. Nyamala - Karera	+	Nyamala - Rilima						
P4: Study or renovation of Nyamala - Musenyi - Shyara road.	+	Nyamala, Musenyi, Shyara						
P5: Rehabilitation of Nyamala - Mwogo - Rilima road. 30km	+	Nyamala, Mwogo, Rilima						
P6: Rehabilitation of Arete - Kiburungo - Kagamba road : 15 km	+	Nirama						
P7: Rehabilitation of Kagasa - Isir - Nkanga - Rweru road: 3 sectors	+	3 sectors						
P8: Rehabilitation of Kindama Gashembe road: 20 km	+	Rweru, Kamabye, Nyatugugue, Ruhuha, Nguaka						
P9: Construction of rural road along lake Cyohoha south: 78km	+	Gashora, Nyamala, Ruhuha, Namba						
P10: Construction of bus parks in urban centres	+	15 sectors						
P11: Support for the establishment and strengthening of community	+							
Sub-program: Promotion of alternative sources of energy and their diversification								
P1: Inception of a centre to promote alternative sources of energy.	+	15 sectors					To reduce the burden to fetch firewood by women	
P2: Inception of a unit for the exploitation of peat	+							

Table 7.3.3 Basic Concept for District Development Plan for Agricultural and Rural Development in Bugesera District Based on the lessons learnt through QP and PP implementation

To Achieve Sustainable Agriculture		Sub-Program: Sustainable management of Ecosystems to generate income																	
Natural Environmental Conservation		Development Approach to the Goal																	
100% of the land is protected against soil erosion, 30% is covered with trees, lakes and rivers are protected from drying.		Area with radical terraces increases from 100 ha to 2,000ha.	15 sectors																
Progressive terraces are constructed on erodible land		Area with progressive terraces increases from 40,896ha to 46,460ha	15 sectors																
All lakes and rivers of the district are protected		*Protection plan for lakes and rivers	15 sectors																
Flowing water is retained		750 valley dams are constructed to retain flowing rain water	15 sectors (except Nyamata)																
Hydrometric data are regularly collected and published		Monthly hydrometric data available	15 sectors																
All projects in the district are sensitive to the environment		*An environmental integration guide is available. *A monitoring and evaluation team for	District																
Sub-program: Management of forest resources		All hills are covered with trees.	District																
Fauna and Flora of the district are protected.		*Forest development plan for the district. *A plan for the protection of natural forest.	District																
		P1: Elaboration of a simplified plan for forestry development in each sector. P2: Elaboration of a plan for the protection of flora and fauna of the district (Gashora natural forest, Zoological museum).	15 sectors																
			15 sectors																



- Category for sustainable and self-help project
- C1: CD & Peoples Needs
 - C2: Low cost/ applicable technology
 - C3: Improvement of life style
 - C4: Natural environmental conservation

Project Sheet	
Project	Improved Rice Seed Multiplication and Dissemination Project
Objectives and Compatibility to National Policy	<ul style="list-style-type: none"> ▪ The Project is aimed at introducing the 3 promising rice varieties for multiplication purpose together with introduction of improved farming practice, and disseminating them not only Nyaburiba but also other rice farming areas in the ex-Ngenda area. ▪ Rice production in marshland is prioritized in the national rice production plan as well as DDP, which is compatible with food security and poverty reduction.
Project Type	C1,C2,C3,C4
Target Area	<ul style="list-style-type: none"> ▪ Ruhuha Sector, Nyaburiba Marshland (42 ha)
Project Implementing Period	<ul style="list-style-type: none"> ▪ Principal phase: From June,2007 to March, 2008 ▪ Follow up Phase: From April, 2008 to October, 2008
Project Cost	<ul style="list-style-type: none"> ▪ Seed/Fertilizer, 0.25 million Rwf, farming implements (T-shape, Rotary weeder, Thresher, Winnow, Sprayer) 6.0 million Rwf ▪ Concrete drying yard (810m²), Storage 6.5 million Rwf ▪ Total Cost: 12.5 million Rwf/ 3ha
Verifiable items, outcomes and lessons learnt	<p>It is aimed at producing and disseminating of improved rice seed together with introduction of improved farming practice, and acquiring certificate of certified seeds by RADA/AFSR</p> <ul style="list-style-type: none"> ▪ Yield/ha increased from 3 -4t/ha to 6 - 8t/ha, and one of 3 varieties got a certificate as certified seeds from AFSR/RADA. The produced seeds were sold to Nyaburiba rice farmer, and moreover, around 60 % of the ex-Ngenda area is scheduled to use the Nyaburiba seeds for July - December, 2008 cropping season. ▪ 1-It is essential for raising of farmer's motivation by supporting materials and technical guidance based on grasping their real needs in the target area. 2 - Targeting existing farmer's organization as a beneficiary group instead of forming new farmer's group is effective in terms of institutional support and strengthening of farmer's organization, 3-Awareness creation of farmer's initiative is effective to train leader of farmer's organization and encourage their incentives by demonstrating visual project impact. ▪ Seed production is required to manage seed plot strictly by practicing rouging operation as well as disease control to meet RADA/AFSR criteria. After the seeds pass lab test, it is possible to sell it in good price as certified seeds, but If not, it should be sold as cooking rice.
Possibility of project implementation by local population	Institutional strengthening is accelerated depending on leadership of farmer's organization. Further, if external support and leadership of farmer's organization efficiently cooperate, leveling up of whole organization capacity (rice coop) is feasible
Supporting method to local population by local administration	<ul style="list-style-type: none"> ▪ As one of possible intervention, local administration could play a role of interface between beneficiary and other supporting organs, and that of inviting agricultural conference organized by the administration, or advisor about formation of farmer's group. ▪ In order to bring out independence of the beneficiary and increase sustainability of the project, showing a visual project effect is vital factor by introducing appropriate farming practice with grasping farmer's needs exactly. ▪ The existing rice farming area faces degeneration of rice variety due to no supply channel of improved rice seeds from outside, thus yield increase is expected by introducing locally adaptable rice variety. But project on seed production is required to

	control purity of variety strictly, thus guidance of seed production technology by the administration and research organ is essential.
Extension through farmer to farmer and expansion to larger areas	<ul style="list-style-type: none"> ▪ Rice farming is mostly managed by rice association or rice cooperative in Rwanda. For this reason, study tour to advanced rice farming area is very effective for them to extract useful farming practice by comparing their farming system with the advanced one.
Recommendations to DDP and further issues	<ul style="list-style-type: none"> ▪ Establishment of 6 observation stations for hydrological data in the ex-Ngenda area ▪ Renovation of market facility and access road in the same area ▪ By introducing early matured rice variety, a fallow period between 1st and 2nd crops is possible to expand, and which gives spare time to the beneficiary for doing other work. ▪ It is essential that agricultural extension framework is strengthened for sustainable project implementation.

Project Sheet	
Project	Marshland Agricultural Development Project in Muzi Cyeru
Objectives and Compatibility to National Policy	<ul style="list-style-type: none"> ▪ This project is aimed at examining a possibility of marshland agricultural development by introducing rice crop together with newly reclaimed paddy field (pilot farm; FP) and improving income generation with agricultural production and securing of food in sustainable way. ▪ Rice production in marshland is prioritized in the NAP, PSTA, National Rice Production Plan as well as DDP, which is fully compatible with food security and poverty reduction.
Project Type	C1, C4, C5
Target Area	<ul style="list-style-type: none"> ▪ Muzi Cyeru Marshland in Kanzenze Cell, Ntarama Sector (1ha)
Project Implementing Period	<ul style="list-style-type: none"> ▪ Principal Period: From July, 2007 to March, 2008 ▪ Follow-up Period: From April, 2008 to October, 2008
Project Cost	<ul style="list-style-type: none"> ▪ Land consolidation work for paddy field (Casual worker's wage, topography survey) 5.3 million Rwf ▪ Seed, fertilizer and chemicals ,0.13 million Rwf and, ▪ Farming implements(T-shape, rotary weeder, thresher, winnowing machine, plastic sheet, balance, pump and its accessories) 5.7 million Rwf ▪ Total cost 11.1 million Rwf/ha
Verifiable items, outcomes and lessons learnt	<ul style="list-style-type: none"> ▪ 1-Examining of land consolidation work by man power only without construction machines <ul style="list-style-type: none"> ▪ 1- Paddy field consolidation work by manpower was completed ▪ 2- Environmental conservation of the surrounding paddy fields with disposal of cutting soils, <ul style="list-style-type: none"> ▪ 2- Paddy yield resulted in 1.2 t/ha and many physiological disorder and severe empty grains which appeared to be caused by soil physical/chemical characteristics under submerged condition and uneven soil fertility due to no handling of surface soils ▪ 3- Agronomic issues on rice cultivation <ul style="list-style-type: none"> ▪ 3-To make new marshland agricultural development project success, the following project components are essential; <ul style="list-style-type: none"> ▪ Collection of hydrological data, diagnosis of soil fertility by analyzing soil and water quality, decision of direction on handling surface soils in land consolidation work, operation of uniformity cultivation, various verification trials(Civil engineering and agronomic trials), and introduction of pump irrigation method

Possibility of project implementation by local population	<ul style="list-style-type: none"> ▪ Paddy field consolidation in marshland requires topographic survey, thus basic design by the administration side and HIMO approach by local population should be combined for project implementation.
Supporting method to local population by local administration	<ul style="list-style-type: none"> ▪ Rice cultivation in the newly consolidated paddy field in marshland is usually associated with various agronomic problems until farming practice becomes stable (depending on project site of marshland). Thus for the time being, verification trials by the administration side should be preceded so as to establish feasible farming system adaptable to local agro-ecosystem. After that, it should be disseminated to local population (farmer).
Extension through farmer to farmer and expansion to larger areas	<ul style="list-style-type: none"> ▪ Paddy field consolidation work requires civil engineering technology such as water intake method, topographical survey of paddy field elevation, leveling work of plot, thus area expansion by farmer to farmer is difficult. ▪ When rice cultivation becomes stable to get profit, area expansion by farmer to farmer is possible via study tour.
Recommendations to DDP and further issues	<ul style="list-style-type: none"> ▪ Marshland is classified into two types by hydrological system (a. flood water of marshland is directly linked to existing river water, b. flood water of marshland is not linked to river water like inland marshland), and development work should be launched by deciding irrigation method. ▪ As no hydrological data of existing marshland is available, observation of water level including ground water level which is essential for marshland development project should be recorded. Observation point should be established in the major marshlands over Akagera and Akanyaru river system. ▪ Diagnosis of soil fertility by analyzing soil and water samples in details for the target marshland development. ▪ Rice is the first trial in Ntarama Sector including Muzi Cyeru area, and extension activity should be undertaken after suitable farming system through conducting of various verification trials is developed by the administration side (Pilot Farm should be constructed in order to conduct various verification trials). ▪ The marshland like Muzi Cyeru topographical condition has no way except for pump irrigation method, thus introduction of early matured variety should be considered. That is to say, double cropping of vegetable and rice cultivation become possible with saving of fuel cost by shortening of growth period.

Project Sheet	
Name of project	Hilly Terrain Agricultural Development Project
Project goals and conformity with superior policies	<ul style="list-style-type: none"> ▪ The project aimed at 1- stable food security through stabilized crop cultivation by supplemental irrigation in rainy seasons, 2- improved livelihood through the cultivation of cash crops by small-scale irrigation during onset of dry season, by means of the construction and use of farm ponds (hereinafter referred to as FP). At the same time, technical transfer was tried on the manual method of planning / constructing, environment conserving measures to be taken in the periphery of construction sites required at post-construction stage etc. ▪ Major tasks of agricultural sector in EDPRS constitute establishment of statewide food security and increase as well as diversification of agricultural household income. As the countermeasures to be applied on these tasks, it calls for introduction of irrigation and water harvesting utilizing surface water in hilly terrain and inter alia harnessed access to food by rural inhabitants and the socially vulnerable. ▪ LWH project by MINAGRI also emphasizes water harvesting, introduction and promotion of appropriate techniques for irrigation farming on hilly terrain. Water harvesting (effective storage and use of rainwater) has effect in particular on improvement of

	<p>productivity of farming in dry season, but the area coverage of this practice throughout the territory of Rwanda still remains at around 0.4%. This is the reason why this Project envisages the promotion of water harvesting.</p> <ul style="list-style-type: none"> ▪ Bugesera District has been designated as the target area of the above-cited project. ▪ Thus, Project aims at pursuing "trial of small-scale irrigation utilizing water stored in FP in hilly terrain and stable food security as well as livelihood improvement through irrigation ". Hence, it is in compliance with the superior plan of Rwanda in terms of the above-mentioned agricultural policies.
Category of project components in DDP	<ul style="list-style-type: none"> ▪ C1, C4 and C5
Target area of project	<ul style="list-style-type: none"> ▪ Ntarama Sector, implemented in 22 sites
Implementation period	<ul style="list-style-type: none"> ▪ June 2007- October 2008
Costs and benefits	<ul style="list-style-type: none"> ▪ Construction tools, 0.19 million Rwf, Construction material, 0.24 million Rwf ▪ Labor fee, 0.58 million Rwf, Vinyl sheeting, 0.15 million Rwf ▪ Total Cost; 1.16 million Rwf/site
Contents of verification and fruit /lessons learnt	<ul style="list-style-type: none"> ▪ 1-Whether manual construction of FP was possible or not. 2-Whether effect was identified on the state of water storage in FP and prevention of water leakage or not. 3-Whether O.M were relevantly made or not, and whether water of FP was properly utilized or not. ▪ 1- Manual construction of FP was proved feasible though difficulty of construction is dependent on soil mechanical property, 2- No remarkable effect by counter leakage measures making use of such local natural resources as clay has so far been observed, but it is necessary to continue monitoring in the light of the nature of sustainable effect. Use of plastic sheets enables FP to store water but it is necessary to monitor its durability and O.M. 3-O. M activities were inert. WUA has been established for the purpose of practicing O.M, water use and safety measures envisaging adequate management hereafter of FP, for which it is indispensable to establish closer coordination among Sectors and Cells concerned. 4-To take measures for capacity development (CD) of human resources in the position of locally leading roles in addition to leaders of Umudugudu is also indispensable. ▪ In order to secure safety of users of the farm pond, safety measures should be taken on the site. The measures actually taken are i) creating a live fence with naturally grown Euphorbia which is generally utilized for hedging homesteads around the pond, ii) setting up the door at the entrance to the pond, iii) placing the signboard beside the pond.
Possibility of project implementation on the initiative of inhabitants	<ul style="list-style-type: none"> ▪ Since the inhabitants have mastered methodology of constructing FP, implementation of the project by them is technically possible. ▪ However, at present, provision of material/ implements is a bottleneck. ▪ Supply of these inputs from administration is essential for the inhabitants to implement projects on their initiative. Besides, making more use of locally available natural resources and capacity building of human resources are also prerequisite for the success of the projects.
Measures for assisting inhabitants taken by the administration	<ul style="list-style-type: none"> ▪ As the assistance from administration, supply of such inputs as seed and implements /material for the construction of FP is conceivable towards the implementation and sustenance of the projects on their own initiatives. ▪ No less essential than assistance is to nurture ownership of the facilities among their users, and proper instruction on O.M is made towards WUA. ▪ It is required to take measures for CD to create local human resources.
Method of extension and	<ul style="list-style-type: none"> ▪ The beneficiary people of FP acquired method of construction and knowledge because they were themselves involved in the construction thereof. It follows that possibility of

<p>deployment by way of Farmer to Farmer (FtF)</p>	<p>developing the project from spot to area is existing where core of the developers are the beneficiary people who participated in the construction of FP. Yet, from the aspect of cost bearing, especially considering the cost incurred by the renewal of plastic sheets, extensive deployment of the project by the inhabitants alone is difficult. From this standpoint, assistance by the administration is prerequisite.</p> <ul style="list-style-type: none"> ▪ Besides, need arises to demonstrate visible effect in an early stage through the activities in which WUA plays core role. To this end, farming instructions and assistance for organizing the beneficiary from administration are necessary.
<p>Proposal to District Development Plan (DDP) and issues to be addressed hereafter</p>	<ul style="list-style-type: none"> ▪ Construction of FP is being planned at 750 sites in DDP, while this Project is placed as a part of this plan. The stakeholders of DDP project evaluated this Project as a useful tool for improving farming in dry season. ▪ In general, the stakeholders of projects including RADA tend to take the use of plastic sheets for water storage for granted. However, taking account of making projects sustainable, it is necessary to continue observation of the outcome of other measures for stopping water leakage by means of material found in local natural resources such as clay and vegetation ▪ In this Project actual practice of irrigation farming using water in FP was not realized, but a pragmatic environment was created to put supplemental irrigation during rainy season as well as small-scale irrigated cash crop farming in dry season into practice using FP. Hereafter, need arises from WUA to enhance recognition on necessity of O.M activities, and it is required to start actual activities of WUA. ▪ It is indispensable to monitor activities by WUA by making coordination with Sector offices and Cell offices closer. ▪ Promotion of the Project requires strong leadership kept by the leaders of Sector, Cell and Umudugudu. Therefore, relevant measures should be taken such as provision of training programs and enlightenment for the CD of human resources. ▪ In developing farming on hilly terrain, need arises to establish climatic /meteorological data observatory for accumulating such technical data as runoff coefficient, volume of soil loss, farming improvement etc. ▪ A guideline was provided on the construction of FP. Hereafter, it is possible to serve this guideline as a reference for construction of FP in similar projects.

Project Sheet	
Project	Livelihood Improvement Project: Rabbit Rearing
Objectives and Compatibility to National Policy	<ul style="list-style-type: none"> ▪ The project aims to improve livelihoods of the people living in Ntarama Sector through diversification of income sources with rabbit rearing. ▪ This rabbit rearing is included in the logframe of the Development Plan for Bugesera District (2008-2012): Promotion of poultry and rearing of small ruminants. With its successful results, it helps accelerate poverty reduction in rural areas which is one of the most urgent national policies.
Project Type	<ul style="list-style-type: none"> ▪ C1, C2, C3
Target Area	<ul style="list-style-type: none"> ▪ This component was implemented in Kanzenze Cell, Ntarama Sector.
Project Implementing Period	<ul style="list-style-type: none"> ▪ Preparation: November 2007 ▪ Implementation: From December 2007 to August 2008 (9 months) ▪ Evaluation: September 2008

Project Cost	<ul style="list-style-type: none"> ▪ Project costs are indicated below. (Unit: Rwf) <table border="1"> <thead> <tr> <th>Item</th> <th>Amount</th> <th>Remarks</th> </tr> </thead> <tbody> <tr> <td>Direct cost</td> <td>430,700</td> <td>48 rabbits (16 males, 32 females), materials for cages</td> </tr> <tr> <td>Other cost</td> <td>92,700</td> <td>Workshop expenses, Hiring carpenters, etc.</td> </tr> <tr> <td>Total</td> <td>523,400</td> <td>Rwf 32,713 per farmer (Rwf 10,904 per rabbit)</td> </tr> </tbody> </table> ▪ Model farmers: 16 model farmers were selected from 8 Umudugudu and each of them received a combination of one male and two female rabbits after training. 	Item	Amount	Remarks	Direct cost	430,700	48 rabbits (16 males, 32 females), materials for cages	Other cost	92,700	Workshop expenses, Hiring carpenters, etc.	Total	523,400	Rwf 32,713 per farmer (Rwf 10,904 per rabbit)
Item	Amount	Remarks											
Direct cost	430,700	48 rabbits (16 males, 32 females), materials for cages											
Other cost	92,700	Workshop expenses, Hiring carpenters, etc.											
Total	523,400	Rwf 32,713 per farmer (Rwf 10,904 per rabbit)											
Verifiable items, outcomes and lessons learnt	<ul style="list-style-type: none"> ▪ The project tries to verify the feasibilities of a relatively new income generating activity, rabbit rearing in Ntarama Sector. ▪ In general, this component went well and many of the model farmers got benefits through newborn rabbits. Some of the model farmers had problems such as attacks by stray dogs/cats and difficulties in marketing rabbits, but they started to cope with them. ▪ On average, one female rabbit give 2.3 births per year and 3.9 live baby rabbits are born per birth. After grown up, one rabbit can be sold at Rwf 1,800 in Nyamata. Therefore, the initial cost will be paid back in almost one year. ▪ Rabbits were not only sold to others for income generation but also consumed by the model farmers themselves which improved their diet and nutritional conditions. ▪ Protection of rabbits from stray dogs/cats is indispensable since some model farmers often lost their rabbits. ▪ Some of the procured rabbits were infertile and the model farmers who received them had difficulties to increase the rabbits. If the rabbits are unfortunately infertile, they should be replaced as soon as possible. 												
Possibility of project implementation by local population	<ul style="list-style-type: none"> ▪ Internal evaluation revealed that 63% of the model farmers thought rabbit rearing could be implemented by themselves. ▪ Although some knowledge is necessary, its level is not so high; hence, most rural people can start rabbit rearing with some initial assistance from the outside. 												
Supporting method to local population by local administration	<ul style="list-style-type: none"> ▪ The evaluation result indicates that the model farmers thought that government organizations should do the following things for the sustainable project implementation. <ul style="list-style-type: none"> ▪ To organize meetings to share the merits of rabbit rearing ▪ To visit his rabbit rearing and help distribution of rabbits ▪ To mobilize people and make them like rabbit rearing ▪ To organize workshops ▪ To give technical assistance ▪ It is desirable that Sector and/or District Office arrange periodical monitoring of model farmers by experts. 												
Extension through farmer to farmer and expansion to larger areas	<ul style="list-style-type: none"> ▪ In general, rabbit rearing need neither high level technologies nor costly facilities. It can start with small cages mostly constructed with locally available materials and some technical assistance. Moreover, weeds are enough for feeding, which means no competition with human food production. If rural people have no hesitation to eat rabbits, it has possibilities to expand in Ntarama Sector through the model farmers. 												
Recommendations to DDP and further issues	<ul style="list-style-type: none"> ▪ As compared to medium- and large-size ruminants, small ruminants including rabbits have several merits. For instance, they need relatively small initial investment and their gestation period is shorter than the medium- and large-size ruminants. Hence, with a certain amount of budget, it can target more people than other expensive animals with quick results. ▪ From the viewpoint of nutritional improvement within each household, rabbit rearing can be promoted since the meat is a good protein source for daily diet. ▪ In addition, rabbit rearing can be promoted as one of school activities and the meat can be used for school lunch. 												

	<ul style="list-style-type: none"> There is some reluctance among the rural people to eat rabbits. If people don't like to eat the rabbit meat, publicity of the rabbit rearing should be done.
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Project Sheet													
Project	Livelihood Improvement Project: Bee Keeping												
Objectives and Compatibility to National Policy	<ul style="list-style-type: none"> The project aims to improve livelihoods of the farmers living in Ntarama Sector through diversification of income sources with modern bee keeping. The bee keeping is included in the logframe of the Development Plan for Bugesera District (2008-2012): Strengthen the capacity of apiculture farmers. With its successful results, it helps accelerate poverty reduction in rural areas which is one of the most urgent national policies 												
Project Type	<ul style="list-style-type: none"> C1, C3 												
Target Area	<ul style="list-style-type: none"> This component was implemented in the three Cells, Kanzenze, Kibungo and Cyugaro, Ntarama Sector. 												
Project Implementing Period	<ul style="list-style-type: none"> Preparation: From June to August 2007 Implementation: From September 2007 to August 2008 (12 months) Evaluation: September 2008 												
Project Cost	<ul style="list-style-type: none"> Project costs are indicated below. (Unit: Rwf) <table border="1"> <thead> <tr> <th>Item</th> <th>Amount</th> <th>Remarks</th> </tr> </thead> <tbody> <tr> <td>Direct cost</td> <td>1,297,700</td> <td>Materials for sheds and bee keeping</td> </tr> <tr> <td>Other cost</td> <td>106,300</td> <td>Workshop expenses, Transportation of materials, etc.</td> </tr> <tr> <td>Total</td> <td>1,404,000</td> <td>Rwf 42,545 per model farmer</td> </tr> </tbody> </table> Model farmers: In total, 33 model farmers were participants of this component. Among them, 25 are members of three existing bee keeping associations (2 in Cyugaro and 1 in Kibungo). Because there are no associations for bee keeping in Kanzenze, 8 independent bee keeping farmers were selected from each of 8 Umutugudu. 	Item	Amount	Remarks	Direct cost	1,297,700	Materials for sheds and bee keeping	Other cost	106,300	Workshop expenses, Transportation of materials, etc.	Total	1,404,000	Rwf 42,545 per model farmer
Item	Amount	Remarks											
Direct cost	1,297,700	Materials for sheds and bee keeping											
Other cost	106,300	Workshop expenses, Transportation of materials, etc.											
Total	1,404,000	Rwf 42,545 per model farmer											
Verifiable items, outcomes and lessons learnt	<ul style="list-style-type: none"> The project tries to verify the feasibilities of a modern bee keeping activity in Ntarama Sector. Because modern bee keeping needs some technical knowledge, it hasn't gone well so far even though the existing bee keeping associations were target groups. The project has not yet brought the fruits of the project, honey, because it needs a certain period to get honey. Hence, the feasibility of modern bee keeping should be judged after getting honey. Bee keeping needed group works and sometime these works were stagnated by conflicts among the group members. Fortunately, the conflict arisen this time was solved through the discussions among the stakeholders, but this kind of internal disputes may severely interfere the progress of the project. During the project period, chemical insecticides were applied at the tomato fields near one of the beehive sheds in Cyugaro. Some bees collected nectars tainted with chemical insecticides, and this resulted in the abandonment of some of the beehives. Sheds for beehives should be constructed near the areas where horticultural crops are not cultivated which often uses chemical materials. 												
Possibility of project implementation by local population	<ul style="list-style-type: none"> 70% of the model farmers didn't think that the support so far given was enough for them. In particular, they wanted continuous material supply. This may imply that bee keeping is rather difficult to be implemented by people themselves. Women might be key stakeholders for bee keeping since they seem to be keener on group works; hence, they are more suitable for this kind of income generation activity. 												
Supporting method	<ul style="list-style-type: none"> The evaluation result indicates that the model farmers thought that government 												

to local population by local administration	<p>organizations should do the following things for the sustainable project implementation.</p> <ul style="list-style-type: none"> ▪ To help farmers to get support ▪ To help bring the modern knowledge ▪ To look for support providers ▪ To give technical support ▪ To find honey market <ul style="list-style-type: none"> ▪ Technical assistance is indispensable since modern bee keeping is not so popular among the rural people and some technical knowledge is very important for honey production. ▪ If there are some farmers' groups doing modern bee keeping, it is better to work together with them since their experiences can be reflected.
Extension through farmer to farmer and expansion to larger areas	<ul style="list-style-type: none"> ▪ Because technical knowledge is necessary for modern bee keeping, it is rather difficult to extend through the farmer-to-farmer approach. If there are some innovative farmers who do successful modern bee keeping, a bee keeping association could be organized if he/she becomes a leader of the association.
Recommendations to DDP and further issues	<ul style="list-style-type: none"> ▪ For the expansion of apiculture in Bugesera, it is recommendable to support existing bee keeping associations since the members already have some knowledge on bee keeping. ▪ Because chemical insecticides cause harmful effects on bee keeping, it is better to regulate its application near the areas where bee keeping activities are ongoing. ▪ Since the tools and materials for modern bee keeping are available only in Kigali, the plan for modern bee keeping expansion needs careful investigation. ▪ For the successful modern bee keeping, it is desirable to work with bee keeping experts who can provide technical assistance through governmental organizations (or NGOs).

Project Sheet													
Project	Livelihood Improvement Project: Pineapple Cultivation												
Objectives and Compatibility to National Policy	<ul style="list-style-type: none"> ▪ The project aims to improve livelihoods of the farmers living in Ntarama Sector through diversification of income sources with pineapple cultivation. ▪ The pineapple cultivation is a supporting activity for the logframe of the Development Plan for Bugesera District (2008-2012): Construction of a pineapple processing plant. With its successful results, it helps accelerate poverty reduction in rural areas which is one of the most urgent national policies 												
Project Type	C1, C2, C4												
Target Area	<ul style="list-style-type: none"> ▪ This component was implemented in Kanzenze and Kibungo Cells, Ntarama Sector. (2 ha in total and 1 ha in each Cell) 												
Project Implementing Period	<ul style="list-style-type: none"> ▪ Preparation: From June to July 2007 ▪ Implementation: From August to September 2008 (2 months) ▪ Evaluation: September 2008 												
Project Cost	<ul style="list-style-type: none"> ▪ Project costs are indicated below. (Unit: Rwf) <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 20%;">Item</th> <th style="width: 20%;">Amount</th> <th style="width: 60%;">Remarks</th> </tr> </thead> <tbody> <tr> <td>Direct cost</td> <td style="text-align: right;">665,820</td> <td>Pineapple suckers</td> </tr> <tr> <td>Other cost</td> <td style="text-align: right;">846,400</td> <td>Transportation of suckers, Study tour, etc.</td> </tr> <tr> <td style="text-align: center;">Total</td> <td style="text-align: right;">1,512,220</td> <td>Rwf 47 per sucker (Rwf 756,110 per ha)</td> </tr> </tbody> </table> <ul style="list-style-type: none"> ▪ Model farmers: In total, around 200 model farmers received suckers in this component. Each of them was supposed to receive 160 suckers, which can be planted on 100 m² of farmland. However, in Kanzenze, the distribution didn't go well due to improper 	Item	Amount	Remarks	Direct cost	665,820	Pineapple suckers	Other cost	846,400	Transportation of suckers, Study tour, etc.	Total	1,512,220	Rwf 47 per sucker (Rwf 756,110 per ha)
Item	Amount	Remarks											
Direct cost	665,820	Pineapple suckers											
Other cost	846,400	Transportation of suckers, Study tour, etc.											
Total	1,512,220	Rwf 47 per sucker (Rwf 756,110 per ha)											

	<p>communication within the cell, and many of the suckers were distributed to farmers who were not included in the original farmers list. In Kibungo, the suckers were distributed to the prearranged model farmers without confusion.</p>
Verifiable items, outcomes and lessons learnt	<ul style="list-style-type: none"> ▪ The project tries to verify the feasibilities of pineapple cultivation in Ntarama Sector. ▪ Pineapple cultivation doesn't need any specific technologies, but it needs regular cares for mulching. Some of the model farmers didn't care about mulching, which, in turn, resulted in poor growth of pineapples. ▪ Originally, pineapple suckers were planned to plant in a triangle to reduce surface soil erosion between rows. However, many suckers were actually planted in a rectangle due to insufficient technical advice. ▪ In general, pineapples have been grown better in Kanzenze than in Kibungo. Partly, this result may come from the fact that surface soil is stony and very shallow in some areas in Kibungo Cell.
Possibility of project implementation by local population	<ul style="list-style-type: none"> ▪ Because pineapple cultivation doesn't need any special technical knowledge and the price of sucker is inexpensive, pineapple cultivation could be implemented if there are some motivated farmers.
Supporting method to local population by local administration	<ul style="list-style-type: none"> ▪ Technical assistance including appropriate mulching is important. ▪ It is desirable to check the possible site by experts before introduction of pineapple cultivation because some types of soils are unsuitable for pineapple cultivation. ▪ Trial cultivation is useful before extensive introduction of pineapple cultivation. (The result of this project suggests that the area around Kagoma, Kibungo Cell, is not suitable for pineapple cultivation due to its poor soils.)
Extension through farmer to farmer and expansion to larger areas	<ul style="list-style-type: none"> ▪ For pineapple cultivation, the farmer-to-farmer extension approach is not so difficult if initial suckers are prepared since no special techniques are required. ▪ Because it takes some time to get fruits, it is not recommendable for the farmers who urgently need cash income.
Recommendations to DDP and further issues	<ul style="list-style-type: none"> ▪ Because of its relatively dry climate condition, it seems that the Bugesera District has a potential to produce more pineapples. If there are governmental supports for initial sucker provision, farmers can start pineapple cultivation. To boost pineapple production, it is recommendable to work with the successful pineapple farms such as Ruhuha Parish that manages several pineapple farms in the former Ngenda area. ▪ Plan of processing plants for pineapples could be an incentive for expansion of pineapple cultivation, but the pineapple production system should be firstly established.

Project Sheet	
Project	Livelihood Improvement Project: Fruit Banana Cultivation
Objectives and Compatibility to National Policy	<ul style="list-style-type: none"> ▪ The project aims to improve livelihoods of the farmers living in Ntarama Sector through diversification of income sources with fruit banana cultivation. ▪ The fruit banana cultivation is not included in the logframe of the Development Plan for Bugesera District (2008-2012). However, the price of fruit banana is higher than that of plantain and brewery bananas; hence, it helps accelerate poverty reduction in rural areas, which is one of the most urgent national policies, if it brings good harvest.
Project Type	<ul style="list-style-type: none"> ▪ C1, C2
Target Area	<ul style="list-style-type: none"> ▪ This component was implemented in the three Cells, Kanzenze, Kibungo and Cyugaro, Ntarama Sector. (3 ha in total and 1 ha in each Cell)
Project Implementing Period	<ul style="list-style-type: none"> ▪ Preparation: From November 2007 ▪ Implementation: December 2008

	<ul style="list-style-type: none"> ▪ Evaluation: September 2008 												
Project Cost	<ul style="list-style-type: none"> ▪ Project costs are indicated below. (Unit: Rwf) <table border="1" style="margin-left: 40px;"> <thead> <tr> <th>Item</th> <th>Amount</th> <th>Remarks</th> </tr> </thead> <tbody> <tr> <td>Direct cost</td> <td>1,260,000</td> <td>Banana suckers (Kamaramasenge and Gros Michel)</td> </tr> <tr> <td>Other cost</td> <td>229,000</td> <td>Transportation of suckers, Bags for transportation, etc.</td> </tr> <tr> <td>Total</td> <td>1,489,000</td> <td>Rwf 414 per sucker (Rwf 496,333 per ha)</td> </tr> </tbody> </table> <ul style="list-style-type: none"> ▪ Model farmers: There are 11 model farmers in total, 5 in Kanzenze, 2 in Cyugaro and 4 in Kibungo. The suckers were distributed to these model farmers according to the size of farmland they prepared ranging from 20 to 1,100 suckers. 	Item	Amount	Remarks	Direct cost	1,260,000	Banana suckers (Kamaramasenge and Gros Michel)	Other cost	229,000	Transportation of suckers, Bags for transportation, etc.	Total	1,489,000	Rwf 414 per sucker (Rwf 496,333 per ha)
Item	Amount	Remarks											
Direct cost	1,260,000	Banana suckers (Kamaramasenge and Gros Michel)											
Other cost	229,000	Transportation of suckers, Bags for transportation, etc.											
Total	1,489,000	Rwf 414 per sucker (Rwf 496,333 per ha)											
Verifiable items, outcomes and lessons learnt	<ul style="list-style-type: none"> ▪ The project tries to verify the feasibilities of fruit banana cultivation in Ntarama Sector. ▪ Due to little rainfall in December 2007 and January 2008, initial growth of banana suckers was poor. Hence, watering just after planting is important for initial growth since the root system is not yet established at that time. ▪ Same as the pineapple cultivation, fruit banana cultivation doesn't need any specific technologies, but it needs regular cares such as giving manure, weeding, reducing branches, etc. ▪ Contrary to pineapple cultivation, banana suckers have been grown better in Cyugaro and Kibungo as compared with Kanzenze. Partly, this may result from the fact that it rained less in January 2008 in Kanzenze Cell, particularly in Kabaha Umudugudu. 												
Possibility of project implementation by local population	<ul style="list-style-type: none"> ▪ Internal evaluation revealed that 55% of model farmers thought fruit banana cultivation could be implemented by themselves. ▪ Although fruit banana cultivation doesn't need any special technical knowledge, the price of sucker is not cheap (Rwf 350/piece) for ordinary farmers. Some rich farmers can start with their own resources, but it is rather difficult for many farmers to start fruit banana cultivation. 												
Supporting method to local population by local administration	<ul style="list-style-type: none"> ▪ The evaluation result indicates that the model farmers thought that government organizations should do the following things for the sustainable project implementation. <ul style="list-style-type: none"> ▪ To motivate the people to plant bananas ▪ To organize more meetings for banana cultivation ▪ To give materials (manure, wheel barrow, shovel, etc.) ▪ To visit farmers and advise them ▪ If governmental organizations do propagation of fruit banana suckers and sell them to local people at low price, it really helps expand fruit banana cultivation among the farmers in Bugesera. 												
Extension through farmer to farmer and expansion to larger areas	<ul style="list-style-type: none"> ▪ For fruit banana cultivation, the farmer-to-farmer extension approach is not so difficult since no special techniques are required once banana suckers were procured. ▪ Because it takes more than one year to get bananas, it should incorporate with some multiple cropping systems such as intercropping and mixed-cropping until bananas grow. Otherwise, fruit banana cultivation is difficult for those who need cash income urgently. 												
Recommendations to DDP and further issues	<ul style="list-style-type: none"> ▪ If fruit banana cultivation is combined with road side irrigation system, it brings better production as the Quick Project results indicated. ▪ One farmer pointed that the climate conditions in Bugesera was too sunny for banana growth. It is helpful for the farmers in Bugesera to do research on banana variety selection and better cultivation methods of fruit bananas in Bugesera. 												

Project Sheet	
Project	Modern Cow Distribution
Objectives and Compatibility to National Policy	<ul style="list-style-type: none"> ▪ The Project is aimed at improving living standard, soil fertility by applying cow dung manure, and nutritious condition by ingesting milk. ▪ The Project is fully implemented in accordance with a national program of "One Cow, One Poor Family Program".
Project Type	C1,C3, C4
Target Area	<ul style="list-style-type: none"> ▪ The three Cells in Ntarama Sector received six heifer-in-calves each and were amounted to the 18 heads.
Project Implementing Period	<ul style="list-style-type: none"> ▪ Principal phase of the project : From July, 2006 to March, 2007 ▪ Follow-up Phase: From May, 2007 to August, 2008
Project Cost	<ul style="list-style-type: none"> ▪ Construction materials for cowshed, training of Model Farmers, monitoring MF by vet-technicians ▪ Total Cost 0.3 million Rwf, excluding modern cow cost (140,000-200,000 Rwf)
Verifiable items, outcomes and lessons learnt	<ul style="list-style-type: none"> ▪ a. income generation of MF by crossbred, b. soil fertility improvement, c. family health improvement. ▪ 1. Dairy farming requires the highest and various systematic combinations of practical elements and labor intensive management, and candidate farmer should clear the pre-condition such as farm plot, water resource, labor force, capital, feeding practice, and motivation. ▪ 2. From the government support, vet-technician should be properly allocated, and it is essential for vet-technician to visit the model farmers regularly for guidance of animal health and feeding practice. ▪ 3. Selection and distribution of high quality of crossbred is vital factor to inspirit the model farmer's incentive. ▪ 4. A follow-up framework by implementing body/supporting body is essential for the model farmer to stand on his/her own feet.
Possibility of project implementation by local population	<ul style="list-style-type: none"> ▪ An initial cost is very high, thus the government side bears crossbred cost as a part of One cow, One Family Project, meanwhile the model farmer bears cowshed, fodder crop plot, security of water for cow under a cost sharing system. ▪ It is essential for a supporting framework to MFs from administrative side in terms of protecting heifer/cow from animal diseases.
Supporting method to local population by local administration	<ul style="list-style-type: none"> ▪ Should support the MF's activity to form livestock cooperatives from administrative side. ▪ Grasping MF's cow keeping condition regularly especially feeding condition, and support them in terms of selection of next generation, enlightenment and distribution of heifer.
Extension through farmer to farmer and expansion to larger areas	<ul style="list-style-type: none"> ▪ Training of the next generation through OJT in order to make them grasp know-how of dairy farming, and promote preparation of heifer in calf and awareness creation.

Recommendations to DDP and further issues	<ul style="list-style-type: none"> ▪ Dairy farming by zero-grazing system requires the highest and various systematic combinations of practical elements and management recourses (land, labor and water) and motivation. Thus, candidate farmer who could meet these pre-condition should be selected. ▪ Administrative service is essential for crossbred keeping to make reproduction based on life cycle (AI and natural mating), and animal health service to protect livestock from disease possible. ▪ Bottom line of "One Cow, One Family Project" is to distribute high productive cow (high lactation performance), thus selection of crossbred should be carefully made by sparing ample time so as to evaluate performance of cow
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Project Sheet	
Project Name	Rainwater Storage Installation
Project goals and conformity with upper ranked policy framework	<ul style="list-style-type: none"> ▪ Not only matching BHN but also aiming at cost/ labor saving effect for saving household expense to procure clean/ safe water, alleviating effect of labor burden and improving effect in the rate of infection of water-borne diseases. ▪ Improved access to safe living water has been launched in EDPRS. Further, it attaches importance to establishment of water supply plan and its implementation for mitigating labor of women/ infants required for fetching and carrying water. ▪ According to DDP, about 40% of the inhabitants presently use unsanitary water in streams, lakes or ponds, which only 0.4% of them utilized rainwater. As multitude of water supply facilities have been destroyed by genocide, it is planned to repair/ newly build these broken ones, and along with the rehabilitation construction of rainwater utilizing facilities are planned to be promoted.
Classification of project	<ul style="list-style-type: none"> ▪ C1, C3 and C5
Target area for project	<ul style="list-style-type: none"> ▪ Ntarama Sector and Ruhuha Sector, introducing into 103 sites (nos)
Project implementation period	<ul style="list-style-type: none"> ▪ Main project: May 2006 - January 2007 ▪ Follow-up project (FU): September 2007 - January 2008
Project cost	<ul style="list-style-type: none"> ▪ 1.3 million Rwf (245US\$) per site
Content of verification and fruit/ lessons learnt	<ul style="list-style-type: none"> ▪ 1-Whether household expense for securing water was saved as set in the project goal or not? 2-Whether labor for water fetching was alleviated? 3-Whether the facility construction was possible through inhabitants' self-help efforts? 4-Whether post-establishment repairs/ inspections by facility owners are possible? 5-Whether strengthening of solidarity among inhabitants or local people's organizations activities progressed through its implementation? ▪ 1-Clean /safe water was secured, 2-Labor, time and expense for water fetching as well as occurrence of water-borne diseases were declined/ economized, 3-Offering of water for use of facility construction and voluntary light labor service by the Model Project farmers are possible, 4-No problem arises from maintenance/ management (maintenance-free), however, as to regular cleaning of inside water tank, it is necessary hereafter to continue to thoroughly inform and obtain cooperation of stakeholders, 5-The Project proved its effectiveness as an illustration corresponding to improvement of living environment, i.e., one of its project goals.
Possibility of project implementation by the initiative of inhabitants at large	<ul style="list-style-type: none"> ▪ Because after the introduction of rainwater storage system, the beneficiary can amortize his/her initial construction cost within 2-3 years, efficiency from cost versus effect point of view is evidently high. ▪ Since the construction cost lies above the affordable expense by inhabitant's individual

	<p>cost bearing capacity, it is difficult to introduce the facility through entire cost bearing by individual households.</p> <ul style="list-style-type: none"> ▪ Participants themselves also bore part of input provision and joined in the participatory construction activities. Nevertheless, assistance by administrative authorities concerned (supply of material and equipment) is essential to realize project implementation by inhabitant's initiative. In addition, effective utilization of additional local resources, effective mobilization of human resources and inhabitants' self-help efforts are also required.
Way of assisting inhabitants by administration	<ul style="list-style-type: none"> ▪ Because Sector's activity fund is only available at the rate of 200 thousand Rwf/ month, it follows that it is difficult to continuously introduce and extend rainwater storage systems by mobilizing the official account at Sector level. ▪ For this reason, Sector staff offers such information as possibility of applying UBDEHE fund or means for access to micro-financing institutions. In this occasion, rainwater storage system is not constructed for individual use, but it will be made as a public facility to be introduced into Umdugudu level. In this connection, because inhabitants have decision-making competency as far as methods of utilizing UBDEHE fund is concerned, Sector staff and Cell staff should instruct through consultation among inhabitants concerned on decision making. ▪ At the same time, these staff should nurture ownership of the water facility, while administration must give pertinent instructions as to maintenance and management of the completed facilities so that they can extend economic life of the constructed facility.
Extension by "Farmer to Farmer" type transfer and method of horizontal (two-dimensional) project deployment	<ul style="list-style-type: none"> ▪ The Model Project farmers could acquire method of constructing water tanks and related knowledge during their participation in the construction works. Skills of plastering works are also required for completing part of construction process. Anyway, there remains ample possibility to diffuse construction techniques from the Model farmers as a nucleus for technical source. ▪ As a bottleneck, extensive deployment among inhabitants is rather difficult due to limitation of cost. Likewise, assuming to make it individual ownership, joint construction by a neighborhood group for sharing cost burden would encounter some other difficulty. ▪ Notwithstanding, facial expansion in the domain of sharing its utilization has been identified in such a way that stored rainwater is shared among neighborhood households, and development of such mutual benefiting pattern will hereafter be expectable. ▪ The water tank employed in this Project can be constructed cheaper than the conventional tanks, and also construction works are simpler. With these merits, a tank of this type has been built in a polytechnic school in Ruhuha Sector, serving as an example of further diffusion to other Sectors.
Proposal to DDP and issues in future	<ul style="list-style-type: none"> ▪ Water supply through tap water line began its operation since December 2007 within the Project implementation area, though beneficiary is limited only around the pipeline. As an incentive / assistance for those who live out of beneficiary, it is pertinent to expand this Project in two-dimensional way. ▪ While it's self-evident that this Project can contribute to environmental improvement of living space of the inhabitants, hereafter it will be necessary to examine possibility of constructing this as public facility. Namely, in the on-going living quarter concentration policy, this can be incorporated in such a way that one or plural number of rainwater storage tanks per a group of households can be installed side by side with living compartments as a component of public welfare services so that this may contribute to improvement /amelioration of living environment.

Project Sheet	
Name of Project	Shallow Well Irrigation
Project goals and compliance with higher ranked policies	<ul style="list-style-type: none"> ▪ It aims at income improvement for dry season farming revenue and labor saving for fetching irrigation water. ▪ As "Land-husbandry, water harvesting and Hillside-irrigation (LWH) Project" promoted by MINAGRI promotes irrigation farming during dry season, this Project seems to have technical linkage with LWH project. ▪ Agricultural sector of EDPRS has urged to expand commanded area under irrigation in already reclaimed wetland, thereby promoting sustainable and productive farming system. This Project is just in line with this policy.
Classification category	<ul style="list-style-type: none"> ▪ C1, C2, C4, and C5
Target area for the project	<ul style="list-style-type: none"> ▪ Ntarama Sector, introducing into 19 sites
Duration of project implementation	<ul style="list-style-type: none"> ▪ Core project: May - December 2006 ▪ Follow up (FU) project: August 2007 - January 2008
Project cost	<ul style="list-style-type: none"> ▪ 5,900 Rwf per site, for purchasing vegetable seeds and pesticide per 300m²
Content of verification and fruit / lessons learnt	<ul style="list-style-type: none"> ▪ 1- Whether the facility construction was possible through inhabitants themselves? 2-Whether farm income was ameliorated? 3-Whether facial (two-dimensional) deployment of the project by farmers is possible? ▪ 1-Facility construction is a kind of locally adaptable technique. In addition, zero cost, 2- It depends on conditions on which the site locates, while a site succeeded in annual earning of 6,000Rwf per Model farmer, 3- Although usefulness of shallow well irrigation has been made evident, two-dimensional development was observed only in a part based on farmer's verbal communication etc. ▪ In order to achieve user's safety for their use of the shallow well, safety measures should be taken on the site. As one of measures, stretching a vinyl tape around the opening of the well is considered and it was actually carried out on the sites by the participants.
Possibility of project implementation by the initiative of inhabitants at large	<ul style="list-style-type: none"> ▪ From the needs and effectiveness of the project, conventional construction works that can be met by only farmers (locally adaptable technique), low construction cost (zero cost) points of view, a sustainable project development by their self help efforts is expected
Way of assisting inhabitants by administration	<ul style="list-style-type: none"> ▪ Sufficiently explaining usefulness and importance of the Project to target farmer, thus activating their motivation or giving them spiritual incentive. ▪ Also necessary to assist them to establish or fortify farmer's organization or to instruct them how to manage the project. ▪ Acute requests have been issued from the farmer's side on the technical assistance for farming and cultivation. Not only construction of facility (shallow well digging = hardware portion of the project) but also technical aid for farming /crop culture (software portion) as well as procurement of market outlets are required.
Extension by "Farmer to Farmer" type transfer and method of horizontal (two-dimensional) project deployment	<ul style="list-style-type: none"> ▪ From the needs and effectiveness of the project, conventional construction works that can be met by only farmers (locally adaptable technique), low construction cost (zero cost) points of view, a sustainable project development by their self help efforts is expected. ▪ Sustainable project development by farmer's self help efforts is expectable, but at the same time two-dimensional deployment of the project can also be facilitated only if Sector Office or Cell Office make their propaganda on the project effect and benefits. ▪ By giving such instructions as the creation of model sites for shallow well irrigation and

	quick nurturing of progressive farmers, extensive deployment can be made viable through "Farmer to Farmer" way of extension, or mutual visits by farmers groups.
Proposal to DDP and issues in future	<ul style="list-style-type: none"> ▪ As construction works of shallow wells are very easy without incurring farmer's financial burden, facial deployment or two-dimensional expansion can be expected at farmer's level, thus contributing to their livelihood improvement through raised income from small scale irrigation farming. ▪ In this case, external assistance such as micro-finance is essential because most farmers cannot afford to provide initial investment for new type of farming. ▪ In order to succeed extension through Farmer to Farmer and to deploy the project into horizontal expansion, instructions by the agronomist officers in Sector or Cell Offices are indispensable. ▪ In order to enhance farmer's incentive, how to cultivate and hold market outlets will hereafter become a key issue. Sector or Cell Offices are requested to publicize on the usefulness of shallow well irrigation towards local inhabitants.

Project Sheet	
Name of Project	Roadside Irrigation
Project goals and compliance with higher ranked policies	<ul style="list-style-type: none"> ▪ Aiming at amelioration of farming income during rainy season and environment conservation by the effect of minimizing soil erosion. ▪ As "Land-husbandry, water harvesting and Hillside-irrigation (LWH) Project" promoted by MINAGRI highlights approaches to introduce/ accelerate proper techniques on water harvesting and hillside irrigated farming, thereby envisages improvement as well as sustainable growth of agricultural productivity and diversification of agro-products through market-oriented production. ▪ Similarly, DDP attaches importance on water harvesting. Therefore, this project envisaging effective use of rainfall and the subsequent income improvement is in conformity with the upper ranked plan.
Classification category	<ul style="list-style-type: none"> ▪ C1, C2, C4, and C5
Target area for the project	<ul style="list-style-type: none"> ▪ Ntarama Sector, introduced into 23 sites
Duration of project implementation	<ul style="list-style-type: none"> ▪ Core project: October 2006 - January 2007 ▪ Follow up (FU) project: January - February 2008
Project cost (initial construction cost)	<ul style="list-style-type: none"> ▪ Only labor offered by the Model farmers
Content of verification and fruit / lessons learnt	<ul style="list-style-type: none"> ▪ 1- Whether the facility construction was possible by farmers themselves or not? 2- Whether farm income was ameliorated? 3- Whether the effect of checking soil erosion was proved? 4- Whether facial (two-dimensional) deployment of the project by farmers is possible? ▪ 1- Facility construction is a kind of locally adaptable technique, and further zero cost, 2- In most cases the irrigation was applied to banana, and a part of the Model farmers considerably increased their income from sale of banana, 3- The effect of minimizing soil erosion was observed since irrigation held runoff soil within the irrigated plot surface, 4- two-dimensional development was observed in a part through farmer's verbal communication etc.
Possibility of project implementation by the initiative of inhabitants at large	<ul style="list-style-type: none"> ▪ From the needs and effectiveness of the project, conventional construction works that can be met by only farmers (locally adaptable technique), low construction cost (zero cost) points of view, a sustainable project development by their self help efforts is expected.
Way of assisting	<ul style="list-style-type: none"> ▪ Sufficiently explaining usefulness and importance of the Project to target farmer, thus

Project Sheet	
inhabitants by administration	<p>activating their motivation or giving them spiritual incentive.</p> <ul style="list-style-type: none"> ▪ Pressing requests have been issued from the farmer's side on the technical assistance for farming and cultivation. Technical aid for farming /crop culture and also consolidation/ streamlining of markets are required.
Extension by "Farmer to Farmer" type transfer and method of horizontal (two-dimensional) project deployment	<ul style="list-style-type: none"> ▪ From the needs and effectiveness of the project, conventional construction works that can be met by only farmers (locally adaptable technique), low construction cost (zero cost) points of view, a sustainable project development by their self help efforts is expected only if these project merits are made public through propagation. ▪ By giving such instructions as the creation of model sites for irrigation using rainwater drained into roadside ditches and speedy training of progressive farmers, extensive deployment can be made viable through "Farmer to Farmer" way of extension, or mutual visits by farmers groups.
Proposal to DDP and issues in future	<ul style="list-style-type: none"> ▪ As construction works of irrigation system utilizing drained rainwater into roadside drains are very simple without incurring burden farmers should bear, facial deployment or two-dimensional expansion can be expected at farmer's level provided that the project effect is made public through propaganda. ▪ Strong requests have been made from the Model Project farmers on the technical assistance for farming and cultivation. Likewise, hereafter another task would be posed to exploit and secure market outlets. Further, assistance towards these demands will serve as incentive for farmers. ▪ This Project has effect on income amelioration and environment conservation (checking soil erosion), thus serving local needs. Organic linkage should be sought with already constructed farm ponds in hillside farming development for efficient utilization of rainwater.

CHAPTER 8 TECHNOLOGY TRANSFER

8.1 Quick Project (QP)

According to the “ SW ” as well as the “Minutes of Meeting of SW ” conducted on 1st April 2005, MINAGRI has committed to assign suitable counterpart personnel through the implementation of the subject Study but due to the decentralization policy and territorial reform effected at the end of 2005, staffing of MINAGRI, related parastatal agencies such as ISAR, RADA, RARDA, RHODA as well as Bugesera district have been quite limited and generally it was found to be insufficient to afford assigning counterpart personnel in the Study. Taking due consideration on this matter, the target of technical transfer provided by the Study Team was modified to towns on Sector/Cell officers in charge of QP and PP and the officer in charge of environmental aspect in Bugesera district. In case of QP: Modern cow distribution, JICA team concluded a partnership with RARDA via MOU and both parties agreed to implement the cow QP as joint team. Through on-the-job training in the implementation of the Phase 1 of the Study, the following officers were assigned as counterpart personnel. However from the Phase 2 of the Study, following the recommendation of the 2nd Steering Committee meeting held on February 22, 2007, the Mayor of Bugesera district has dispatched an agro-economist to exclusively serve as counterpart for JICA Study Team in addition to the Agronomist of Ntarama Sector. Both C/P were not fulltime but have been assigned to JICA study activities for technical transfer purpose.

8.1.1 Technology Transfer to the Sector/Cell officers

The technology transfer is concentrated on small-scaled activities that can readily be handled by local population such as livelihood/life style improvement where various tools as to how QP and PP are planned, mobilized and implemented, how the monitored outcome is reflected on the development plans, how the projects/components are evolved and expanded into lateral direction. The outline and schedule of technology transfer is as shown in Table 8.1.1.

Table 8.1.1 Technology Transfer Items to Sector and Cell Offices

Trainee	Mr. NTWAZA Gilbert; Agronomist in Ntarama Sector Office Mr. Katarwa Andrew; Coordinator in Cyugaro Cell Office Mr. NDANGA Patrick; Ex-Executive Secretary in Kibungo Cell Office Ms. Muragijimana Janvier, Executive Secretary in Kibungo Cell Office Mr. GATABAZI Justin; Executive Secretary in Kanzenze Cell Office
Transfer Item	<p style="text-align: center;">Rural Development Plan</p> <ul style="list-style-type: none"> ● Methods of formulating implementation plan of QP and PP ● Methods of the study on rural communities ● How to mobilize local population and to implement in collaboration with recipients ● Methods of lateral expansion of QP as model projects. ● Method of Monitoring of QP: Modern cow distribution ● Method of Monitoring of three water related project: Rainwater storage construction, Shallow well and Road side irrigation

Transfer Item	<p><u>Inhabitants organizations/rural communities/improvement of life style</u></p> <ul style="list-style-type: none"> ● How to organize recipients group to improve their life style ● Methodology of regarding gender in project activities ● Method of public awareness on sustainable use and conservation of natural resources
	<p><u>Farming Techniques/Extension</u></p> <ul style="list-style-type: none"> ● Development of farming techniques by the use of low-cost natural resources <ul style="list-style-type: none"> - How to use groundwater/surface water in/near the marshland effectively in dry season - How to introduce rain water to the fields in rainy season (focusing on banana plantation) <p><u>Rural infrastructure/ water use</u></p> <ul style="list-style-type: none"> ● Rural infrastructure betterment by low-cost, use of available local resources <ul style="list-style-type: none"> - How to repair and prevent from soil erosion for rural roads ● Methods of readily applicable rainwater use and management <ul style="list-style-type: none"> - How to collect rain water at household in rainy season
Transfer Method	<ul style="list-style-type: none"> ● On the Job Training (OJT) by QP on JICA study member to CP ● Discussion at workshop

8.1.2 Technology Transfer to the Environmental Specialist

The objectives of the technical transfer on environmental consideration and natural resource management are:

- To enhance the technical ability to establish environmental impact assessment (EIA) for rural and agricultural development
- To enhance the implementing ability to establish the plan on natural resource management

The outline and schedule of technology transfer are shown in Table 8.1.2.

Table 8.1.2 Technology Transfer Items for Environment Aspect

Trainee	Ms. Sylvie Uwacu; Environmental specialist in the Unit of Infrastructure and Environment in Bugesera District Office
Transfer Item	<p><u>EIA technique</u></p> <ul style="list-style-type: none"> ● Method of data collection and its analysis on legal basis of EIA in Rwanda ● Method of executing for Project Brief (first step for EIA in Rwanda) ● Method of evaluation on environmental impact caused by rural and agricultural development ● Planning of implementing of full-scale EIA and executing on TOR for environmental study
	<p><u>Planning technique</u></p> <ul style="list-style-type: none"> ● Method of data collection and its analysis on resource management of forest, hillside and wetland/marshland ● Method of data collection and its analysis on the existing condition of soil erosion site ● Planning of zoning to take into consideration with natural resources ● Planning of sustainable land use of forest, hillside and wetland/marshland ● Method of public awareness on sustainable use and conservation of natural resources
Transfer Method	<ul style="list-style-type: none"> ● On the Job Training (OJT) by JICA study members to CP ● Discussion at workshop

8.1.3 Technology Transfer to the RARDA Staff

The outline and schedule of technology transfer are shown in Table 8.1.3.

Table 8.1.3 Technology Transfer Items for to RADA Staff

Trainee	<ul style="list-style-type: none"> ✓ Dr. Abel UKUNDIMANA, RARDA ✓ Dr. Samson NTEGEYIBIZAZA, RARDA ✓ Ms. Angeliqne BARONHOM, RARDA ✓ Dr. Muhinda Otto Vianney, RARDA
Transfer Item	<p style="text-align: center;">Rural Development Plan</p> <ul style="list-style-type: none"> ● Methods of formulating implementation plan of QP ● How to mobilize local population and to implement in collaboration with model farmers ● Methods of designing model cowshed for cow QP ● Methods of Capacity Development of Model Farmers by organizing training via using training module and study tour ● Method of Monitoring of QP: Modern cow distribution
Transfer Method	<ul style="list-style-type: none"> ● On the Job Training (OJT) on JICA study member to counterpart team ● Discussion at workshop

8.1.4 Progress of Technology Transfer

During the 1st to 2nd field survey period from middle of April 2006 to the February 2007, the main technology transfer to the Cell and Sector officer in Ntarama Sector was finalization of project components, formulation of implementation plan, monitoring with participatory manner through a series of Workshop, OJT and Study Tours in QP as well as selection of project sites and formulation of implementation plan in PP. Regarding the environmental aspect, review of EIA, points to remember for making a plan of watershed conservation, and preparation of the project brief in QP were transferred to the environmental specialist in Bugesera District with site inspections and OJT.

8.2 Pilot Project (PP) and Follow up QP

8.2.1 Basic Policy for Technology Transfer

Through implementing QP and PP, it was found that trained professionals and technicians are very few due to the genocide and brain drain. In addition, extension services by governmental agencies concerned with provision of information to the local population are very low and transportation measures are little. Taking due consideration of these situations, the basic policy for Technology Transfer was decided as the following.

- In order to provide information to all the stakeholders, communication measures should be made available as many as possible such as issue of newsletter, bulletin board, MINAGRI Radio, study tour, etc.
- To extend improved farming as well as engineering innovation by natural resources in the Study Area
- Cell officers, Umudugudu leaders and junior civil engineers and agronomists living in the Bugesera district employed by the Study Team should involve in as many as possible

transferring technology through OJT.

8.2.2 Technology Transfer Plan

Overall technology transfer plan is summarized as table 8.2.1. As for the target stakeholders for this plan, central government level is confined to ISAR, RARDA and RADA under the control of MINAGRI. However, it is difficult for these organizations to provide C/P as mentioned in the It/R(1). As of beginning June 2007, the Bugesera district has dispatched a junior agronomist as a full time C/P to the Study Team and the Study Team proposed the technology transfer plan through OJT to the District (See Annex VIII.8.1 for details.). Regarding the central level, MoU was made between RADA and Study Team for implementing the PP focusing on the Marshland Agricultural Development and Improved Rice Seed Multiplication and Dissemination as joint team (See Annex VIII.8.2 for details.). Accordingly the technology transfer was obliged to address District, Sector and Cell level as well as the beneficiaries of the PP. In this plan, the central level was positioned as technical resource provider for project implementation and sharing progress of the PP.

Table 8.2.1 Overall Technology Transfer Plan

C o n t e n t s	Planning Stage	Implementation Stage			
		Civil Work	Farming	Environmental Conservation	Survey/Others
Formation of Project Plan (PO)	-Facilitation ability by WS	Making a plan	Cultivation -Rice	Soil Conservation -Forestation	Soil Survey Monitoring (QP)
		Design	-Vegetables	-Fence by trees	Monitoring (PP)
	Formulation of Implementation and Farming Plan	Construction	-Pineapple -Banana	-Contour Ditch -Contour Cultivation	Reporting
		-Schedule management	Water Control Post Harvesting	-Sedimentation Pond Land Acquisition	Preparation/Delivery of News Letter
	-Facilitation of WS	-Quality Control	improved rice seed	Safety Measures	Livelihood Improve't -Bee Keeping
		Management of procured materials			-Rabbit Rearing
	Objects	Aim for Strengthening of Organization and Improvement of Problem Processing Ability			
Umudugudu	⊙	⊙	⊙	⊙	⊙
Cell	⊙	⊙	⊙	⊙	⊙
Sector	⊙	⊙	⊙		⊙
Cooperative/AS	⊙		⊙		⊙
Agronomist in Bugesera	⊙		⊙	⊙	⊙
Local Consultants	As many as possible local consultants will be employed				
-Agronomists	⊙		⊙	⊙	⊙
-Civil Engineers	⊙	⊙		⊙	

Note: AS refer to representative of Association, Umudugudu and Local Population:

8.2.3 C/P Personnel

In accordance with the technology transfer plan, the PP has involved in various items on target stakeholders focusing on RADA, District, Sector/Cell level personnel concerned, the beneficiaries from Corinyaburiba cooperative, Ruhuha Sector and beneficiaries from 22 Umudugudu in Ntarama Sector and locally employed extension and civil engineering staff as following.

Table 8.2.2 List of Counterpart Personnel

Object	Name	Organization
Environment	Ms. Uwacu Sylvie,	Unit of Infrastructure and Environment in Bugesera District Office
Improved Rice Seed Multiplication and Dissemination Project in Nyaburiba Marshland		
Management	Mr. Sindayigaya Martin, e	President of Corinyaburiba
Rice Farming	Mr. Mutabazi Alfred Mr. Nzabonintego Adolphe Mr. Munyaneza Jean Claude Mr. Gashongore Isaië	Agronomist, Ruhuha Sector Agronomist, Nyarugenge Sector Agronomist, locally employed by the Study Team -Ditto-
PP & Follow-up QP in Ntarama Sector		
Management	Mr. Rugabage Emmanuel	Civil Records and Population Inquires, Ntarama
Marshland Agricultural Development in Muzi-Cyeru Marshland		
Rice Farming	Mr. Muragwankuku Eric Mr. Kabera Jean Paul	Agronomist, Bugesera District Agronomist, locally employed by the Study Team
Land Reclamation Supervising	Mr. Hakizimana Bonaventure	Locally employed by the Study Team
Hilly Terrain Agricultural Development in Muzi-Cyeru Marshland		
Civil Engineering: Farm Pond Construction Supervising	Umudugudu Representatives Mr. Iddi Mutabazi Mr. Nyiringango Evariste Mr. Nsengimana Claude	22 Umudugudu Locally employed by the Study Team -Ditto- -Ditto-
Livelihood Improvement Project in Ntarama Sector		
Monitoring of Bee Keeping & Pineapple Cultivation	Mr. Musoni Jean Claude Mr. Mwiseneza Robert Patrick	Locally employed by the Study Team -Ditto-
QP Follow-up in Ntarama Sector		
Monitoring, Planning of QP follow-up, supervising	Mr. Rusanganwa Justin Mr. Gasirabo Emile Mr. Nsanzeamahoro Steven	Cyugaro Cell Secretary Kanzenze Cell Secretary Kibungo Cell Secretary

8.2.4 Progress of Technology Transfer

During the 3rd to 5th field survey period from middle of April 2006 to the February 2007, the main technology transfer to all trainees was focused on implementation & monitoring and mid-term and final evaluations in QP and PP with participatory manner through a series of Workshop, OJT and Study Tours.

Detail of the progress during the 3rd to 5th field survey period is shown in See Annex VIII.

8.3 Technology Transfer Seminar

(1) Objectives

- ◆ Appropriate technologies obtained through implementing the QP and PP are transferred to the counterpart personnel(s) and stakeholders concerning rural and agricultural development in Bugesera District.
- ◆ In order to implement projects by local population with a sustainable way for the DDP, lessons learnt from the implementation of QP and PP are provided to the stakeholders

(2) Date and Place: 17th September 2008 at Nyamata Tell Service Center

(3) Object persons: Participants of the QP and PP, RADA. RARDA, District/Sector representatives, 3 Cells Staff in Ntarama Sector, Ruhuha Sector, Nyarugenge Sector, Corinyaburiba Cooperative, and Development partners

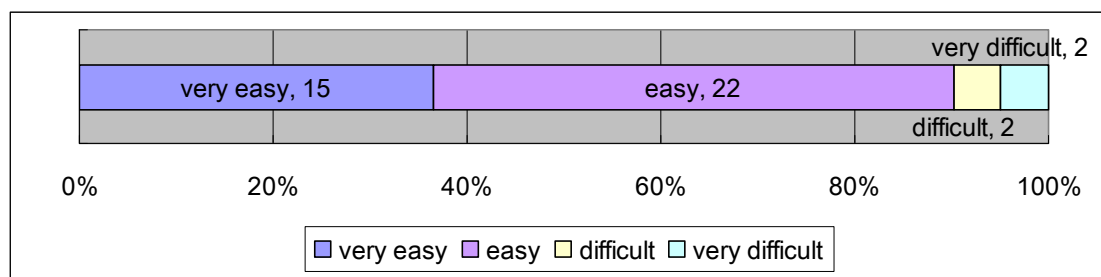
(4) Contents of the technology transfers

Content of the technology transfer seminar is shown in table below.

Project Name	Content	Remarks
(1)Quick Project(QP)		
1) Modern Cow Distribution	Construction, Cost sharing and Issues	Guideline
2) Rainwater Storage Installation	-ditto-	Guideline
3) Shallow Well Irrigation	-ditto-	
4) Road Side Irrigation	-ditto-	
(2)Pilot Project(PP)		
1)Improved Rice Seed Multiplication	Improved rice farming, Strngthening of Organization of	Guideline
2) Marshland Agricultural Development Project	Land reclamation for paddy/	Guideline
3)Hilly Terrain Agricultural Development Project	FP construction/WUA and O&M	Guideline
4) Livelihood Improvement Project		
a) Rabbit rearing	Project Summary and Lessons Learnt	Guideline
b) Bee keeping	-ditto-	Guideline
c) Pineapple cultivation	-ditto-	
d) Fruits & cooking banana cultivation	-ditto-	
(3)Lessons learnt from the Study	Recommendation to the DDP	

(5) Results of the Seminar

Technologies introduced by the Study Team, cost benefit and lessons learnt from implementation of the QP and PP were explained by the local administrative officer, agronomists and engineers employed by the Study Team, and Corinyaburiba Coop. About 60 persons are participated in. Through the discussion, many opinions and comments are given. A simple question to the attendants was conducted after closing the Seminar. The question results are summarized as below.



(a) Question results

Q1: Was it easy for you to understand the contents of the Seminar?

If you think difficult or very difficult, how to improve the Seminar











Result from the answer to the question is summarized as in the following table, 37 respondents (90%) out of 41 are assumed to understand the contents of the Seminar. 4 Respondents answered as difficult or very difficult recommend improved method of the Seminar as below.

- Presentation materials including power point should be used in Kinyarwanda.
- Such seminar should be held at each project sites.
- 2days are necessary to hold such seminar so as to understand the contents completely.

Q2: Was it useful for you to participate in the Seminar?

If yes, please write down your projects in order of priority.

All respondents answered the Seminar was useful for them. The projects in order of priority to be implemented for them in future are given to the Modern cow distribution project, Fruit and cooking banana cultivation project and Rabbit rearing as table below.

Quick Project		Response
1) Modern cow distribution		No.1 23
2) Rainwater Storage Installation		8
3) Shallow well Irrigation		-
4) Road side Irrigation		-
Pilot Project		
1) Improved Rice Seed Multiplication and Disseminat		14
2) Marshland Agricultural Development		-
3) Hilly terrain Agricultural Project		9
4) Livelihood Improvement Project		-
a) Rabbit Rearing		No.3 16
b) Bee Keeping		15
c) Pineapple Cultivation		8
d) Fruits and cooking banana cultivation		No.2 21
Others		
1) Chicken rearing		2
2) Vegetable cultivation		1

CHAPTER 9 CONCLUSION AND RECOMMENDATIONS

9.1 Conclusion

The Study has been carried out from April 2006 to October 2008 to achieve the following objectives through implementing the projects for marshland development, hilly terrain agricultural development by means of farm pond and livelihood improvement towards the final goal of attaining food security and poverty reduction.

Objectives are;

- ◆ Formulation of an action plan for agricultural and rural development that reflects real needs of population in the Study Area and allows their own participation therein in a sustainable manner.
- ◆ Capacity development of administrative staff in District, Sector and Cell and rural people's organization through the implementation of the Quick Project and the Pilot Project.

(1) Quick Project (QP)

One of the characteristics involved in this Study was the implementation of the QP, as an antecedent stage to pilot project. This QP was launched to meet what the GoR strongly requested in the consultation meeting, i.e., request of "Initiate the Study with concrete activities as early as possible". In other words proposed components are derived from the concept that "local population be in a small scale, having low risk, based on adequate technologies, and also including ideas of readily quick-return nature". The QP was commenced in June 2006 and completed as of the beginning of September 2008.

Through the formulation of the implementation plan by participatory approach workshop introducing cost-sharing concept, implementation of the plan and monitoring & evaluation of the projects, the following conclusions were clearly confirmed;

- ◆ Through the implementation of the project, it was found that collaboration with the MINAGRI, RADA, RARDA and ISAR was difficult because of the lack of budget and staff as caused by decentralization policy.
- ◆ This situation is similar at District, Sector and Cell offices and it was confirmed that almost all of population has a mind to rely upon outside, strong suspicion and there are very few advanced farmers in the community. Accordingly, it is difficult to educe their self-help endeavor, activeness and solidarity which are considered essential to implement project by themselves.
- ◆ Taking the above into due consideration, it was necessary to focus on collaboration with the Umdugudu and the existing farmers' organization for further PP implementation.

- ◆ As for modern cow raising, sufficient knowledge of livestock management and animal hygiene as well as securing enough forage crop field and drinking water are necessary but these are too much burden for poor family. For sound raising management of modern cow, more than 5 to 9 liter/day of milk production is necessary. Actually, however, almost all of the model farmers have yielded only 2 to 3 liter/day from their modern cows due to low blood purity, etc.
- ◆ In line with the “one cow, one family” policy and strong request from Eastern provincial government and Bugesera district, this project was selected as the QP but there were some gaps between the policy and current situation of the poor farmer and/or the objective of QP as mentioned above.
- ◆ The projects such as shallow well irrigation and road side ditch irrigation are easy for farmers to expand from spot to area because inputs are a little and effectiveness appears quickly. In fact, the former project increased from 6 sites to 19 sites, and the latter from 3 sites to 18 sites.
- ◆ Rainwater storage installation project has proved its viability and quick appearance of effectiveness but construction cost revealed at about 245US\$ per unit being too expensive for local population to shoulder by themselves.
- ◆ On the Shallow Well Project, prompt measures like putting a rope around the opening of shallow well should be taken to call the users’ attention.

(2) Pilot Project (PP)

Based on the lessons learnt from the QP implementation, the PP implementation was commenced in June 2007 and terminated in September 2008. The PP aims mainly to verify effectiveness and feasibility as well as outcomes of area expansion of PP components as suggested in the District Development Plan (DDP).

Through the implementation of the PP, the following are noted as conclusion.

- ◆ Staff of the RADA and RARDA participated in the monitoring and evaluation workshops as advisors, and they understood the issues and these mitigations of the projects as well as knew the problems farmers faced with. What is positive in their stance is to intend to use guidelines prepared by the Study team to the other related project area.
- ◆ Officers in Ntarama Sector and those under the umbrella of 3 Cells understood the way how to formulate the plans and implementing know how through a series of workshops by the time of the completion of the Study.

- ◆ Umudugudu people has a mind to rely much on the outside support due to the influence of “food for work” or “cash for work” and advanced farmers and Umdugudu leaders who can show the strong leadership are very few in the community. As a result, due guidance to them by the Study Team was necessary to implement and monitor the projects. Regarding the Kinyarwanda language, there is no word implying “operation and maintenance” and it will take a lot of time for them to understand this concept in future.
- ◆ In response to the needs of Corinyaburiba Cooperatives, the Study team provided various inputs of the equipment & materials and proper techniques for rice farming. This has led to a considerable increase in paddy yield (from 3 to 4 t/ha to 7 to 8 t/ha) and strengthening of the Cooperatives as achieved remarkably.
- ◆ As for rabbit rearing, pineapple cultivation and fruit banana cultivation, if in case supporting initial cost and distribution to the 2nd applicant are implemented as planned, expansion of the project from the spot to area would be very possible as verified through the PP.
- ◆ Considering the probability that extension services by the administration would not be carried out sufficiently, to accelerate the use of bulletin board at administrative offices, MINAGRI radio broadcast and newsletter issued by the Study Team are the useful and effective means for enlightening the improved farming to the farmers.
- ◆ It was verified that the land reclamation for marshland development for the area less than 5 ha is possible by community level as confirmed through PP in Muzi Cyeru. But pump irrigation has to be introduced for some marshland where directly influenced by the Akagera River or Akanyaru River because the river water level becomes lower than the paddy field in the dry season.
- ◆ Rainwater storage and farm pond are possible to be constructed applying the CDF and small scale construction projects for community level also possible to be implemented by using the Ubudehe Fund because these project are given with a priority for securing safety water and environmental conservation method respectively in CDF. But almost all of local population does not know how to take necessary procedure to secure these budgets. In case an availability of the solar cooker device could be confirmed, application of the Ubudehe fund might be considered to subsidize purchase of material for fabrication of the device on a premise of voluntary fabrication.
- ◆ .DDP budget is estimated at 20 billion Rwf/ year, which is 4 times bigger than the actual annual budget in Bugesera district then depending on the Donors’ financial support. Furthermore, to formulate plans, implement and monitor the projects in DDP, there are various problems such as insufficient number of staff, inability of local administrations as well as the lack of

transportation/communication means.

- ◆ On the Hilly Terrain Agricultural Development Project, safety measures should be taken to secure the safe of users of farm pond. The measures are probably, i) putting the Euphorbia fence which is generally utilized for hedge of housings around the pond, ii) setting up the door at the entrance to the pond, iii) placing the signboard beside the pond, and so forth.

9.2 Recommendations

Capacity development (CD) has been tried in a multi-disciplinary way throughout the whole process of the Study, by the efforts of the participants who themselves extract and grasp currently prevailing local situations and issues/ problems, and acquire the ability of finding solutions thereof. From the initial stage of the Study, participatory manner of development has been applied to the whole process including formulation of the QP / PP, project planning and implementation, monitoring and evaluation. Stakeholder's capacity to cope with their problems has been achieved with limited success through OJT. To promote the agricultural and rural development by local population in the community level, they have to jump over many hurdles. In order to solve the problems, followings are proposed as recommendations.

- (1) Professional civil engineers and farming/cultivation experts more than 40 years of age are very few in Rwanda then to promote the agricultural and rural development projects, development of human resource is essential and urgent issues. GoR encourages local administrative staff to go to college or university with the support by scholarship system as well as MINAGRI organizes workshops and training seminars to the staff and farmers. Central government is in need to strengthen disclosure of information in a positive way and give opportunities to let them learn in an equitable manner. Furthermore, as verified by the Study, it is important and effective for local administrative staff and population to support and train throughout the OJT. It should be necessary to support them like this way continuously.
- (2) Sector and Cell offices should play an important role as facilitator to stimulate local population who promote agricultural and rural development by themselves under current situation. Through the implementation of the Study, capacity building for them has been achieved to some level but it will take more time to complete.
- (3) Main actors promoting agricultural and rural development are Umudugudu and farmers organizations who play on the front line. It is necessary to support these organizations as well as strengthen CD of Umudugudu leaders. In parallel with this, places for provision of information to propagate their achievement among local population are also necessary. Bulletin board installed at administrative office and MINAGRI radio campaign should be practically used for enlightening of

farming extension to the local population.

- (4) Relevance of the “One cow, one family” policy is appreciated and understood. In order to strengthen high lactation modern cow distribution system (replacement high potential lactation heifer) and beneficiaries’ livestock husbandry technology for enhancing of beneficiaries’ motivation, supporting system by RARDA is essential. As for poor farmers, small scale livestock rearing such as rabbit or chicken should be promoted in parallel with the modern cow. Because the former is very easy to breed with low initial cost and quick appearance of effectiveness, but the latter is very heavy burden for them to secure fodder field as well as to fetch water for drinking.
- (5) The marshland development for rice cultivation has been promoted similar to the Muzi Cyeru Marshland in DDP and small scale land reclamation by labor force in community was verified in the PP. In marshlands directly connected with the Akagera River and Akanyaru River, water level in dry season becomes lower and pump irrigation is required and double cropping is difficult due to topographical condition, etc. Results from the rice cultivation project in Muzi Cyeru, beneficiaries found it difficult to pay pump fuel fee because of low yield of paddy caused by poor soil and water quality problems. If they harvested paddy more than 3.5 t/ha, the project will be sustained. In case of new marshland rice cultivation, the administration should consider supporting system to the farmers until they secure enough production of paddy. Also to introduce double cropping of rice and vegetable cultivation, short matured variety rice should be verified.
- (6) It is possible to increase paddy yield dramatically through improvement of rice farming practice and proper water management, etc. at the existing marshland in ex-Ngenda area. In fact, paddy yield in Nyaburiba Marshland increased from 3-4 t/ha to 7-8 t/ha. It is therefore necessary to promote the Nyaburiba Marshland rice farming as well as strengthening Corinyaburiba Cooperatives to make it as a model area for rice farming at not only 360ha of neighboring Marshland but also the other districts nearby in future.
- (7) To secure irrigation water for hilly terrain agricultural development, construction of small scale dam as well as pumping from a marshland are possible measures, but the former is difficult in proceeding land acquisition for reservoir area and the latter is costly due to fuel fee for pump operation. Consequently, in the meantime, farm pond is a practical solution to secure limited water for use for small scale irrigation and construction of farm pond by community level by themselves is possible as verified in PP. Vinyl sheeting is a common measure to prevent leakage from the pond but it is rather costly and not easy to repair torn portion by local population. An important thing in using farm pond as well as shallow well is to secure safety of their users. Installing a live fence and a door at the entrance up on the site of farm pond as well as using a vinyl tape in case of the shallow well site are worthwhile to call the users’ attention.

- (8) It is clear that there is no concept of “operation and maintenance” in Kinyarwanda. In order to operate and maintain their farm ponds and ancillary facilities in good condition by farmers themselves, awareness campaign to them should be done by local administration. Also, effective use of natural resources such as clay soils, sodding, etc., which are low cost and easy to maintain should be verified to prevent leakage from pond. In parallel with this, strengthening of Water Users Association (WUA) for O&M of farm pond and small scale irrigation technology should be supported by the local administration.
- (9) Regarding the livelihood improvement project;
- ◆ Rainwater storage is useful for people who have no access to water supply system. Through the period both the long and short rainy seasons, about 80 days per year is possible to use. But construction cost is too high for people to construct by themselves and the facility should be used publicly in such locations as school and clinic and Umudugudu level applying CDF or Ubudehe Fund.
 - ◆ Construction cost for shallow well irrigation and road side ditch irrigation projects is almost zero, so that it is very easy to expand from spot to area by farmers. In order to advertise its effectiveness to the farmers, Sector and Cell office should play a key role of information provider.
 - ◆ Cost benefit ratio of pineapple cultivation and fruit banana cultivation same as rabbit rearing is higher than the other projects. It will be possible to expand project from spot to area introducing distribution to 2nd applicants with planned system, but more than 1 year for harvesting is a negative aspect. Regarding the bee keeping same as the modern cow, professional know-how and skill for breeding is required so that supporting from outside is continuously necessary.
 - ◆ The local population seems to be interested in the use of solar cooker device to reduce expenditure for buying energy sources for home consumption such as kerosene. To see effectiveness of the device, however, it is essential to design/ devise and verify the shape of device, material to be used, cost for fabrication of the device, and so on. Furthermore, safety measures should be taken to secure safety of users because the solar cooker device would probably be heated hotter than the uses imagine.
- (10) Implementation of the DDP has been depending on the donor’s financial support but it will not be able to help but concern about the unstable economic situation of donors due to influence of oil prices escalation and so on. Under this situation, in order to increase income for local population step by step, projects from spot to area by local population should be prompted applying the low cost and easy/simple technology verified by the Study. Lessons learnt from the QP and PP is organized as the project sheet and guideline. These documents should be actively promoted for

use for referring implementing the similar project and review of the DDP by local administration and Umudugudu level.

- (11) All the valuable accomplishments and lessons learnt under the Study should be disseminated and made available to not only Bugesera district but also to the other districts and provinces as widely as possible. In this regard, the central government agencies were expected to be involved in the Study positively but in fact it was not. In future MINAGRI and RADA, RARDA under the umbrella of MINAGRI should involve more deeply in the similar projects to be implemented with supporting by Japan and the other donors. To do so, the GoR is in need of taking necessary actions to improve the institutional system of central governmental agencies concerned.
- (12) Finally, it is noted that hilly terrain agricultural development and marshland agricultural development are essential for poverty reduction and food security in the Study Area like two wheels of a vehicle, as well, human resources development is necessary from now on. Especially, strengthening of CD for stakeholders through OJT in the field should be continuously necessary. Among others, strengthening of improved rice farming technology, promotion of improved rice seeds dissemination, improvement of hilly terrain agricultural farming practices (introducing of water harvesting methods, NERICA varieties and fruit trees) and strengthening of WUA, etc. should be continuously followed up by the GoR agencies concerned.

