1.1.8 Farmers' Organizations and Their Activities

1) Cooperative Society

One of the major crops grown within the Project Area is coffee. For this reason, the community formed "Kibugu Coffee Farmers Cooperative Society" which also includes farmers outside Rupingazi Ngerwe Irrigation Scheme. The main function of this cooperative society is processing and marketing of coffee on behalf of its members.

"Ngerwe Coffee Factory," which is managed by the cooperative society, is located within the Project Area. Apart from processing and marketing the community's coffee, the factory also renders the following services;

- Stocks a range of farm in-puts for issuance, on credit, to its members.
- Provides cash advances to members for meeting school fees or other emergencies such as hospital charges
- Maintains a nursery for raising coffee and macadamia seedlings for sale to members and non-members alike

2) Water User's Association

There is a "water users association" (WUA) registered as "Rupingazi Ngerwe Irrigation Scheme" with the Ministry of Culture and Social Services. The association was established with the purpose of managing and maintaining the irrigation system. Regrettably, both the irrigation system and the "water users' association" were initiated without meaningful participation of the project community (ref. to Problem Tree). As a result, the association has remained loose and poorly organized thus leading to;

- Lack of cooperation among top (block A), middle (block B& C) and tail end (block D) farmers
- Poor irrigation water allocation and distribution along the canal
- Uncompleted main canal, poor maintenance of the intake and canals thus rendering the irrigation system totally unserviceable
- Inadequate mechanism for marketing irrigated produce

Two weeks before the field survey, the farmers conducted elections when a new set of nine committee members were elected including five office bearers (chairman, vice-chairman, secretary, vice-secretary and treasurer). Although the new team appears enthusiastic, it will take some time and considerable training before it can reverse the existing poor performance of the irrigation scheme.

3) Marketing Groups

Apart from existing arrangements for processing and selling coffee through the cooperative society, no other marketing groups were identified. At present, selling of bananas, vegetables as well as maize is done on an individual farmer basis.

4) Women Groups

During the planning workshop, farmers identified four active women groups within the Project Area (ref. to participation/stakeholder analysis).

These women groups are engaged in self-help activities aimed at improving their members welfare using the "merry-go-round" method. This means each member has to make an equal monthly financial contribution which is then given to one member at a time. The money, so raised, is used in assisting an individual member to buy household utensils, construct water tanks or install roofing iron sheets.

5) Other Community Associations/Organizations

There are other loose associations based on family or clan affinities. Although these associations are not formally registered, they serve a useful purpose by providing mutual assistance for meeting large or unforeseen expenses such as weddings, medical bills, funerals, and school fees.

6) Non-Government Organizations (NGOs)

The only significant NGOs development operation is represented by;

- Anglican Church of Kenya (ACK) which provides extension services on organic farming
- Diocese of Embu (Catholic Church) which is currently implementing a group-based dairy project featuring paid A.I services. The church was stated to be preparing a credit programme for irrigation pump purchase where the farmers will be expected to raise 30 percent of the cost.

1.1.9 Irrigation Water Sources and Water Permit

The water source for the Project is the Rupingazi river which is a tributary of the Thiba river. The Rupigazi river starts the origin from the peak of Mt. Kenya (altitude 5199m) and flows down towards south with a steep slope. The river length from the origin to the intake site of scheme is 33 km and the river slope around the intake site is 1/40. Since the catchment area at the intake site is as large as 130 sq.km, the water is available year round.

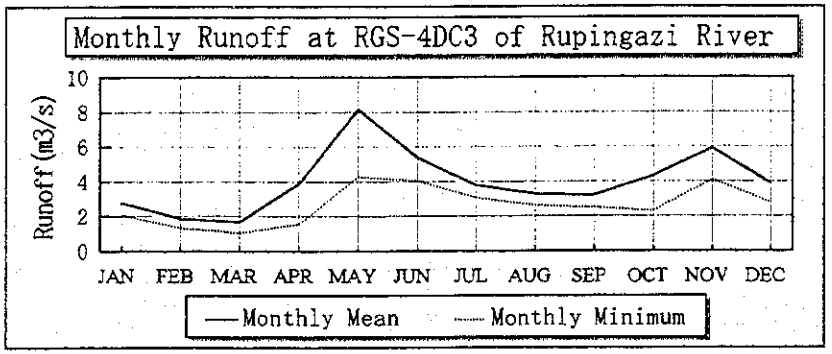
The Rupingazi river is gauged at Regular Gauging Station(RGS)-4DC3, which is situated at just upstream of junction to the Kiye river as shown in Figure 1.1-1. The station has a catchment area of 197 sq.km and discharge record of 26 years from 1970 to 1996. The high flow occurs two times (May and November) in a year and the lowest flow occurs in March. The annual mean and low flow are 4.0 and 2.7 cu.m/sec, respectively. The variation of monthly runoff is shown in Table 1.1-1.

The authorization of water permit belongs to MWR. The scheme has not yet applied the permit to the Ministry. There exist seven projects holding water permit in the upper basin of the scheme. The total amount of authorized water is 0.376 cu.m/sec. No water permit exists in the down-stream up to the junction of the Kiye river which is one of major tributaries of the Rupingazi river.

Table 1.1-1 Monthly River Runoff at RGS-4DC3 of Rupingazi River

(unit m3/s)

RGS	YEAR	ITEM	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Rupingazi River(C.A.= 130 km2)															
4DC03	1970-'96	MEAN	2.78	1.86	1.66	3.89	8.16	5.39	3.77	3.28	3.19	4.31	5.92	3.88	4.01
4DC03	1970-'96	MINI	2.06	1.35	1.05	1.56	4.29	4.06	3.08	2.64	2.51	2.28	4.12	2.78	2.65



1.1.10 Irrigation and Drainage

Rupingazi Ngerwe Irrigation Scheme was initiated by Government under rural development fund (RDF) in 1987. The member of scheme excavated the irrigation canal, and the operation of irrigation was started in 1988. The scheme adopted an open canal system getting water from the Rupingazi river. However, the irrigation system has not been operated for recent years since 1992 due to heavy silutation in the upper reach of main canal.

The water distribution system consists of two sub-system i.e. Rupingazi sub-system and Kanji Kanini sub-system as shown in Figure 1.1.-2. The former is an irrigation system having the canal length of 2.5 km, and is directly connected to Rupingazi intake, and covers the upper and middle part of scheme area. A part of water intaked at Rupingazi intake is supplied to the Kanji Kanini stream on the midway of former system as a water source of the latter system. The released water is intaked again at Kanji Kanini weir in the Kanji Kanini stream and is supplied to the middle and lower part of the Area through the canal of 4.2 km.

Total net area of farmland is 161 ha in 119 farm plots and the major crop is maize, beans and coffee. The irrigated area when the system was operated is estimated about 24 ha with 76 farm plots among 119 farm plots. The diverted irrigation water at Rupingazi intake did not reach to the lower part of area.

According to the committee member of the scheme, the scheme was instructed to divide the area in four division as an area for water management. However, due to the lack of knowledge on water management of farmers, water distribution did not achieved properly. Consequently, the canal which was excavated by farmers in the lower reach were back filled again due to scarcity of available water.

The causes of water shortage at the downstream are as follows:

- Intaked water is not sufficient to the needed water amount due to heavy silutation in upper reach of the irrigation system,
- Some canals have not enough capacity since the construction was carried out without a proper design document and survey equipment and
- Poor water management within the member of Water Users Association

The irrigated crops were carrot, tomatoes, French beans, etc. and flood irrigation is adopted with 12 hours operation time per day and six day irrigation interval.

Since the Project Area is located in sloping area, there is no severe drainage problems in the Area.

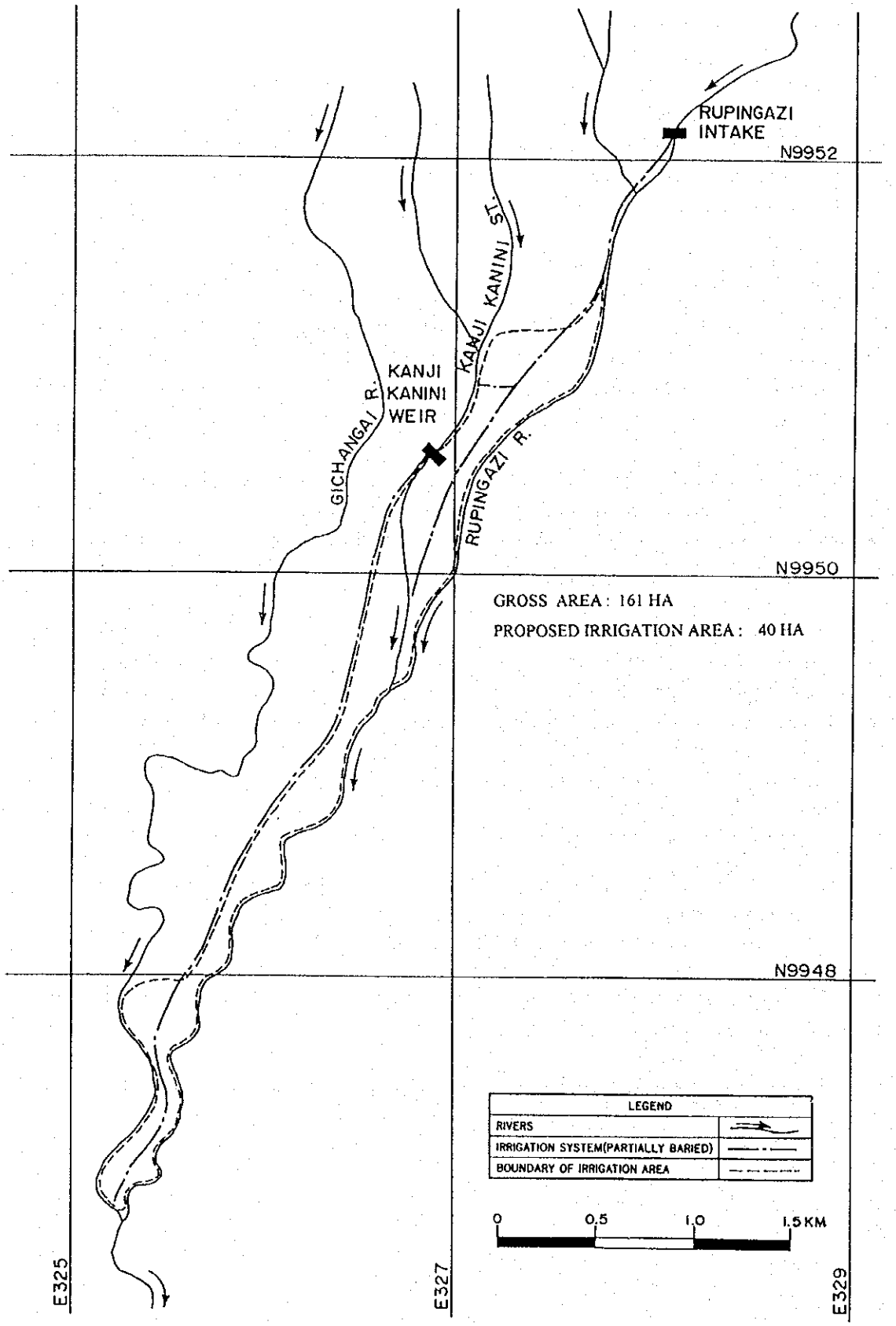


Figure 1.1-2 **Irrigation Area of Rupingazi Ngerwe Irrigation Scheme**

1.1.11 Agriculture and Rural Infrastructure Conditions

1) Irrigation and Drainage

Present irrigation water supply system is an open canal system tapping water from Rupingazi river. However this irrigation system has not been operated for many years due to heavy siltation caused by soil erosion from the steep mountain slope where the canal is passing. Particularly the upper reach of the canal is so heavily silted that canal cleaning and maintenance would not be easy and effective.

Major facilities of the system are an intake weir with intake box, earth canal line, a division box, a canal bridge, pipe culverts and drop structures. In the middle reach of the canal system, there is another intake weir to tap additional irrigation water from Kanji Kanini stream where water is available only during rainy season.

The intake weir at Rupingazi river is just small concrete structure built on the riverbed rock and is likely guide wall crossing up to the half of the river. There is a concrete intake box connected to the weir at the right bank of the river. Both weir and intake box seem to be in fair condition.

Irrigation canals with a total length of around 11.5 km are mostly earth canal. According to committee members of the irrigation association, the canal is so long that irrigation water could not reach to the lower reach of the canal. There are several pipe culverts which cross roads and footpath and many concrete drop structures at the middle reach of the canal. Those concrete structures including one division box are all in fair condition. The second intake weir at Kanji Kanini stream where the canal is crossing is firm concrete structure. There is no inlet structures for leading water into farm plots. Movable small pipes are used putting through into canal banks to take water to the plots. Furrow irrigation was practiced when the system was operated.

There is a water users association named Rupingazi Ngerwe Irrigation Association with 60 members for operation and maintenance (O&M) of the irrigation system. However present O&M activities are minimal since its irrigation system has not been operated.

2) Domestic Water Supply

Rural water supply for domestic use in the Project Area has been supplied by Ngandori-A Rural Water Supply System, one of the major water supply system in Embu district, which is operated and maintained by National Water Conservation and Pipeline Corporation (NWC&PC) under supervision of MWR. Ngandori-A Water System tapping water from upstream of Rupingazi river supplies treated water to the rural area of northern Embu district covering about 5,000 households and to Embu municipality.

Domestic water to the Project Area is supplied through the branch pipeline L32 with PVC pipe (ϕ 2 inches) which is maintained by Kathangariri division office of NWC&PC. Approximately 50 percent of total household in the Project Area have received treated water from Ngandori-A Water Supply System with individual house connection with PVC pipe (ϕ 1/2 inches). Present water rate being collected by

NWC&PC is 150 Ksh per month per connection as a flat rate which is applied to connections without water meter. The rest of households take water from streams and Rupingazi river since they could not afford to pay water rate and/or initial connection fee which amount to 2,700 Ksh plus material cost.

3) Rural Roads

Access from Embu to the Project Area is not very bad with earth road of E632 (minor road) which is maintained by MPWH, but partially becomes impassable at steep sections during rainy seasons from March to May and from October to November, expect for four wheel vehicles. Distance from the Project Area to the major market, Embu, is 6.3 km and to the rural market, Kibugu, is 2.0 to 4.0 km on E632 road. Improvement of E632 road has not been included in the first stage of EC Roads 2000 Project which commenced in March 1998.

Village/farm roads in the Project Area are generally in fair condition except some steep sections where hollows and small gullies are observed. As the Project Area is narrow land developed along Rupingazi river, village roads passing along the river are generally gentle slope, on the other hand the roads toward the side mountain are steep slope. Roads are all earth surface with 4.0 to 4.5 m in road width.

Village roads belong to Embu County Council which is supposed to undertake operation and maintenance (O&M). However, no maintenance activities have been conducted by county council for many years due to lack of road maintenance fund in the local government. Actual road maintenance has been carried out by communities particularly by youth group occasionally, but such road maintenance by community is limited.

4) Rural Electrification

There is no electric power supply distribution in the Project Area. Existing power line under operation of Kenya Power & Lighting Company is passing along E632 Minor Road from Embu town toward Kibugu and Kairuri area.

5) Public Health

Kibugu health centre, 2.0 to 5.0 km from the Project Area, is the nearest public medical facility where a clinic officer and several nurses are stationed. When further medical treatment is required, inhabitants have to go to Embu town, 6.3 km from the entrance of the Project Area, where Embu provincial hospital and other private clinics are available.

6) Education

There is no primary school in the Project Area, therefore children have to go to school around the Area. Three primary schools are located in the vicinity area, namely Kibugu primary school (2.0 km), Gituri primary school (2.0 km) and Govio primary school (3.0 km). According to villagers approximately 100 percent of children in the Area have attended primary school.

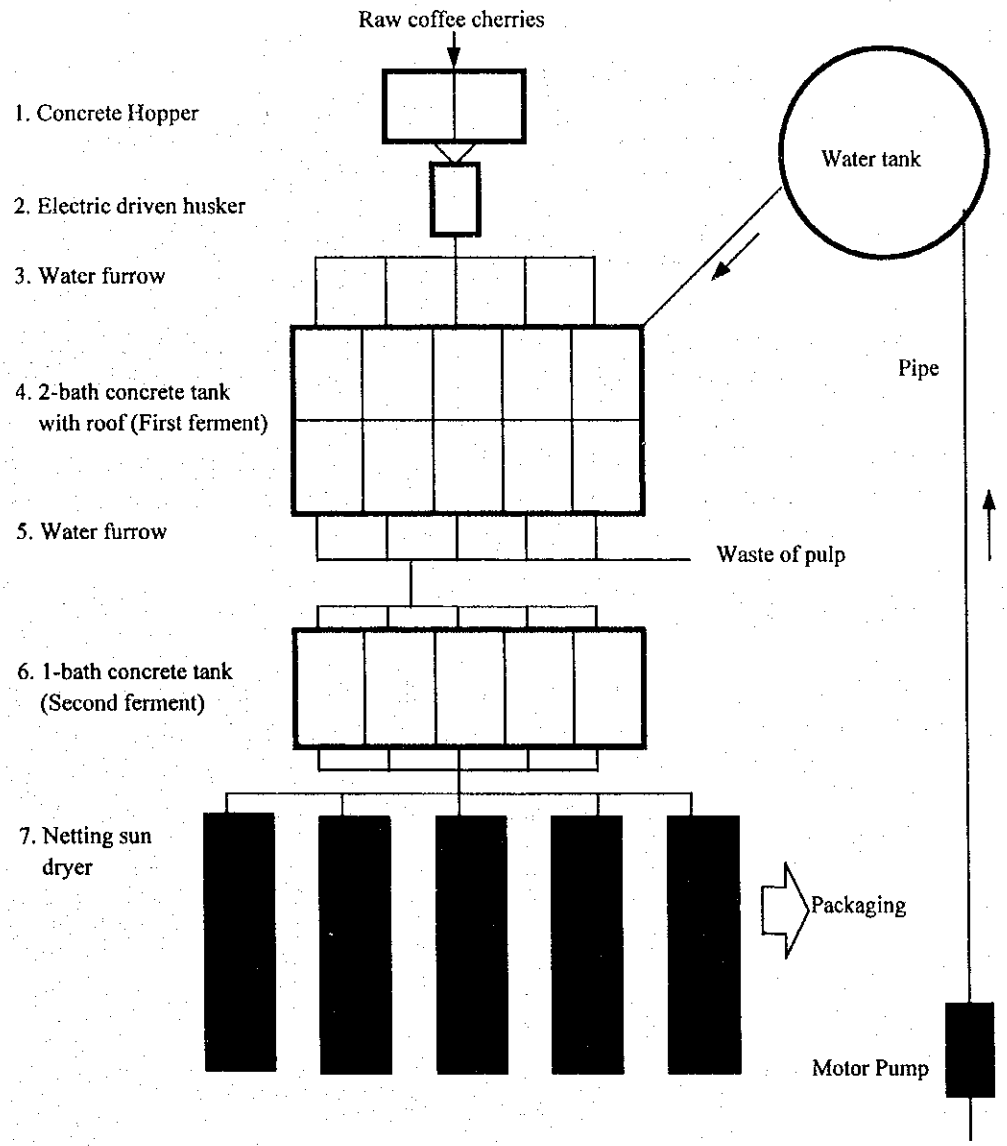
1.1.12 Post-Harvest and Rural -Agro-Industry

1) Post-Harvest

The post-harvest losses for domestic produce occurred mainly by the transaction mode. The middlemen rarely come to collect in certain time, therefore the harvesting of leaf and fruit vegetables are very risky, which estimated at 10-30 percent in quantity. The losses of root vegetables are comparatively lower. The mold on the surface of harvested maize can breed easily due to high humidity. Periodical drying of maize and ventilation means in household storage are needed to arrange.

2) Rural Agro-Industry

The coffee factory located at the slope and the centre of the Project Area has the functions of pulping, drying, pre-grading, temporary storing, farm inputs supply and communication with Embu Cooperative Union to supply clean coffee cherries. The processing use wet pulping method as follows:



1.1.13 Rural Environment and Public Health

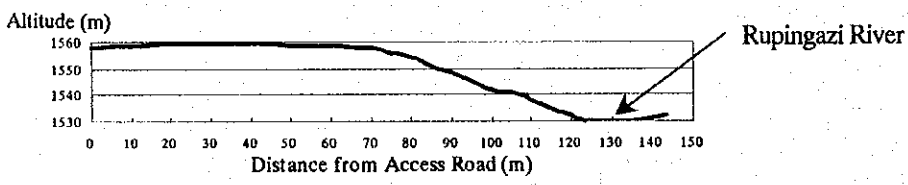
1) Natural Conditions

The Rupingazi water catchment area lies mostly within the Mt. Kenya Forest Reserve, that is consisted of mainly indigenous trees and some plantations of pine and Eucalyptus. The lower parts of the catchment bordering with the Project Area are farmlands including Nyayo tea zone, tea factories and coffee factories. There is not any forest around the Project Area and farmers are growing trees for firewood in their farmlands.

Rupingazi River is one of the five trout rivers which the Government has earmarked for fishery development in Embu District. The river had a high potential for sport fishing and was once used to attract tourists, and due to this activity the stocks are now feared depleted.

Many farmlands are in the valley of Rupingazi River, where the slope is very steep, e.g. 53 percent (28°) at the farmland 2,200 m down from the intake of Rupingazi River as shown below.

Slope of the Farm Land in Rupingazi



Mwea National Reserve is situated over 50 km downstream from the Project Area, between Thiba River and Tana River in Embu district. It was declared as a game reserve in 1975 with the area of 68 sq.km, though the size is reducing below 42 sq.km due to human encroachment into the National Reserve. Elephants raid and destroy crops in farms and grains in storage. In the process, they often cause injury and sometimes, loss of life. Damages of crops by wildlife in the Project Area does not occur as there are no nearby game reserves and the Project Area is surrounded by another farmlands.

2) Health and Sanitary Conditions

As for the drinking water, 41 percent of households use the tap water with the water fee of 150 - 200 Ksh/month and 33 percent use the river water at a distance of about 285 m. Details are shown below.

Sources of Drinking Water in Rupingazi Ngerwe Irrigation Scheme

Source of Water	Households (%)		
	July 1998	Dry Season	Rainy Season
Tap Water	41	39	38
River	33	53	29
Roof Catchment	15	0	33

Source of Water	Households (%)		
	July 1998	Dry Season	Rainy Season
Shallow Well	7	4	0
Spring	4	4	0

Source: EIA Survey, July 1998

The water quality of Rupingazi River and two dug wells in the Project Area are over the standard for drinking water on some parameters as summarized below. Details of the water quality analysis are shown in Table T.2-1, Annex T.

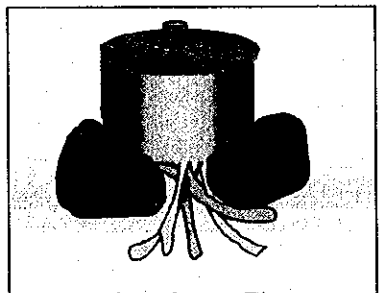
Summary of the Water Quality Analysis

Parameter		Standard	Rupingazi River		Shallow Well 1	Shallow Well 2
			Intake	11 km downstream		
BOD	(mg/l)	< 1	4.0	3.0	1.0	4.0
HCO_3	(mg/l)	<25	33.6	0.0	137.3	33.6
NO_3^-	(mg/l)	<10	4.7	4.4	20.4	4.9
E. Coli.	/250 ml	-	+	+	+	+

Source: EIA Survey, July 1998

As for the construction material of house, all houses have corrugated iron sheet roof although most households rely on mud as the common material for the wall and floors. The common excreta disposal is pit latrine with the depth of 4 - 5 m and it is used by 95 percent of households and the 5 percent use flush toilet.

The cooking stoves being used in the Project Area are mainly three stones. Though the Special Energy Project (1983 - 1994) was implemented by GTZ for the promotion of improved cooking stove (one-pot ceramic liner-stove without a chimney) with the target of whole country and it was made in 4,591 households in Embu District by the training of women's groups, it is supposed that this area was not included.



Three-Stones Fire

One of the major diseases is Malaria and it accounts for nearly 30 percent of reported cases. Next to Malaria in terms of incidence are diarrhea diseases, worm infections, respiratory tract infections, etc.

Medical facilities are underutilized partly due to lack of drugs which are heavily subsidized and hence the Government finds it difficult to sustain the supply. However, all women in the Project Area attend ante-natal clinic and deliver their babies in health facilities.

3) Soil and Water Conservation Conditions

Many farmlands are in the valley of Rupingazi River whcih slope is very steep or its streams as shown in Figure T.2-1, Annex T.

The common crop management being practiced in this area is mixed cropping in coffee field such as Maize, Bananas and Macadamia (see Figure T.2-2, Annex T). The farm management for soil conservation is contour cultivation, grass stripes of Napier grass, etc., plantation of trees (*Grevillea robusta* and Eucalyptus). The plots of river side are mainly covered with trees and it is effective for soil conservation. However, some plots along the river are cultivated and planted maize, sweat potatoes, etc. and this kind of land use should be changed as it is the cause of soil erosion.

Some farmers are very active in agriculture and they are also active in soil conservation. For example, there is a farm where *Leucaena leucocephala* (*Mimosaceae* and nitrogen-fixing), that is useful for the improvement of soil fertility and the prevention of erosion and for feed, is planted along many plots. There are four plots of Napier grass for the feed of cows and it also contributes for the prevention of soil erosion and the production of lot of manure. The river side plot is very steep and covered by fodder and trees, though the farmer is planning to grow maize and kales there, although proper river protection works should be provided at the intake site to protect the farmland from riverflow. The steep slope area along the river should be kept with fodder and trees (see Figure T.2-3 ,Annex T).

The farmers' awareness for the soil and water conservation is shown in the next table. Most of farmers practice tree plantation, Napier grass plantation and contour cultivation though there are some differences among their practice level.

Farmers' Awareness for the Soil and Water Conservation

Soil and Water Conservation Activities	Farmers' Answer (%)	
	I know.	I practice.
Planting trees	100	100
Planting of Napier grass	94	94
Contour cultivation	97	83
Others (Planting of sugarcane, bananas & papaya along contours, plant grass along furrows)	22	17

Source: EIA Survey, July 1998

4) Use of Agrochemical

84 percent of farmers use agrochemical mainly against insects, leaf rust and Coffee berry diseases for Coffee as shown below. All of them are approved for agricultural use in Kenya.

Crop	Agrochemical
Coffee	: Green Copper, Lybacyd 500 EC, Basudin 60 EC, Sumithion, Cabox, Copper Nordox
French bean	: Dursban, Ambush cy,
Kale	: Karate 2, Dursban,
Tomato	: Redomil mz 63.5 WP, Dursban
Bananas	: Green Copper, Copper Nordox

According to the EIA Survey, all farmers answered to have the knowledge of agrochemical use, though 48 percent answered that they followed the recommended dilution and 27 percent answered that they followed the recommended application interval. Actually, from the point of environment, the condition of agrochemical dosage is not bad because many farmers use less than the recommendation and the application interval is longer than the recommendation. All farmers know that they must use gloves and mask when they use agrochemical, though most of them do not practice as shown below.

Farmers' Awareness for the Agrochemical Use

Questions	Farmers' Answer (%)	
	I know it.	I practice it.
Dilution of Agrochemical	100	48
Frequency of Agrochemical Application	100	27
Use of Gloves and Mask	100	17
Maximum Pesticide Residue Levels	64	0

Source: EIA Survey, July 1998

Actual Agrochemical Use by Farmers

Agrochemical Use	% of Agrochemical
Less than the Recommended Dilution:	69 %
Within the Recommended Dilution:	(56 %)
Equivalent to the Recommended Dilution	(13 %)
Over the Recommended Dilution	13 %
Unknown:	18 %
Recommended Application Interval was followed:	85 %
Recommended Application Interval was not followed:	5 %
Unknown:	10 %

Source: EIA Survey, July 1998

5) Related Projects on Environment and Public Health

The following projects were/are implemented widely in the district including the Project Area.

Name of Project	Donor	Duration	Method	Results
National Agricultural Extension Program	World Bank	1983 - 97	Farmer training including soil conservation	Success
Soil and Water Conservation Project	SIDA	1984 - Now	Farmer training	

Source: EIA Survey, July 1998

1.1.14 Gender Issues

1) Women's Status in Rural Society

Current women status in Rupingazi Ngerwe Project Area has been shaped both by traditional culture as well as by modern institutions (government agencies, churches, private firms etc). While traditionally, women occupied a sub-ordinate status in the community, recent advances in education and employment opportunities (formal and informal) have appreciably improved their status. Indeed, it was gratifying to note that the treasurer of the recently elected project management committee is a woman which affirms the community's trust in women.

2) Women's Roles in Farm Households

In Rupingazi Ngerwe Project Area, differentiation of gender roles is still largely determined by custom and tradition. However, with the ever increasing integration of the community into the national and international market economy , new gender roles have been generated while old ones have been obscured. On the basis of PRA sessions conducted during phase-I study, roles and activities presently discharged by female and male members of the household may be summarized as shown below;

Division of Roles at Household Level

Role/Activity	Female	Male
1. Land Opening		XX
2. Buying inputs	X	XX
3. Planting	XX	X
4. Weeding	XX	X
5. Spraying		XX
6. Harvesting	XX	X
7. Open market selling	XX	
8. Fetching groceries	X	X
9. Livestock grazing		X
10. Stall feeding	X	
11. Milking	XX	X
12. Milk delivery	X	X
13. Irrigation	X	XX
14. Firewood collection	XX	
15. Water collection	XX	
16. Cooking	XX	
17. House cleaning	XX	
18. Caring for young children sick and the old	XX	

Note: X = sometimes; XX = main responsibility

3) Women's Rights to Land Inheritance

Tradition does not provide for a woman to own land or inherit it although she has user rights to land belonging to her husband or her father. However, a recently legislated law does accord equal treatment to men and women on matters of land inheritance but tradition has been slow to embrace the laws provisions.

However, women empowerment through education and employment in the formal sector has led to some women purchasing land and therefore acquiring an independent right to own land.

4) Women's Rights to Selling of Agricultural Products

Field discussions, indicated that women have control and marketing authority for subsistence crops (maize and beans), bananas, sweet potatoes and kales. However responsibility for disposal of major cash crops such as coffee and export vegetables rests with the male head of the household.

1.1.15 Findings through Workshop Seminars held at Rupingazi Ngerwe Irrigation Scheme

Workshop seminar at Rupingazi Ngerwe Irrigation Scheme categorized into Type-B was held at project site during the period from July 14, 1998 to July 17,1998 with a participation of beneficiary farmers of the scheme, and through the seminar under eager discussion among farmers, the studies on i) members and relevant information, ii) participatory/stakeholder, iii) problem analysis, iv) objective analysis, and v) project design matrix (PDM) were analyzed.

Followings indicate the outlines of problem analysis and PDM, and Figure 1.1-3 and Figure 1.1-4 indicate the formulated problem and objective trees. The details of these analysis are referred to Table C.2-1 to Table C.2-3 and Figure C.2-1 to Figure C.2-3, Annex C.

- Prioritized Present Problems;
  Low Production
  - Reduced farm labour
  - Parents dose not give the youth farm plots
  - Destruction of crops by wild animals
  - High incidence of crop diseases
  - Poor farming methods
  - Leaching of soil
  - Soil born plant diseases
  - Lack of farm inputs
  - Low quality of seeds
  - Insufficient water for irrigation
  - Discouragement to farmers
  - Lack of capital

- Overall Goal : Living standard uplift
- Project Purposes : Horticultural irrigation farming
- Results/Output : Pipe water systems installed
  : Capital available
  : Farming labour available

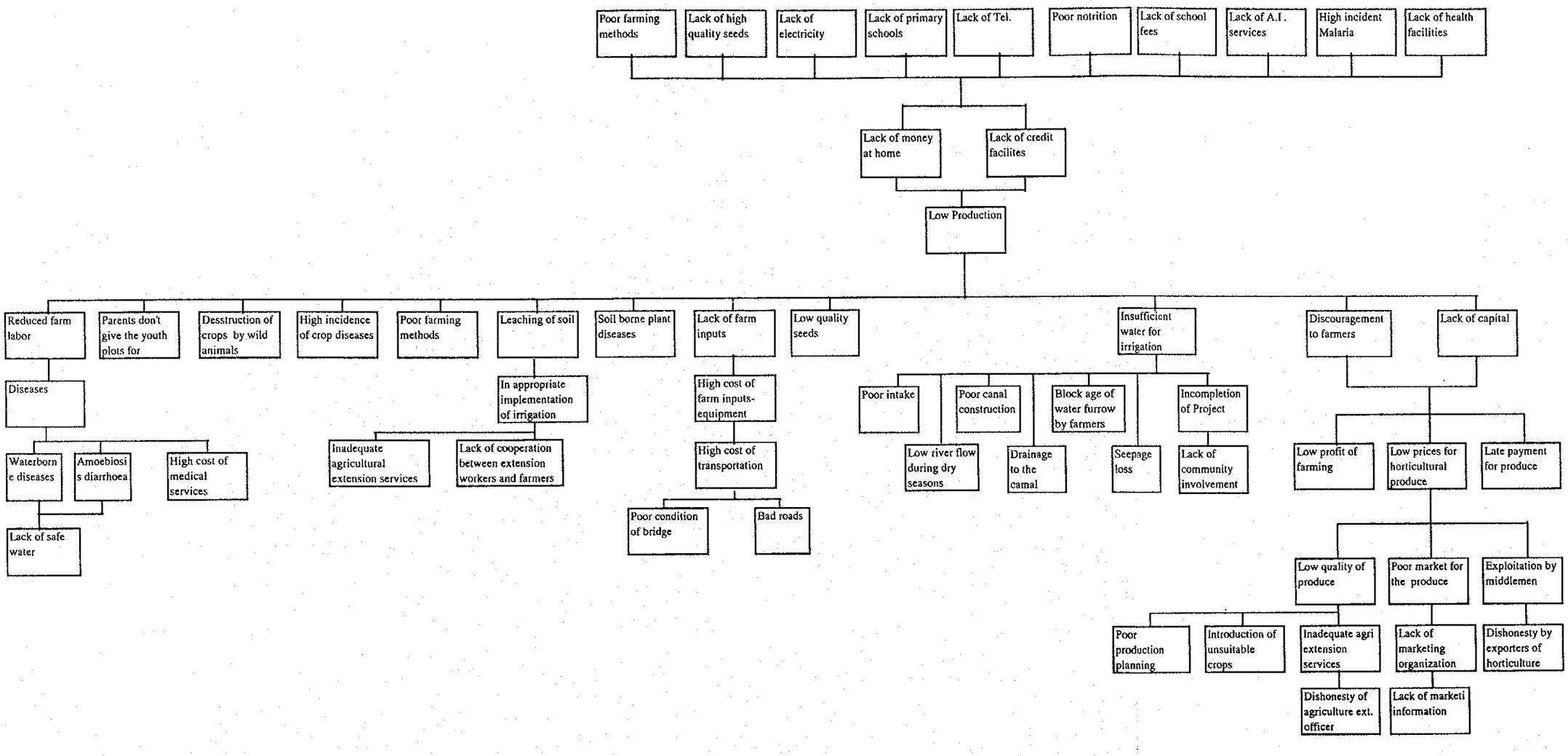


Figure 1.1-3 Problem Tree for Rupingazi Ngerwe Irrigation Scheme

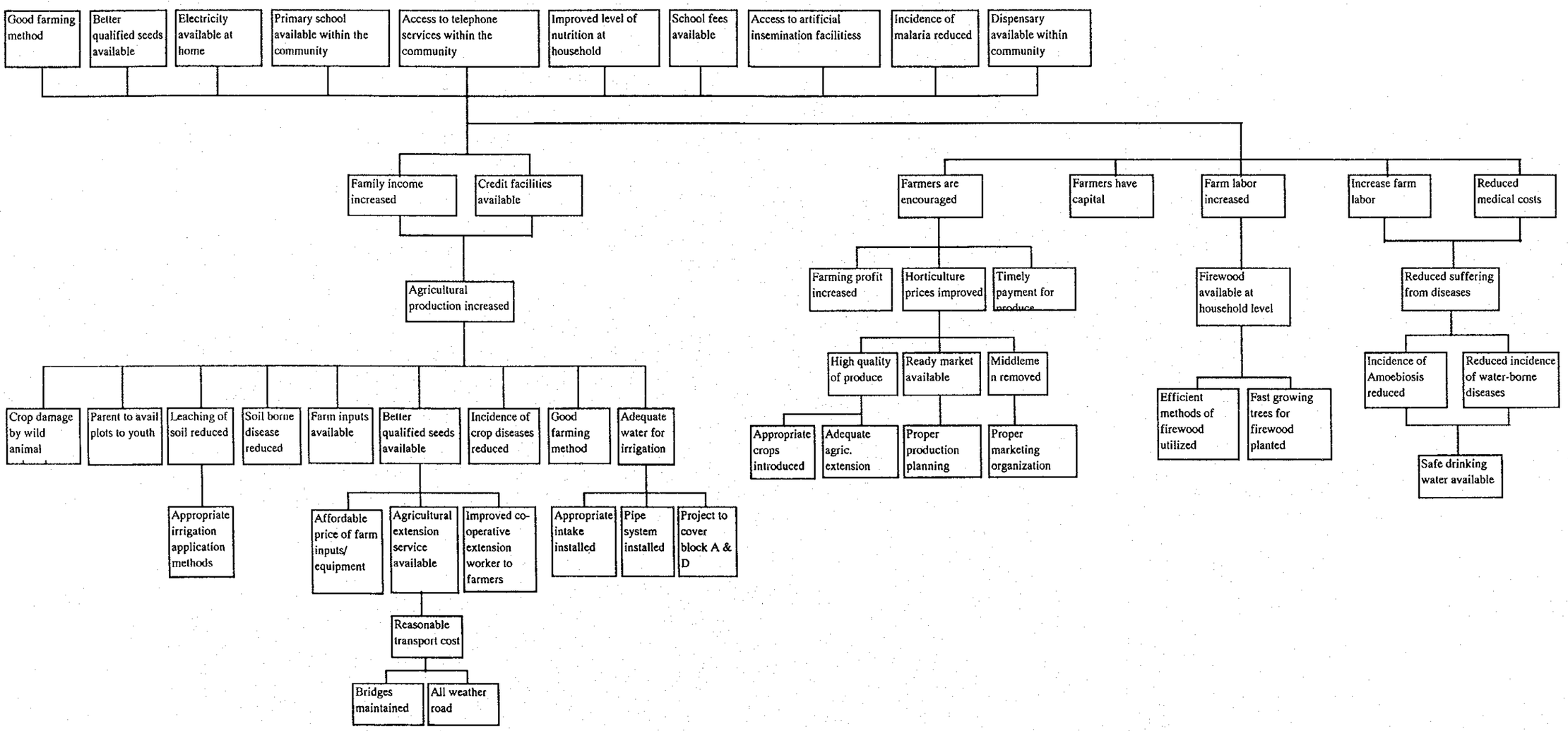


Figure 1.1-4 Objective Tree for Rupingazi Ngerwe Irrigation Scheme

1.1.16 Present Problems, Constraints and Development Potentials

1) Present Problems and Constraints

a) Rural Community

The main problem in Rupingazi Ngerwe Irrigation Scheme is marketing. Owing to the community's bad marketing experience in the past, they are reluctant to trust persons and agencies who would like to assist them in addressing marketing problems. This mistrust includes middlemen, exporter cooperatives as well as MOA.

However, the community is now willing to make a fresh start and are keen to build a more positive working relationship with MOA including IDB. At the same time community has considerable organization problems which will need to be resolved to implementation of the project.

b) Crop Production

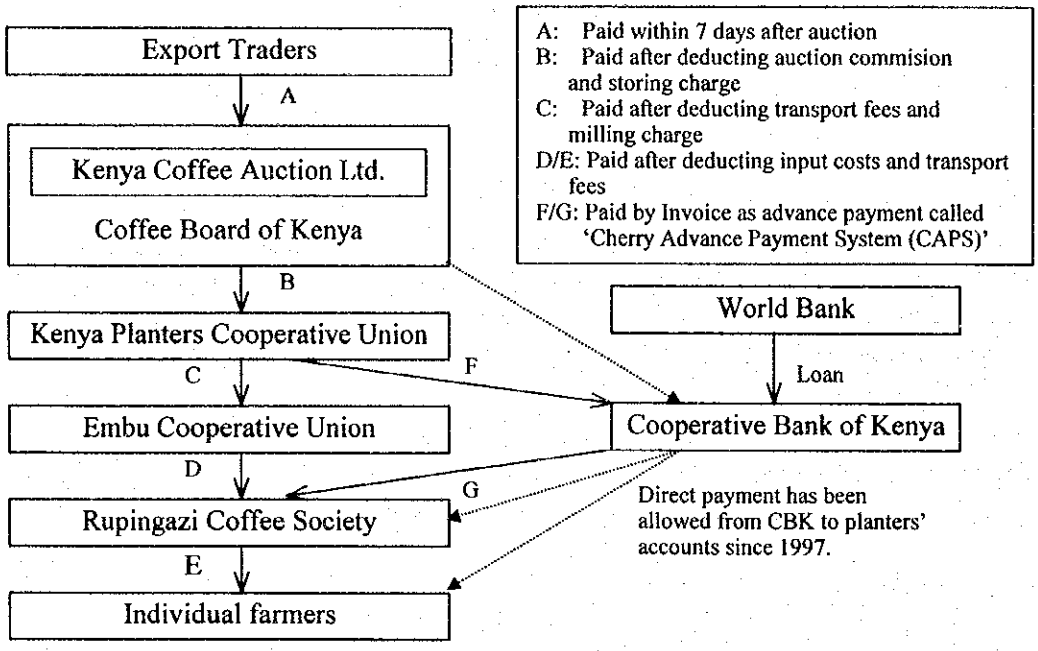
The average farm size is small at 1.33 ha per farm household. The Rupingazi valley is densely populated and the current rainfed cropping is already at an intensity of more than 140 percent. This intensive cropping for many years has diminished the inherent fertility of the soils. Deficiencies of both Nitrogen and Phosphorus were observed on the current maize crop, and a compact hoe layer occurs at 40-70 cm, which is probably restricting rooting depth and slowing down drainage. A large area of the farm land in this steep sided valley is terraced. On these steeper slopes, the friable soils are susceptible to erosion. This erosion causes the existing water distribution channel to be partly silted in each rainy season, requiring continuing ongoing maintenance by the users. There are only limited areas of natural vegetation left, mainly in the rocky areas where the soil is shallow. The road access in the wet season, particularly to the upper end of the scheme can be difficult.

c) Marketing

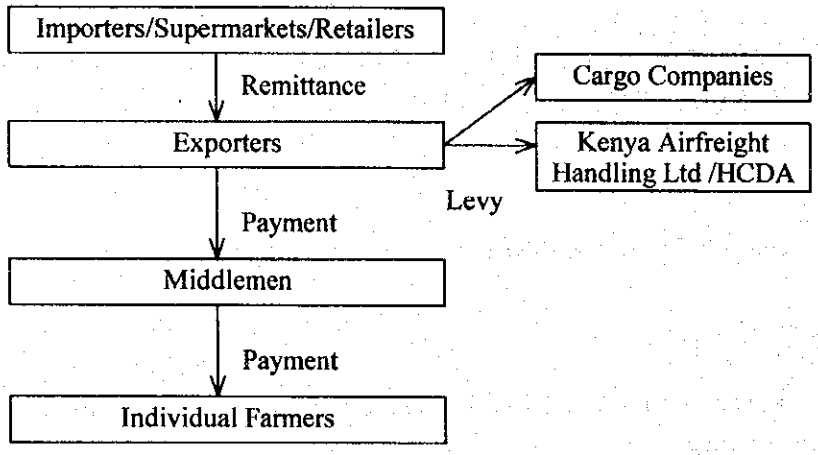
As the result of PCM workshop, the following problem tree was suggested in marketing sector.

Late payment for produce

This is mainly payment system for coffee and export produce. For coffee payment, it takes three to six months after harvesting.



The payment for export produce by middlemen is quite unclear at the moment of collection. After getting payment from exporters, the middlemen pay to farmers, normally taking two weeks or more. In cases of reject from exporters and cheap payment, the middlemen would not pay to farmers without notice.



Low profit of farming

This is caused by various factors of farm input application, cultivating technique and marketing arrangement. In order to improve farmers' income from the marketing, changing current individual transaction with middlemen, attaining Embu market information, grading in size and removing immature/ damaged produce, searching works for the marketing outlet alternative to good dealing middlemen/ retailers /contract farming with exporters and conquering the next mentioned will be required.

Low prices for horticultural produce

- Low quality of produce

- Poor production planning

  More information attaining activities are required by groups for local consumed and export produce. The necessary information for skillful production planning are sounded through PCM workshop and the Project Area survey;

  - Market Prices: Embu market price fluctuation are collected from Marketing Officer in Embu District Agricultural Office and Nairobi market price fluctuation reported on the newspaper 'The Daily Nation'. Individual transaction only between farmers and middlemen is unclear in pricing, which caused farmers' complaints.
  - Weather Forecast: The drought did and shall conduct rapid price escalation of agricultural produce, especially canadian wonder bean, dolichos bean, mwitemania bean, rose coco bean, cabbage, carrot, green gram, kale and fresh pea. The beans as staple food are required to store in farm household level or in stores of the coffee factory.
  - Seed Information: Within farm inputs, arrangement of hybrid seeds are quite strategic matter for cash crop production. New varieties are tested at KARI- Embu such as maize of Pioneer Hybrid H3253 and Cargill Hybrid for coffee zone (UM3) and tomato of Cal J. The activities to get farm input information and purchasing arrangement by the group can help for good husbandry.

- Introduction of unsuitable crop
- Inadequate agricultural extension services
  - Dishonesty of agricultural extension officer

- Poor market for the produce
- Lack of marketing organization
  - Lack of marketing information

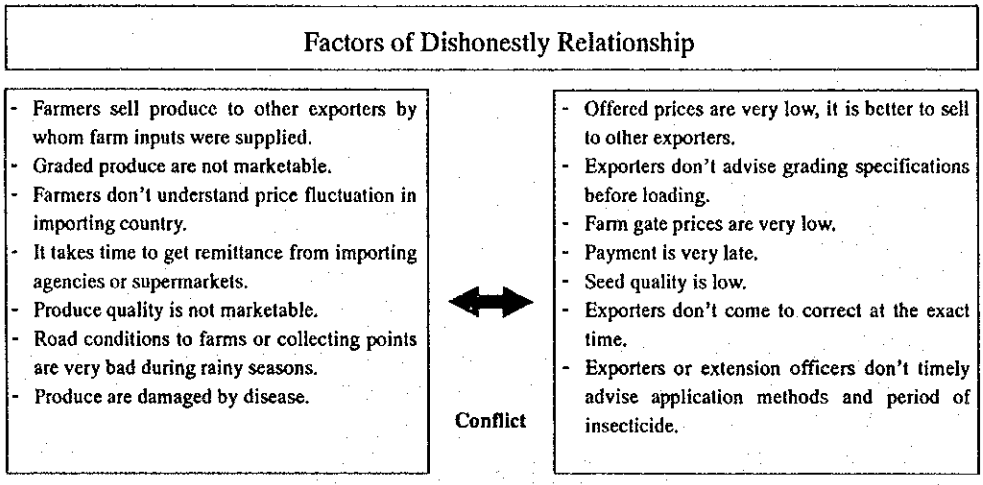
    Marketing information can be attained after establishment of marketing groups, exchange of information and transporting arrangement to Embu market using *Matatu* (public transporter). Currently, the farmers can get the marketing information only from middlemen for domestic consumed horticultural produce.

- Exploitation of middlemen

  Middlemen take margin at 50-60 percent including fuel costs, payment for staff and truck depreciation interviewed at by the team in Embu District, and pursue only their profits. Middlemen for export produce do not know selling prices to exporters at the moment of farm gate. As well, middlemen for domestic consumed produce negotiate with farmers in incorrect price information at markets because of their profits.

  - Dishonesty by exporters of horticulture

    Most of exporters also complain dishonesty with small-scale farmers. The relationship can be compared by the following factors.



d) Agricultural Credit

Problems in the agricultural finance are mainly divided into two, attributing banks as credit institution and to farmer themselves as users. Bank's problems are that slow action in business, rising interest without any prior notice, intricate application form, high interest, demands for land as collateral and commission. It is difficult to utilize for farms that don't have such a high educational status. While, there are problems in farmer's side too, that is, no knowledge on credit system and weakness in collateral and so on. Despite the existence of coffee cooperative which works to intermediate credit service for members 60 percent of farmers are not given credit because of the obstacles as mentioned above. It must be considered that most of farmers in the Project Area are smallholders, therefore irrigation facilities cannot be constructed without any support on credit as project cost will become heavy burden for smallholders.

However, collateral would be necessary for bank side to avoid the risk. As about 30 percent farmers in the Area don't hold title deed, they cannot be given credit. Therefore, Ministry of Land and Settlement is required to survey individual farmlands, and publish title deed immediately to improve accessibility to credit.

e) Farmers' Organizations

There are three categories of farmers organization that are relatively important within the Rupingazi Ngerwe Irrigation Scheme. These are Cooperative Society, Water Users' Association and Women Groups. A summary of problems associated with each category is given below;

Summary of Current Problems Facing Farmers' Organizations

Category of Farmer Organization	Main Problems Identified	Potential
Cooperative Society	- Delayed payment of coffee proceeds - Low payment per kilogram of coffee cherry delivered - Relatively high cost of running coffee processing factory	- Promoting saving and issuance of credit farmers - Stocking farm inputs

Category of Farmer Organization	Main Problems Identified	Potential
Water Users' Association	- Lack of cohesion among various blocks along the canal - Lack of a maintenance fund - Insufficient understanding of irrigation water management - Unrealistic expectation and dependency on outside assistance	- Focal point for promotion of and training on irrigation skills - New management leadership that is receptive to new ideas
Women Groups	- Loose organizations established for short maturing benefits (eg purchasing utensils) and hence not geared to pursuing goals that take long to realize - Weak financial management skills	- Opportunity for getting women angle in irrigation and horticultural production - Entry point for women - oriented technology transfers

f) Agricultural Extension Services

Within the Project Area, agricultural extension services from the Ministry of Agriculture are theoretically available at the District, division, location and sub-location levels. There are, however, considerable problems that constraint provision of agricultural extension support to the project community as summarized as shown below;

Problems and Potential of Providing Extension Services to Rupingazi Ngerwe Area

Type of Problem	Assessment of Problem Severity	Potential of Existing System
Ineffective supervision of Frontline Extension Workers (FEW) by divisional and district staff	xx	- Provide framework for channeling skills and improved technologies on irrigated horticultural production
Lack of transport and financial facilities at district and divisional staff	xxx	
Inadequate relevant technical packages for use by the project community	xxx	- Has mechanism for co-ordinating support in-puts by other agencies (government, NGOs, Private) to the project community
Insufficient work plans and performance indicators	xxxx	
Lack of farmers confidence in extension staff who are regarded as dishonest and grouped at same level as brokers in problem tree	xxxx	- There already exists a pool of technically trained personnel whose capacities can be easily improved to provide necessary support services to the project community
Poor motivation of field extension staff	xxx	

Note: xxxx = Very severe; xxx = Severe; xx = Substantial

g) Water Resources

- Water permit is not yet acquired

h) Irrigation and Drainage

- Irrigation plan was not properly established
- Existing irrigation system was not properly designed and constructed
- Existing irrigation system is not functional and operational
- No consensus within the scheme members on water management
- Lack of extension service to farmer on irrigated agriculture

i) Agriculture and Rural Infrastructure

- Existing irrigation system is not functional and operational.
- Irrigation water does not reach to the lower reach of the canal due to long earth canal line and seepage loss.
- Heavy siltation at the upper reach of the canal caused by soil erosion from the steep mountain slope.
- Access roads from B6 national trunk road to the Area become impassable at steep road sections during rainy seasons.
- Village/farm roads need rehabilitation at sections where hollows and gullies are found.
- There is no electric power supply in the Area.

j) Farm Economy

It is considered that the standard of living in the Area is maintained on income lower than poverty line. Farm household income is composed of crop and livestock incomes and off-farm income. The farm income accounts for 75 percent of averaged farm household income of 50,000 Ksh per year. Therefore, it is most desired to improve farm household economy through stability and increase of agricultural production.

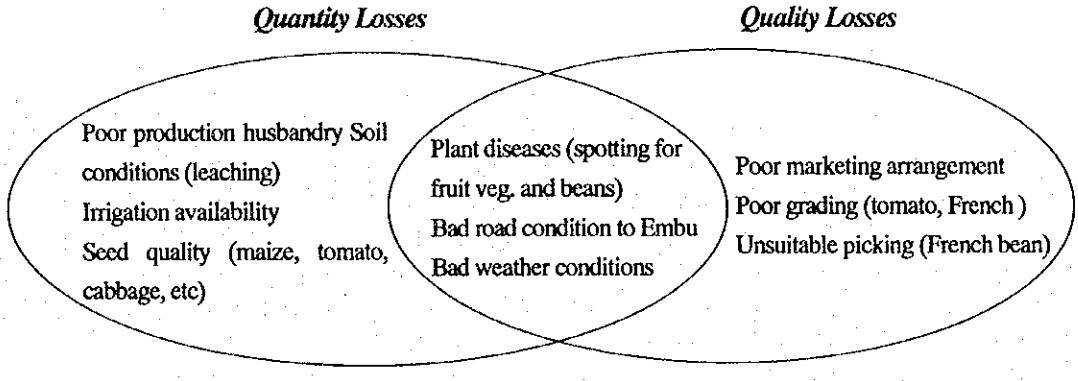
However, following problems appeared from the analysis of the farm economic survey, that is, i) irrigation water shortage, ii) poor bargaining power of farmers, iii) low crop price, iv) high cost of inputs, v) low crop yield. It can be expected that solution of these problems make farm household economy better, especially as the improvement of irrigation facilities will be a strong impact on farm economy, if taken into consideration the farmer's demand for irrigation project is highest. However, to realize it, supporting services both in hard and soft aspects such as agricultural extension service and educational training for farmers must be carried out in parallel. If considering all the problems on marketing, crop management, credit, O & M of irrigation facilities is attributed to farmers and their organizations, supporting services must be given to farmers in long-term with patience.

k) Animal Husbandry

The livestock in the Rupingazi area are mainly cattle. They are usually kept in a corral and zero-grazed. The main constraints to increased dairy production are the small farm size, and the high population density which means that herds are small, 1-2 cows, and most of the milk produced is consumed on the farm. There is no organized market for milk in Embu, so any surplus production has to be sold to individuals, which is time consuming. There is insufficient land available for intensive fodder production, so the general level of nutrition of the cattle, particularly when lactating, is low. The chickens are local breeds, and are subject to predators, and occasional decimation by outbreaks of diseases, such as Newcastle disease or infectious bronchitis.

l) Post-Harvest and Agro-Industry

The post-harvest losses for horticultural produce are caused by the following issues.



The agro-industry in the Project Area is the coffee factory for pulping cherries. There is no serious problems for the facilities physically, but some member farmers complain against the operation methods because the financial statement are not announced to all members.

m) Environment and Rural Life

According to the EIA Survey, there will be some negative impacts due to the project implementation including change in river flow regime, water quality deterioration and increase of water-related diseases. However, these impacts would be minor considering the small size of the scheme. As for the condition of Rupingazi watershed, it is reported that illegal logging is practiced in Mt. Kenya Forest.

According to the Problem Analysis of PCM, the following problems were shown by farmers.

- Lack of primary schools and lack of school fee
- Bad road
- Poor nutrition
- High incidence of Malaria
- Water-borne diseases including Amoebiosis because of lack of safe water
- Lack of health facilities and high cost of medical services

One of the cause of bad road is soil erosion that occurred everywhere out of rural roads. Though these rural roads are rehabilitated little by little by the community and Grevillea robusta with Napier grass are growing along the road, the rain makes another eroded road because of the steep slope.

At present, the farmers are growing coffee in more than half area of farmland. Coffee growing brings less erosion than vegetable cultivation as the land is not plowed and is covered by trees whole year. In case that they increase the area of horticultural crops as a substitute of coffee growing, it will increase the soil erosion in the farmland.

The promotion of horticulture will increase the use of pesticide and chemical fertilizer, and it will exert unfavorable influences upon the quality of river water that is used directly as drinking water by the downstream population. In case that the risk of agrochemical sue is treated lightly by farmer, it is possible to exert a bad influence on their health.

The cooking stoves being used in the Project Area are mainly three stones and it waste more than 30 percent of firewood compared with the improved cooking stove.

2) Development Potentials

a) Land Use and Crop Production

The small farm size and high population density, combined with the high percentage of the existing area currently planted under productive coffee, restricts the range of potential interventions at this site. Intensification of production through improvements in crop husbandry, such as planting time and spacing, pest control, efficient irrigation application and the use of higher levels of inputs on responsive varieties are some of the likely sources of increased yields. After using some of the irrigation to increase the coffee yields, more food crop production is the priority here. Increased attention to soil fertility management will pay dividends in the long run.

b) Marketing

Huge inflow of horticultural produce into Embu wholesale market from other districts

The trading volume are estimated at 180 tonnes per day, of which import mainly come from Kirinyaga, Nyeri and Nyandarua Districts. Especially main produce of cabbages at 4,000 ton/year, carrots at 2,000 ton/year, kales at 2,600 ton/year, tomatoes at 2,300 ton/year, dry pulses at 1,600 ton/year and red bulb dry onions at 350 ton/year were insufficient in 1997 according to a survey by HCDA Embu marketing expert. Only tomatoes can not be recommended for the Project Area due to high production and cheaper prices in neighbouring district of Kirinyaga. It is confirmed that cooking habits of Embu inhabitants are changing, therefore the consumption of herbs such as *dania* (coriander) are increasing.

Introduction of coffee cherry advance payment system (CAPS)

This system was planned and loaned by World Bank, and is operated by Cooperative Bank of Kenya Ltd. (CBK). Application to the coffee societies in the Project Area in 1997 and quick auction by computerized system introduce in April, 1998 may help to avoid that small scale farmers sell to private millers. In that case, the farmers can not procure farm inputs for next year.

Group buying system of farm inputs by coffee societies

The societies purchase from Embu Cooperative Union. It can be utilize for horticultural crops production, but it is necessary to search themselves or contact with Farm Input Officer of DAO-Embu and HCDA marketing expert of Embu for quality seeds in variety and available places and prices.

Competition among macadamia nuts companies

Competition principal is working between Kenya Nuts Co., or named as bland of Macadamia People, and Farm Nuts Co., whose own buying stations are near the Project Area. This produce is demanded throughout the year and stable in prices at 50 Ksh/kg and can be stored more than 10 days after harvesting in farm level. This is recommendable for the farmers to product continuously or expansively.

Use of organic fertilizer

In the Project Area, farmers are going to apply compost made by cows' manure from zero-grazing. This can be one of solutions to combat with high prices of fertilizers and leaching fertility of soils by heavy rain. The materials of stalks and leaves of maize, out-grading of coffee cherries and pulps and other residue of produce can also be used.

Potentials of production of export crops and farming contract

The exports of snow pea, runner bean, sugar snap and baby corn are expanding in EU markets and possible to products in the Project Area. Some French bean planters are requested to show the methodology of farming contract with exporters during the PCM workshop and follow-up interviews, and that transaction mode is more advanced than trade with middlemen in terms of certain crop planning, assurance on minimum selling prices and lowering of post-harvest losses on transaction. However, the member farmers of large-scale horticultural cooperatives in Embu District had experienced failure cases, which were caused by; i) unclear accounting system to operate the cooperatives, ii) technical matter on oral contract regarding obligations of each party, iii) secession of member farmers owing to sale to other middlemen in cash, and iv) absence from official arbitration in contract document.

c) Water Resource

- As a water source of irrigation for the scheme, the water resources of the Rupingazi river is available.

d) Irrigation and Drainage

- Irrigation for the scheme area will be possible by the rehabilitation work of existing irrigation facilities.
- Effective water management in the irrigation system will be possible by farmers training on irrigated agriculture and management.

e) Rural Infrastructure

- Irrigation system exists although it needs to be improved.
- Public domestic water supply system exists in the Project Area.
- Village/farm roads are fairly extended in the Project Area.

f) Animal Husbandry

Limited numbers of dairy cattle are kept in the area. Increasing their stocking level substantially is not realistic. The main increases in yield will come from improved nutrition supplied to those animals with the genetic capability to respond to improved feeding. The private sector is providing A.I: services to the Project Area currently. Irrigated forages such as napier can be grown using the irrigation water. Urea supplements can increase the utilization of roughage.

g) Post-Harvest and Agro-Industry

Facilities of sheds and warehouses at the coffee factory

They can be utilized as pre-grading and collecting points, which must be stated in the contract.

1.2 Development Plan

1.2.1 Objectives and Components of the Project

1) Objectives of the Project

Current dominant farming type of the Rupingazi Ngerwe Irrigation Scheme, which was classified as Type-B in Model Area selection, is commercial-based coffee farming as mentioned previously, and beneficial farmers are requesting that present farming type will be shifted to commercial-based coffee farming in combination with horticultural crops in the Area. The Area has an existing irrigation system, however, it is not fully operational and farming activities are not well managed due to ineffective function of irrigation facilities and also weak farmers' organization.

Under such situation of the Project Area, development objectives of the Project are presented below in terms of short and medium/long-term objectives;

Short-Term Objectives

- To stabilize and raise the rural life of beneficial farmers with introduction of small-scale irrigation system for the proposed irrigation area for 40 ha with improvement of irrigation facilities, improved management of sustainable horticultural farming such as maize, beans and domestic market vegetable and industrial crop farming such as coffee and tea, organization of small-scale farmers of 60 households, and sustainable assistance and support by related government agencies, NGOs, private sectors, etc.,
- To raise self-sufficiency of food for farm household in the area by increasing in food production,
- To establish and strengthen farmer's organizations, that is, irrigation groups, marketing groups, women's groups, cooperative societies by providing educational training by related government agencies, NGOs, private sectors, etc.
- To preserve the natural environmental conditions of the Area by determining proper land-use and preventing soil erosion,
- To develop productive lands by improving/providing agricultural infrastructural facilities of small-scale irrigation facilities such as intake facilities and irrigation canals with related structures, and rural infrastructural facilities of 1.2 km of village/farm roads,
- To strengthen productive activities by developing agricultural and institutional support services, such as the provision of necessary post-harvest facilities mainly focusing on coffee production, implementation of training to farmers, strengthening of extension services to farmers' groups, cooperative organization, introduction of farmers' capability building programme, etc., and
- To improve the rural environmental conditions of the Area by improving access road of route E632.

Medium/Long-Term Objectives

- To alleviate poverty and improve welfare conditions of smallholder beneficiaries by raising living standard and giving them opportunities to increase their income through the introduction of

irrigated agriculture focussing mainly on coffee and horticultural crops as well as improving and/or providing the necessary agricultural infrastructures and services, and

- To raise farmer's capability to manage rural society by providing continuous educational training.

2) Components of the Project

The project components for the Rupingazi Ngerwe Irrigation Scheme are generally planned as follows;

- Formulation of irrigated horticultural development plan such as land-use, crop selection, and development of animal husbandry, considering the conditions of steep sloping area in topography, less fluctuation of rainfall throughout year with relative high humidity,
  - Provision of adequate extension services and trial/demonstration farms,
  - Undertaking of animal husbandry development,
  - Provision of educational training on water management, farm management, agricultural credit, marketing, processing, etc.
- Establishment/strengthening of farmers' organization and promotion of agricultural support services,
  - Establishment and strengthening of farmers' organization (irrigation groups, cooperative societies, women's groups, marketing groups, etc.),
  - Provision of educational training on group management, marketing, O&M of irrigation facilities,
- Environmental considerations,
  - Establishment of soil conservation measures, training on appropriate utilization of agricultural chemicals, management of rural people health and sanitation, rehabilitation and protection of watershed,
  - Environmental monitoring and evaluation,
- Development of agricultural and rural infrastructures,
  - Development of smallholder irrigation systems by means of improvement of intake facilities, irrigation systems and village/farm roads,
- Construction and improvement of access roads,
  - Improvement of access roads to the Area,
- Development of post-harvest and agro-industry facilities,
  - Provision of agricultural equipment, post-harvest and agro-industry facilities mainly focussing on coffee production,
- Social capability building and institutional strengthening programme,
  - Undertaking of village, district agricultural office (DAO) and other local agencies consultations,
  - Formation of technical working committee (TWC),
  - Social preparation for the communities,
  - Strengthening of institutions of IDB and other local agencies,
- Monitoring and evaluation of the project
  - Irrigation system operation
  - Access and village/farm roads maintenance

- Agricultural aspect
- Institutional aspect
- Marketing aspect
- Farm economic aspect
- Control of soil erosion and watershed management

Figure 1.2-1 indicates the development concept to attain overall goals of the Project, which was formulated based on the study results so far made.

1.2.2 Community Capability-Building up and Institutional Development Plan

Irrigated horticultural production in Rupingazi Ngerwe Project Area can only be sustained if the project community is effectively involved in all the stages of the irrigation project cycle. Already, as part of the feasibility study, the local community participated in a one week workshop which analyzed problems as well as objectives and defined a preliminary project design for implementing their project. It is now planned to increase the capability of the local community to undertake the following project tasks;

- More detailed planning of the project
- Participating in the technical design of the project
- Planning and mobilizing funds for implementing the project
- Implementing the project
- Operating and maintaining the resulting irrigation system
- Producing food and other produce on a profitable and sustainable basis

For the community to acquire and up-hold the capability to carry out the above tasks, continued support services will need to be given by the MOA and relevant GOK agencies as well by NGOs and the private sector. Hence, it is planned that the capability of these institutions be built up simultaneously with that of the project community.

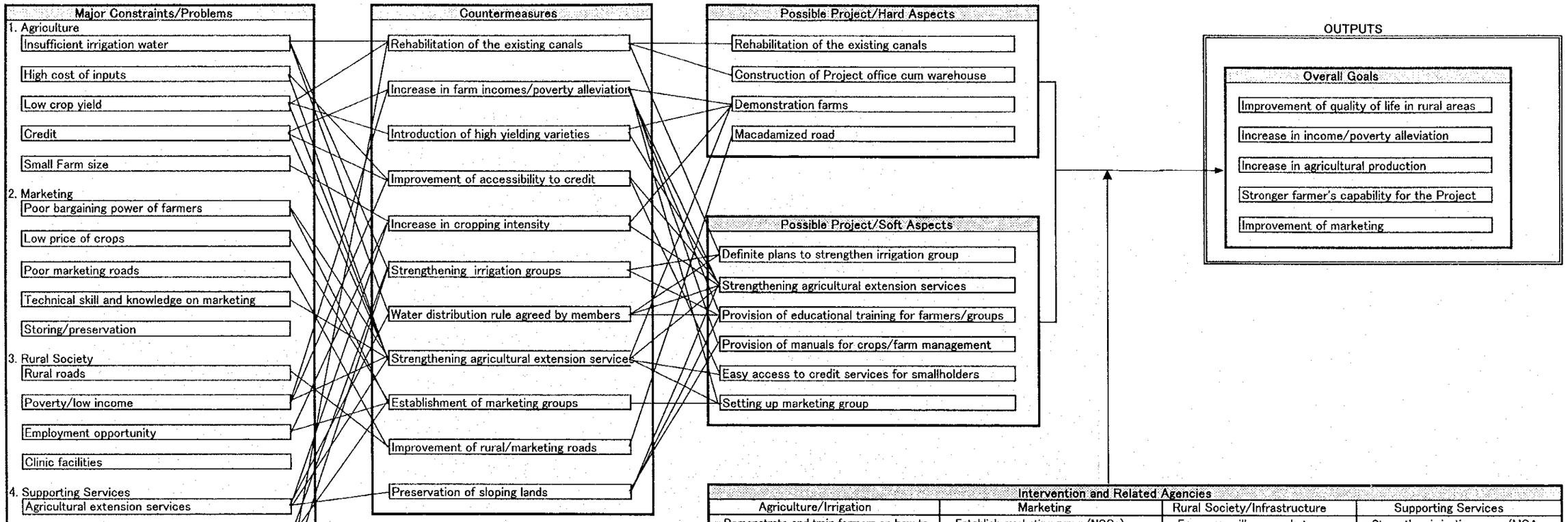
What follows, then, is an outline of how this capability-building will be effected.

1) Community Capability-Building Plan

a) General Social Preparation Plan

At the beginning of the project cycle, it is proposed to conduct a one week PRA workshop within the Project Area where the local community (members and non-members) will be facilitated to review their living environment i.e;

- Community's history, key events and trend observations
- Community resources (physical, social, institutional)
- Problems and prioritized needs (using pair-wise scoring matrix)
  Action plans aimed at meeting the community's priority needs



Source. Workshop seminar and
Farm economic survey(JICA), 1998

Farming Type

Present Farming Type	Proposed farming Type
Commercial-based coffee Farming	Commercial-based coffee with horticulture

Intervention and Related Agencies

Agriculture/Irrigation	Marketing	Rural Society/Infrastructure	Supporting Services
- Demonstrate and train farmers on how to use farm inputs safely and economically (MOA, KARI, NGOs) - Train farmers on horticultural farming technology (MOA, KARI, NGOs) - Promote linkage between KARI extension and farmers (MOA, NGOs) - Promote extension staff's mobility (MOA) - Improve accessibility to credit (CBK, DBK, AFC, NGOs) - Educate farmers on water-saving agricult. and appropriate land use (MOA, NGOs) - Rehabilitate intake and canals (NGOs, Self-help) - Prepare water management manuals (MOA) - Conduct demonstration farms (MOA, KARI, Self-help, Private stokists) - Train WUA members on water management (MOA, NGOs) - Create water distribution rules (MOA) - Encourage water fee collection for O&M (NGOs)	- Establish marketing group (NGOs) - Develop reliable broker/exporters (NGOs, Brokers/Exporters) - Improve marketing roads(MPWH, County Council) - Encourage farmer's group to make minor maintenance of roads (County Council) - Encourage contract farming (MOA,NGOs) - More activities on marketing (HCDA, FPEAK) - Direct remittance from CBK to coffee societies (Brokers/Exporters) - Provide market price information (MOA, HCDA) - Prepare group loading and transport arrangement (NGOs, Self-help) - Holding seminars on MRLs(MOA, FPEAK, Brokers/Exporters)	- Encourage village people to maintain farm/village roads(County Council) - Encourage village people to keep domestic water sources clean and safe (Self-help) - Educate village people to foster their capability (MOA, NGOs) - Promote women's participation to to the project (NGOs) - Rehabilitate access and farm/ village roads (MPWH)	- Strengthen irrigation group (MOA, NGOs, Self-help) - Strengthen marketing group (MOA, NGOs, Self-help) - Strengthen women's groups (MOA, NGOs, Self-help) - Strengthen financial support to the smallholders (MOA, NGOs) - Strengthen agricultural extension services on crops and livestock (MOA, KARI, NGOs) - Urge the county council and MPWH to improve marketing (MPWH, County Council)

Figure 1.2-1 Relation between Hard and Soft Aspects to attain Overall Goal

The expected outcome of the social preparation exercise is establishment, within the community, of a sense of group identity, an increased awareness about their strength and potential as well commitment for self-reliance. Thus empowered, they will be in a better position to confront the challenges of the coming irrigation project. They will be transformed from mere spectators into active participants and contributors into the irrigation drama.

In line with the recent policy shift in extension policy, where MOA will increasingly collaborate with the private sector and NGOs, it is planned that the social preparation exercise will be facilitated by the joint effort of MOA staff and a private consulting firm or NGOs experienced in PRA and PDM approaches.

b) Capability Building Plan for Farmers Organization

There are four types of farmers organizations (three existing and one to be promoted) that will make a contribution towards the irrigation project's implementation and sustenance. These farmers' organization will need to be developed and strengthened as summarized as follows;

Development and Capability-Building Plan for Farmers' Organization

Type of Farmers' Organization	Proposed Development Plan
Rupingazi Ngerwe Water Users' Association (WUA)	- Educate WUA members on requirements and implications of the intended irrigation system including the need for electing capable leaders to the management committee - Facilitate the community in reviewing and updating the PDM which they have already prepared making modifications as necessary - Train management members on organization, leadership, general and financial management
Cooperative Society	- Indirect strengthening of cooperative society through training of WUA since the two organizations have common membership - Promotion of a one day meeting attended by committee members of the Cooperative and WUA to agree on implications of increased irrigated horticultural production - Promotion of linkage with WUA and Production/Marketing groups with regard to stocking and provision of farm inputs on cash or credit
Women's Groups	- Training on proposed irrigation development including review of PDM - Training in organization, general and financial management - Inviting and involving women groups in reviewing technical irrigation design (engineering and agronomic) particularly from view points of labour and irrigation benefits as well as their perceived role and preferences
Production /Marketing Groups	- Promotion of neighborhood production/marketing groups - Training in organization, general management, agricultural marketing, accounting, and financial management - Training in sourcing and collation of market information - Training in production planning in relation to market opportunities

2) Development and Capability-Building of Local NGOs

In order to enhance the capability of the two church NGOs in providing support services to the project community (i.e. strengthening farmers organizations, intermediating in credit delivery), their staff will be provided with appropriate training in the following areas;

- Community organization techniques
- PRA approaches
- Leadership and management structures
- Credit administration methods
- Financial management and accounting procedures

3) Tapping Services of Other Agencies in Undertaking Social Preparation

All rural self-help activities are initially promoted and registered by the Ministry of Cultural and Social Services at the district level. However, the Ministry does not usually carry out after-registration follow-up. Yet at the district level, this Ministry has personnel who are professionally qualified to contribute to social preparation of the local community on development matters.

It is therefore planned to encourage a co-ordinated approach between the MOA and the Ministry of Culture and Social Services during the initial social preparation workshop as well as in establishing and strengthening existing farmers' organizations.

4) Establishment of Institutional Mechanism for Social Preparation

Since MOA/IDB will be promoting other group-based farmer-managed irrigation schemes elsewhere in the country, it is proposed that it assigns a serving member of its staff to be responsible for social preparation and community mobilization nationwide. In this regard, it is planned that the appointed member will acquire on-the job skills in PRA and PDM facilitation and later attend the short PRA course offered at Egerton University.

Once deployed, this staff member will, in future, facilitate one day annual participatory reviews of irrigation activities at Rupingazi Ngerwe Project Area which will be held during the off-season of the agricultural calendar. These annual reviews should include other stake-holders i.e;

- Community members from within the Project Area
- Personnel from local NGOs, relevant ministries such as MOA, Culture and Social Services, Public Works, Water Development etc
- Private sector produce buyers and local in-put stockists

Using the existing PDM, the review will highlight where things went wrong and pin-point accountability for undertaking various activities. The expected outcome of these annual reviews is to re-inforce the community's commitment and confidence to diagnose and confront their problems while at the same time expecting mutually agreed support services from other stake-holders.

5) Strengthening of IDB Field Offices

The process of promoting smallholder irrigated horticultural production is of necessity multidisciplinary. During the entire project cycle, IDB field officers will be expected to render the following support services;

- Facilitation of social preparation and capacity building for farmers' organizations
- Technical advisory services on irrigation design, tendering, construction, operation and maintenance
- Agricultural extension services on horticultural production and marketing

For them to effectively provide the above support services, IDB field staff will ought to have operational skills (technical, economic, sociological and managerial). Hence it is proposed that staff of IDB field offices (at district and divisional level) be strengthened by exposing them to a training regime that will include:

- Communication and social marketing
- PDM and PRA techniques
- Participatory extension approaches
- Organization and leadership training

This training will be in the form of one week workshops facilitated by IDB Head Quarters staff in collaboration with consultant from the private sector or NGOs (Annex J for details). Together with availing of office and field equipment, this training should enhance the capacity of IDB field staff in providing expected support services.

6) Institutional Strengthening of District Agricultural Offices

a) Consultation with District Agricultural Office (DAO)

The District Agricultural Office will play a crucial role in;

- Facilitating social preparation sessions
- Coordinating in-puts of other local level agencies (government, private sector and NGOs)
- Providing technical advisory services to the farming community during various stages of the project cycle (design, construction, operation & maintenance, production and marketing)

In this regard, the Project Coordinator at IDB Nairobi office will make the necessary consultations with the District Agricultural Office at Embu particularly with regard to the project plan and its implication on staff time and technical inputs.

b) Incorporation of Project Support Requirements into DAO's Work Plans

The District Agricultural Office presently accommodates a number of subject matter specialists (SMS) whose skills will be required during implementation, operation and management phases of the project. Such skills include irrigation engineering, horticulture, soil conservation, farm-management, pesticide handling and marketing. Currently, these skills are availed to the project community on an adhoc or uncoordinated basis.

With a view to institutionalizing contribution of these specialists, it is planned that once a year, the relevant specialists make a joint technical visit to the project, diagnose operational problems and submit a report to the DAO on required intervention measures. The recommended interventions will then form the basis for support follow-up which will be incorporated into an individual specialist's operational work plan.

As part of this strengthening of DAO's Office, it is also proposed to;

- Deploy a suitable front-line extension worker (FEW) who will provide services to the Irrigation scheme on an exclusive basis
- Install a modest field office (semi-permanent) within the Project Area, where farmers can make technical consultations with the extension worker, and whose cost will be shared with farming community
- Re-instate farmers confidence in division extension staff by replacing the existing complement as a matter of urgency (ref. to Problem Tree).

7) Equipment and Facility Support

To facilitate the work of IDB field staff in providing support services to the project, it is proposed that the following equipment be availed;

- Two computers : one each to the district and divisional levels
- Two sets of soil augurs: one each to district and divisional levels
- PH meter for divisional office
- One tensiometre for divisional office
- Three motor cycles: one for district office and two for divisional office

Availing of the above equipment will address transport and office facilities constraints currently facing extension services.

8) Partnership with the Business Community

On the basis of the government commitment to promote increased role of the private sector in agriculture, it is planned to encourage linkages between project level institutions and the business community. The Ministry of Agriculture (IDB, DAO) will take the initiative in this respect by;

- Inviting private sector stakeholders to project level workshops or meetings
- Advising and training farmers and farmers organizations on how to develop beneficial partnerships with different elements of the business community.

It is anticipated that a partnership arrangement will be developed as shown below;

Planned Partnership Between Various Institutions and the Business Community

Institution	Type of Business Partner	Nature of Partnership
MOA/DAO	Horticultural Exporters	- Common approach in farm chemicals application in order to comply with "minimum residue level" requirements (MRL) - Drawing of production/marketing contracts
	Farm Input Distributors	- Collaboration in staging field demonstrations and field days - Collaboration in holding local agricultural shows
	Local Input Stockists	- Specification of farm chemical types - Farm chemical stocking levels

Institution	Type of Business Partner	Nature of Partnership
Water Users' Association	Banks	- Banking facilities for members contributions
	Credit/Loan Institutions	- Availability of project implementation funds
	Contractor	- Installation of irrigation infrastructure
Co-operative Society	Farm Chemical Distributor	- Procurement of farm inputs in bulk
	Horticultural Exporters	- Market access through production/marketing contracts
Production/Marketing Group	Banks	- Banking facilities for members contributions and sales proceeds
	Local Input Stockists	- Group acquisition of farm inputs - Probable access to in-put credit or price discount
Individual Farmers	Horticultural Exporters	- Individual market outlet for produce with or without contract
	Banks	- Saving and withdraw facilities
	Local input Stockists	- Supply of farm inputs
	Broker/buyer	- Purchase of farm produce

9) Implementation of Capability Building Training Workshops

As part of a strategy aimed at building up the capability of the farmer community as well as that of supporting institutions, it is planned to implement a series of training workshops over a period of six years. The phasing of the various training events is illustrated in the following figure.

Implementation Schedule of Capability-Building Training Workshops

Training Event	Yr1	Yr2	Yr3	Yr4	Yr5	Yr6	Yr7
1. Social Preparation (Project Community)							
2. Internal Organization & Management (WUA Members)							
3. Project Planning &Implementation (WUA Members)							
4. Irrigation Operation & Maintenance (WUA Members)							
5. Organization & Management (Women Groups Members)							
6. Initiation, Internal Organization & Management (Production/Marketing Groups)							
7. Farm Inputs & Credit facilities for Irrigation Farmers (Co-operative Committee)							
8. Community Organization, Management & Credit Administration (Local NGOs Staff)							
9. Community Organization & Irrigation technology (IDB Field Staff)							
10.Community Organization, Extension Packaging & Delivery (DAO Extension Staff)							

1.2.3 Land Use and Agricultural Development Plan

The development potential and land use at a site is determined by a number of factors including; the soils, the topography, the climatic conditions, the present land use and the relative prices of inputs and products. During the PDM, the land users worked in conjunction with the team helped identify the particular physical, social and economic possibilities and constraints at their location. This section has the horticulturists provisional recommendations for Rupingazi. An appropriate land use plan is very site specific, and contingent on the individual farm conditions and the current market prices. The suggestions that follow will need modification in the future. Project staff should work with the Rupingazi Ngerwe farmers to develop the most appropriate soil conservation plan and a suitably modified cropping pattern to meet those conditions.

The main overall problems on this scheme are likely to be the growing demand for food crops competing with cash crop expansion, coffee competing for labour, and how farmers can generate enough surplus income from their small farm areas to fund the recurrent costs of maintaining the scheme.

1) Land Use Plan

The land suitable for crop agriculture in the Rupingazi Ngerwe area is already fairly intensively farmed. Rainfall is sufficient for dryland agriculture for much of the year. The high population density here has led to a considerable modification of the original landscape, and only a few of the original forest trees remain. The topography, soils and slope vary by location and have determined the current land use. One portion of the farmed area is on the steep slopes of the valley side, the other is along the edge of the river valley. There is little or no scope for opening up new land for agriculture. The soils of the river valley bottom are inherently fertile, but the increasing intensity of land use means that attention has to be paid to maintaining this fertility, particularly organic matter levels. Reductions in organic matter levels will reduce the friability of these soils, and the deteriorated soil structure will require improved management to avoid erosion.

Only a limited amount of capital is available to support the intensification that irrigation could bring. However, inputs such as fertilizer and some crop protection chemicals are likely to be comparatively easy to access, given the flourishing coffee cooperative in the area and the proximity of Embu. The main yield improvements in the Rupingazi scheme are likely to come from improvements in the crop husbandry, such as superior varieties, improved time of planting, plant spacing, and weed control.

2) Crop Selection and Cropping Pattern

The recommendation for Rupingazi is to focus mainly on the production of maize, beans, and domestic vegetables, for home consumption, followed by sales of a few crops in the market. Sweet potatoes and kale are appropriate food crops, and french beans, green maize and cabbage are potential market crops.

Proposed Cropping Areas at Rupingazi Ngerwe with Project

Land Use	Land Area	Cropping Intensity	Crop	Area
(%)	(ha)	(%)		(ha)
1. Irrigated	40			
- Food Crops		80	Maize/beans	32
		14	Sweet Potato	5.6
		5.5	Beans	2.2
		2.5	Kale	1
102%			Sub-total	40.8
- Cash Crops		27	French beans	10.8
		12	Maize (green)	4.8
		7.5	Cabbage	3
		2.25	Other Vegetables	1
49%			Sub-total	19.6
- Animal Feed		0.5	Napier grass	0.2
1%			Sub-total	0.2
- Perennials		25	Coffee	10
		8	Banana	3.2
33%			Sub-Total	13.2
		185%	Irrigated Total	73.9
2. Rainfed	121.42			
- Food Crops		62	Maize/beans	75
		44.5	Beans	54
		4.9	Kale	6.5
111%			Sub-total	135.5
- Cash Crops		4.1	Potato	5
		1.9	Other Vegetables	2.3
		1.3	Millet	1.6
		0.16	Cabbage	0.2
7.5%			Sub-total	9.1
- Animal Feed		0.25	Napier grass	0.3
0.2%			Sub-total	0.3
- Perennials		38.7	Coffee	47
		0.49	Banana	0.6
		3.46	Tea	4.2
43%			Sub-Total	51.8
		162%	Rainfed Total	197
Total	161.42			271

Source: JICA Study Team. Overall cropping intensity = 271 ha/161.42 x 100 = 168%

Suitable fruit trees for establishment around the households are macademia, avocado, pawpaw and banana. Perennials will be encouraged wherever the slope exceeds 8-10 percent. Napier grass, both irrigated and rainfed will be grown for the stall fed cattle.

The main crops at the moment are maize, beans and coffee. The coffee area is expected to remain unchanged, and only a small increase (12%) in the maize/beans area is envisaged to meet the growing demand. The main change proposed here is the irrigation of part of the area of both these traditional crops. With improved husbandry, replacement of old stands with new resistant stock, pruning, fertilization and irrigation on 15 percent of the coffee area, yield increases of 10 percent are easily obtainable, good farmers should do even better. It is also expected that with time up to 30 percent of the area currently

under rainfed local varieties of maize will be converted to improved varieties, such as the hybrids being tested at Kari, Embu. These hybrids can be very responsive to fertilizer, spacing and irrigation. A small area of green maize is being grown at present, and an expansion is not proposed. But with irrigation water available year round, here the main emphasis should be on timing the production of green maize to meet the peak profitability of the early season markets.

The existing kale, potato, millet and tea areas are also not projected to change radically. The big change among the food crops is a projected increase in the area of sweet potato, currently one hectare rainfed to five hectare irrigated. With the use of virus free planting material and the available water, few food crops have so many advantages in terms of easy management, prolonged harvest, high yields of basic food, residues available as fodder, and control of their use and sale by women. It is also envisaged that some of the farmers will specialize in banana production, producing intensively managed areas of about 3.5 ha of banana, much of it irrigated to allow a continuous harvest. The varieties used can be those suitable for home use such as Kampala, as some of the production will be consumed on the scheme and any surpluses can easily be sold locally.

The main change in the irrigated cash crops is a substantial increase in the area under irrigated French beans to 11 ha. Although Rupingazi is often a little too humid and cool for optimum production of legumes, and while French bean is not the easiest of crops to make a consistent profit with, because of the competition and the fluctuating market, it does have at least three distinct advantages. Its production can be timed to not compete with the important coffee harvest (Oct.-Jan). The exporters typically will give support to growers (seed supply, pest control and husbandry advice) on an area of this size, with forward contracts for named varieties. And it can be grown by young farmers on limited areas with small amounts of initial capital. Trials of other export orientated crops such as snow pea, sugar snap and runner bean could be made to look for alternatives, perhaps by examining planting in December or June to avoid the worst of the wet weather.

Cabbage is being grown on about three rainfed hectares at the moment, this area is not projected to increase. Profits should come to those farmers who combine irrigation, fertilizer use, improved nursery management, plant spacing, rotation and pest control on varieties such as Copenhagen, which although the seed is expensive, is able to stand a long time in the field awaiting harvest without spoiling. A hectare of irrigated kale (sukuma wiki) is planned for both home consumption and sales, because not only is this a crop tolerant of neglect, it is also a popular food for both home consumption and sale, and like sweet potato its use is largely managed and controlled by the women.

Table 1.2-1 shows the proposed cropping patter for Rupingazi Ngerwe Irrigation Scheme

3) Proposed Farming Systems

The main yield increases are likely to come from improved husbandry, and the use of adapted varieties. Trials should be carried out on the farmers fields of a range of promising new maize and cabbage varieties, both to demonstrate them and to test their adaptation. Field days focusing on improved water management and critical crop husbandry techniques should be held at the appropriate part of the crop season. Information in the local languages regarding the key constraints to increased yield should be produced and distributed for the major crops.

Irrigation Area = 40ha Cropping Intencity = 185 %

Crop	Crop Area (ha)			Growing Season(days)				
	Maximum		Total					
	MAR-JUL	JUL-FEB		Initial S.	Dev.S	Mid. S.	Late S.	Total
Coffee	10.0	10.0	10.0	-	-	-	-	365
Bananas	3.2	3.2	3.2	-	-	-	-	365
Napier	0.2	0.2	0.2	-	-	-	-	365
Sweet Potato	3.6	2.0	5.6	20	30	40	30/40	120/130
Beans	2.2	-	2.2	15	20	35	25	95
Maize& Beans	20.0	12.0	32.0	25	30	45	35	135
French Beans	-	3.6	10.8	15	20	30	10	75
Green Maize	-	4.8	4.8	25	30	45	10	110
Cabbage/Kale	-	4.0	4.0	20	25	35	30	110
Other crops	0.8	0.2	1.0	20	25	35	25	105
Total	40.0	40.0	73.8					

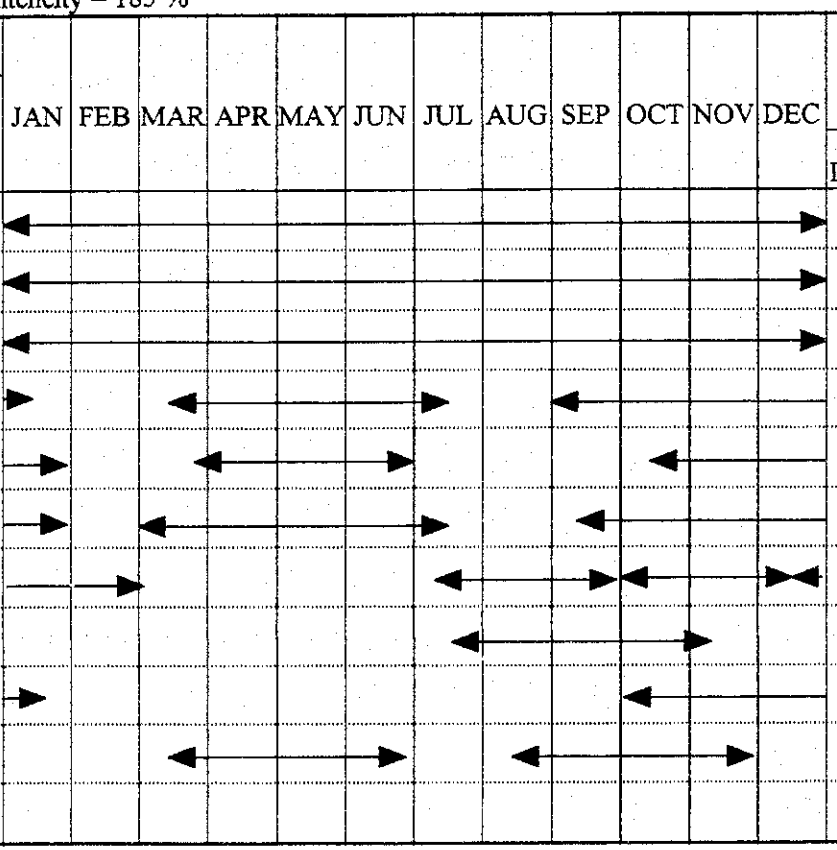


Table 1.2-1 Proposed Cropping Pattern of Rupingazi Ngerwe Irrigation Scheme

Deficiencies of Nitrogen and Phosphurus were seen on the maize crop in the field. Since most of the soils in the valley are moderately acid, the use of non-acidifying fertilizers such as Calcium Ammonium Nitrate and Superphosphates is required. The coffee cooperative should be encouraged to stock these kinds of fertilizers.

Part of the irrigated area in Rupingazi, the valley bottom land, has areas that are large enough to justify laying out level basins and irrigating along the furrow using a siphon.

Small amounts of new seedlings will be required, for banana, and also for macademia. A project nursery is not justified for the areas involved and is not projected in the cost estimates. Access to the existing nurseries for improved clones will be facilitated. Frequently good lines are in limited supply and transport of the bulky stools is the main restriction to their expanded use. Perhaps the project can facilitate the bulk purchase and transport of the improved planting stock, for farmers to purchase.

Projected Crop Production at Rupingazi Ngerwe with Project

Crop	Area Rainfed	Area Irrigated	Unit Yields (Rainfed/Irr.)	Total Production
	(ha)	(ha)	(ton/ha)	(ton)
Maize in mixture	75	32	2/2.25	222
Beans in mixture	75	32	0.4/0.6	49
Maize (green)	0	4.8	4	19
Beans	54	2.2	0.65/0.75	37
Kale	6	1	8/12	64
Potato	5	0	8	41
Cabbage	0.2	3	11/16	50
French beans	0	10.8	4	43
Sweet Potato	0	5.6	8.5	48
Napier grass	0.3	0.2	12/15	6
Millet	1.6	0	0.85	1
Other Vegetables	2.3	1	4.5/6	16
Coffee	47	10	4.5/5	262
Banana	0.6	3.2	8.5/10	37
Tea	4.2	0	10	43

Source: JICA Study Team estimates

The irrigation pattern which follows has been used to calculate the water requirement and the output of the scheme after installation of the irrigation facilities. It must be stressed that this is only an average over the whole area. It is not intended to suggest that full irrigation is essential or required for maize and dry bean production at Rupingazi. However, maize and beans will certainly be grown on the irrigated area, and out of season production and irrigation during drought periods will probably be practiced. It represents all of the different types of farms and farmers that are combined on the scheme. It includes small farms and large farms; farms that will focus mainly on coffee production, and those that will become vegetable specialists. Not everyone will grow all of the crops, the actual cropping mix on a farm will vary with the existing crops and the individual farmers interest, as well as the availability of labour and capital to the head of household. Furthermore, in Kenya the average farmer does not make much more than a subsistence living. The maximum profits and returns come to those who intensify their production, who

match their production to the peak market demands, and those who innovate and adopt new technologies successfully. This project has to support all farmers on the scheme, whilst seeking out and encouraging particularly the small percent of farmers who will maximize their use of this scarce resource, water.

The design cropping pattern at full development is shown in the overleaf. The peak water demand periods are early January, the beginning of June and the beginning of December. Shifting planting dates will shift these periods of peak water use.

An important proviso to these provisional recommendations, especially for Rupingazi, where the transmission distances are quite long, and the topography makes overhead piped irrigation unsuitable on most of the sites, is that the study area soils or water have not been tested for salinity/alkalinity, percolation rates, (a determinant of transmission losses in surface systems), or soil moisture storage capacity.

4) Animal Husbandry Plan

It is expected that the dairy cattle populations in the Project Area will not increase greatly. The main changes will be in the improved yields from the existing animals. These increases will come from a combination of genetics and improved nutrition. Most of the cattle are already improved breeds or partly grade. Continuing access to AI for the cattle on the scheme will be organized in conjunction with the local livestock officer and the private sector. The cattle in this area are usually stall fed, and part of the irrigation area has been allocated to napier grass to increase the production of fodder. The increased irrigation area will also produce greater volumes of crop residues that can be used to improve the growth and nutrition of the local animals. For example, the irrigated banana and the irrigated hybrid maize should significantly increase the volumes of crop residues available. Trials can also be conducted on the use of urea blocks to supplement the nutrition of the lactating cows. If interest is shown, trials of different forage grasses could also be conducted. Improved local chickens, such as Fayoumi could be introduced through providing access to young cocks for purchase. Vaccines and other animal medicines are available for purchase at Embu for treatment of the cattle and the chickens.

The organic matter generated by the stall fed cattle can be used to improve the fertility and the structure of the soils, particularly where vegetables such as cabbage are grown and also where soil erosion is starting to become a problem.

5) Post-Harvest and Rural Industry Plan

For export of green beans, the construction of grading and packing shed with charcoal temporary store is recommended. Quality assurance has become an important aspect in export trade. The shed is quite simple using timbers for frame, vinyl chloride plastic films for side cover, galvanized iron sheets for roof, grading tables and safety tapped water. The washing of hands when handling produce are requisite. Before and after grading, it is better to store the produce in charcoal covered by nets. The latent heat of water in charcoal will remove the respiration heat of green beans and direct sunshine can be avoided. It is estimated that about 5-10 degree centigrade can be lowered than ambient temperature according to the test by Karen Appropriate Technology Center. Also for local consumed produce, member farmers can store before group loading or awaiting traders. These facilities can be constructed or funded by farmers themselves using local materials, and it will motivate ownership of facilities among members for sustainable operation.

1.2.4 Marketing Plan of Agricultural Products

1) Strategies on Marketing Development

The main strategies for this Project Areas are, i) expansion of marketing alternatives for export produce by contract farming, ii) horticultural production planning to meet market demands at Embu wholesale market with price information collection and transporting arrangement and iii) participation in smallholders seminar holding at JKUAT and other institutions managed by the government including marketing sector. The necessary interventions as government services or activities to be done by farmers' marketing groups are categorized by the problems indicated on PCM workshop and identified in field survey as follows:

Interventions and Outputs Categorized by Problem

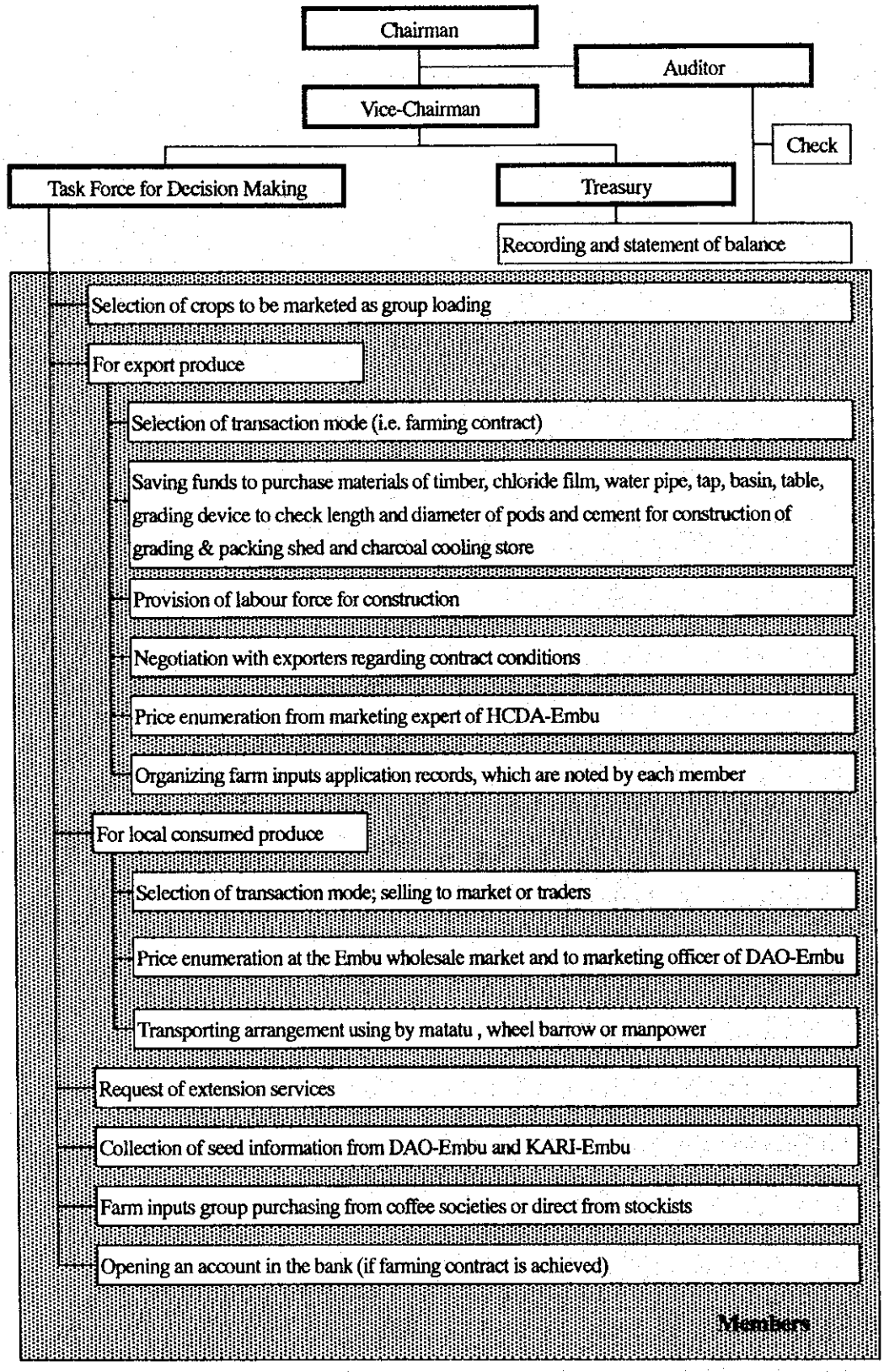
Problems/Constraints	Interventions/Activities	Agency/Operation Body Concerned	Outputs
Indicated problems on PCM workshop			
[1] Late payment of produce (The coffee payment is a main issue.)	- Direct remittance from CBK to account of coffee societies not through intermediate unions	- Coffee Board of Kenya (CBK)	- Reducing time paid and intermediate commissions
[2] Low profit of farming [3] Low prices for horticultural produce	- Seminar on grading at JKUAT and other institutions managed by the government	- Marketing expert of HCDA	- Better trading price for French bean and other green beans
[3-1] Low quality of produce [3-1-1] Poor production planning	- Seminar on varieties and certified seeds information at JKUAT and other institutions managed by the government - Provision of certified seed procurement information	- KARI-HQ - Farm inputs/marketing officer in DAO-Embu - Marketing expert-HCDA-Embu - KARI-Embu	- Better yields and plant protection - Assurance of germination rate
	- Weather forecasting - Kenya broad casting (KBC)	- DAO-Embu - Crop planning to select fluctuated produce such as beans, carrot, kale, fresh peas when expecting drought	- Storing dry beans in warehouse of coffee factory
[3-2] Poor market for the produce	- Seminar on marketing organization though PCM workshop at JKUAT and other institutions managed by the government	- MOA staff on farmers' organization	- Organization of small scale marketing groups

Problems/Constraints	Interventions/Activities	Agency/Operation Body Concerned	Outputs
[3-2-1] Lack of marketing organization [3-2-1-1] Lack of marketing information	- Provision of market price information at Embu wholesale market	- Farm inputs/marketing officer in DAO-Embu - Member farmers	- Better crop planning - Attaining prevailing information - Reducing post-harvest losses - Increasing bargaining power
	- Group loading and transport arrangement for local consumed produce	- Marketing group	- Better transaction conditions than middlemen system
[3-3] Exploitation of middlemen [3-3-1] Dishonesty of exporters of horticulture	- Seminar on farming contract for export produce at JKUAT and other institutions managed by the government	- Marketing expert of HCDA - Representative of exporters or FPEAK staff	- More stable income and better crop planing - Organizing small scale marketing groups
	- Provision of market price information at Nairobi Horticultural Centre (auction results) for export produce	- Marketing expert of HCDA-Embu	- Increasing bargaining power for negotiation in prices (bonus added to contract minimum prices to meet price escalation)
Identified problems by Study Team			
Lack of knowledge on requirements on export produce	- Seminar on maximum residue levels (MRLs) and crop assurance for export green beans using Export Crop Bulletin at JKUAT and other institutions managed by the government	- Marketing expert of HCDA	- Better trading prices and creating better business relation between farmers' marketing groups and exporters to sustain farming contract
Lack of knowledge on consumers' or buyers' demands	- Field trip to Nairobi markets, exporters' grading & packing facilities, Nairobi Horticultural Centre and Coffee Auction	- MOA staff	- Better understanding of consumers' or buyers' demands and how produce is handled
Selling individually coffee cherries to private coffee millers	- Clear and transparent accounting of coffee societies	- Coffee societies	- Avoid disrupting coffee societies

2) Structure of Functional Marketing Group

Farmers understand the importance and benefits of establishment of marketing groups, which was confirmed on PCM workshop. The recommended formation of the groups are shown in the next page, but it is necessary to discuss among all members before the formation.

Recommended Organization Chart and the Functions



3) Strategic Marketable Horticultural Crops

Utilizing the resources of market demands, locating advance, agro-climatic aspect and current production, the following crops are recommended to be selected through discussion among members of marketing groups:

Strategic Horticultural Crops in the Project Area

Category	Strategic Crop
Home consumed produce	dry maize (Pioneer Hybrid H3253, Cargill Hybrid), beans (Rose coco, Dolichos when expecting drought)
Local consumed produce	ripe banana (Apple, Giant Cavendish), green maize, cabbage (Gloria, Copenhagen), carrot (when expecting drought), kale, red bulb dry onion, spring onion, sweet potato, spinach, arrow root, mushrooms (in future), coriander
Export produce	macadamia nut, French bean (Monel, Caudia, Gloria, Morgan, Espada), avocado (Fuerte, Hass), mango (Tommy Atkins, Van Dyke, Keitt, Kent, Apple, and in future Matthias, Kensington, Azacus, Zill, Nimrod, Irwin Sabine after observation), baby corn, snowpea (Carouby, Mommoth Melting Sugar, Drwart Grey Sugar, Oregon Sugar Pod, Suger-Snap, Tolendo), runner bean

4) Farming Contract

Farming contract directly to exporters can be one of improved marketing alternatives. This must be well-understood by each member of marketing groups. It is recommended that marketing expert of HCDA instruct the following necessary articles to be negotiated with exporters in JKUAT and other institutions managed by the government seminars.

i) Name and address of exporter and farmers' marketing group attached all members list with signatures
ii) Contract number and date agreed
iii) Contracted crops and each minimum guaranteed unit price and maximum prices when fluctuated in upper prices
iv) Quality required
v) Quantity required in Kg or number of cartons
vi) Production and practice
vii) Production records of applied fertilizer and pesticide
viii) Field support
ix) Procurement of certified seeds and prohibition of multiplication of the seeds
x) Harvesting and post-harvest handling in salinity
xi) Grading and inspection methods
xii) Conditions of collection and delivery such as dates or days to be collected and time
xiii) Handling of rejected produce
xiv) Payment mode in cheque or cash and limitation of payment
xv) Penalty and compensation
xvi) Arbitration method and concerned agency(ies)